Fifth National Communication of the Republic of Moldova

Submission to the United Nations Framework Convention on Climate Change

2023

Fifth National Communication of the Republic of Moldova

Developed to be reported to the United Nations Framework Convention on Climate Change

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FOREWORD

FOREWORD

The phenomenon of climate change can undoubtedly jeopardize the sustainable development of humanity. It is capable of causing a negative impact by raising the level of the planetary ocean, increasing the frequency of natural cataclysms (floods, droughts, heat waves, hurricanes, tornadoes, etc.), increasing vulnerability of natural and artificial ecosystems to new climatic conditions, etc. This requires the nations of the planet to take action aimed both at reducing the intensity of this process and at mitigating the possible consequences of this phenomenon.

The Fifth National Communication of the Republic of Moldova developed to be reported to the United Nations Framework Convention on Climate Change (UNFCCC) was compiled as a result of the financial assistance provided by the Global Environment Facility through the Project "Enabling Activities for the Preparation of the Fifth National Communication to the United Nations Framework Convention on Climate Change", initiated on 5 August 2019 and planned to be completed by 30 June 2023, managed by the United Nations Environment Programme and implemented by the Public Institution "Environmental Projects National Implementation Office" of the Ministry of Environment of the Republic of Moldova.

As compared to the Fourth National Communication of the Republic of Moldova to the UNFCCC (2018), this Report is an updated overview of the state of things in the Republic of Moldova for the main aspects governed by the Convention. These aspects relate to the assessment of the trend of greenhouse gas emissions (GHG) at national and sectoral level, presentation of climate change mitigation measures at the national level, vulnerability assessment, climate change impacts and adaptation measures for the main sectors of the national economy and human health, the capacity needs and support needed to reduce greenhouse gas emissions on a larger scale, and the capacity needs and support needed to ensure better resilience and adaptation to the new climate conditions caused by climate change.

It is important to note that these assessments can also be used to update the mitigation targets set in the updated version of the Nationally Determined Contribution of the Republic of Moldova (2020), developed in accordance with Decisions 1/CP.19 and 1/CP.20 for the Paris Agreement (2015) – legal instrument with legal force applicable in relation to all the Parties to the Convention, in accordance with the objective of maintaining global warming growth below 2°C as forecasted for the year 2100, compared to the pre-industrial period.

The Paris Agreement was signed by the Prime Minister of the Republic of Moldova in New York on 21 September 2016, being subsequently ratified by the Parliament by the Law no. 78 of 04.05.2017 on ratification of the Paris Agreement, and the targets for the GHG emissions reduction established in the Nationally Determined Contribution of the Republic of Moldova were officially approved at national level by the Government Decision no. 1470 of 30.12.2016 on the approval of the Low Emission Development Strategy of the Republic of Moldova until 2030 and of the Action Plan for its implementation.

In accordance with the updated National Determined Contribution (2020), the Republic of Moldova has committed to reach by 2030 the unconditional target of reducing GHG emissions by 70% as compared to the level recorded in the reference year (1990). The reduction commitment could be conditionally increased to about 88%, in line with this global agreement, which addresses important issues such as provision of low-cost financial resources, technology transfer and technical cooperation, access to all of them as appropriate to the challenges of global climate change. The GHG emission reduction targets have been set in an emission budget covering the period from 1 January 2021 to 31 December 2030.

At the same time, it is worth mentioning that the targets related to the adaptation to the new climate conditions caused by the climate change phenomenon of the main sectors of the national economy and human health, established in the intended NDC of the Republic of Moldova (2015), were approved at national level by Government Decision no. 1009 of 10.12.2014 on the approval of the Climate Change Adaptation Strategy of the Republic of Moldova until 2020 and of the Action Plan for its implementation.

The development of this Report, and the implementation of the country's policies in the field of greenhouse gas emissions mitigation and climate change adaptation, is an essential contribution of our country to solving the problem of climate change both nationally and globally.

Gavril GILCA,
Director,
Environment Agency of the Republic of Moldova

LIST OF ACRONYMS, ABBREVIATIONS AND UNITS OF MEASUREMENT

AA	Association Agreement
AC	Adaptive Capacity
ACAP	Adaptive Capacity of Agricultural Production
ACE	Adaptive Capacity of Education
ACED	Agricultural Competitiveness and Enterprise Development Project
ACHC	Adaptive Capacity of Health Care
ACI	Adaptive Capacity of Industry
ACPPLS	Adaptive Capacity of Providing the Population with Living Space
ACT	Adaptive Capacity of Transport
ACTS	Adaptive Capacity of Tourism Sector
AD	Activity Data
ADA	Austrian Development Agency
AEZ	Agro-Ecological Zone
AF	Adaptation Fund
Ag. SAP	Agriculture Sector Adaptation Plan
AGEPI	Agency for Intellectual Property
AIPA	Agency for Interventions and Payments in Agriculture
AITT	Agency for Innovation and Technology Transfer
AJMTEM	Association of Environmental Journalists and Ecological Tourism
AM	Ante Meridiem
AMP	External Assistance Management Platform
AMS	Agroclimatic Monitoring System
AOGCM	Atmosphere-Ocean Coupled General Circulation Model
ANACEC	National Agency for Quality Assurance in Education and Research
ANRE	National Agency for Energy Regulations
AR4	IPCC Forth Assessment Report
AR5	IPCC Fifth Assessment Report
AR6	IPCC Sixth Assessment Report
Art.	Article
a.s.	active substance
ASM	Academy of Sciences of Moldova
ATU	Autonomous Territorial Unit
ATULBD	Administrative-Territorial Units on the left bank of the Dniester River
bil.	Billion
BCC-CSM2-MR	Global circulation model developed by Beijing Climate Center, Beijing, China (BCC)
BEF_R	Biomass extension coefficient for firewood crops
BMZ	German Federal Ministry for Economic Cooperation and Development
BUR	Biennial Update Report
°C	Celsius degrees
¢	Cents
CanESM5	Global Circulation Model developed by Climate Modelling and Analysis, Environment and Climate Change Canada, Victoria, Canada
CBA	Cost-Benefit Analysis
CBT	Climate Budget Tagging
CCA	Climate Change Adaptation
CCACM	Climate Change Adaptation Coordination Mechanism
CCAS	Climate Change Adaptation Strategy
CCCM	Climate Change Coordination Mechanism
CCO	Climate Change Office
CDD	Consecutive Dry Days
CDDcold18	Cooling Degree Days, measure of the energy demand needed to cool a building calculated as an annual sum of TM - n (where n is a user-defined location-specific base temperature and TM> n), n=18°C
CDM	Clean Development Mechanism
CE	Council of Europe
CEA	Cost-Efficiency Analysis
CEF	Country-Specific Emission Factor
CERs	Certified Emission Reductions
CGO	Community Grassroots Organizations
CH_4	Methane
CHP	Combined Heat and Power Plant
CIESM	Department of Earth System Science, Tsinghua University, Beijing, China
C.I.F.	Cost, Insurance and Freight (with reference to export)
CIS	Commonwealth of Independent States
CLRTAP	Convention on Long-Range Transboundary Air Pollution
CLTS	Coefficients of the Linear Trend Slope
CM	Coordination Mechanism
CMIP5	Coupled Model Intercomparison Project Phase 5
CMIP6	Coupled Model Intercomparison Project Phase 6
cm	Centimeter
CNG	Combined Nomenclature of Goods
CNRM-CM6-1, CNRM-CM6-1-HR, CNRM-ESM2-1	Global Circulation Models developed by CNRM (Centre National de Recherches Meteorologiques, Toulouse, France), CERFACS (Centre Europeen de Recherche et de Formation Avancee en Calcul Scientifique, Toulouse, France)
CO	Carbon monoxide
CO_2	Carbon dioxide
COP or CP	Conference of the Parties
CORINAIR	Atmospheric Emissions Inventory in Europe, prepared by the European Environment Agency with the support of the UN European Economic Commission
CP	Country Program
CPA	Cooperation and Partnership Agreement
CPAs	Central Public Authorities
CPESS	Civil Protection and Emergency Situations Service
CPF	Country Partnership Framework
CSDI	Cold Spell Duration
CS	Country Specific
CSC	Carbon Storage and Capture Technology
CTEIA	Convention on the Transboundary Effects of Industrial Accidents
CV	Coefficient of Variation
CVI	Climate Vulnerability Index
CWD	Consecutive Wet Days
D	Default
dal	Dekaliter
DFID	United Kingdom Department for International Development
DJF	December - February

dm	Decimeter
DNA	Designated National Authority
DOC	Degradable Organic Carbon
$dock_F$	Dissimilated DOC fraction
DRA	Disaster Risk Assessment
DRR	Disaster Risk Reduction
DS	Demographic Sensitivity
DTC	Discounted Total Cost
DTR	Diurnal Temperature Range
E	Exposure
EaP	Eastern Partnership
EaPIC	Eastern Partnership Integration and Cooperation
EB	Energy Balance
EBRD	European Bank for Reconstruction and Development
EC-Earth3, EC-Earth3-Veg	Global Circulation Models developed by EC-Earth consortium, Rossby Center, Swedish Meteorological and Hydrological Institute/SMHI, Norrkoping, Sweden
ECOPact	Green Concrete
EcS	Economic Sensitivity
ECT	Energy Community Treaty
EDN	Electricity Distribution Network
EEA	European Environment Agency
EEC	European Economic Community
EEF	Energy Efficiency Fund
EF	Emission Factor
EHF	Excess Heat Factor
EHF.HWA	Heatwave amplitude (HWA) as defined by the Excess Heat Factor (EHF)
EHF.HWD	Heatwave duration (HWD) as defined by the Excess Heat Factor (EHF)
EHF.HWF	Heatwave frequency (HWF) as defined by the Excess Heat Factor (EHF)
EHF.HWM	Heatwave magnitude (HWM) as defined by the Excess Heat Factor (EHF)
EHF.HWN	Heatwave number (HWN) as defined by the Excess Heat Factor (EHF)
EIB	European Investment Bank
EMEP	Program on Observation and Assessment of Long-Range Transboundary Air Pollution in Europe
EMM	Ecological Movement of Moldova
EnC	Energy Community
EnMS	Energy Management System
ENPARD	European Neighborhood Program for Agriculture and Rural Development
ENPEP	Energy and Power Evaluation Program
ENTSO-E	European Network of Transmission System Operators for Electricity
E-OBS	European Ensemble Observational Gridded Dataset
E5P	Eastern Europe Energy Efficiency and Environmental Partnership Fund
ESCO	Energy Service Company
ESI	Environmental Sensitivity Index
ESTs	Environmentally Sound Technologies
ETCCDI	Expert Team on Climate Change Detection and Indices
Eq.	Equivalent
EU	European Union
EU ETS	European Union Emission Trading Scheme
EU FP7	EU's Seventh Funding Program
EUR	Euro
EUMETNET	European Meteorological Service Network
EWS	Early Warning Systems
FA	Forest area by species, ha, Forestry Vulnerability Indicator
FAO	Food and Agriculture Organization of the United Nations
FD	Frost Days
FDI	Foreign Direct Investment
FEZ	Free Economic Zone
FGOALS-g3	Global Circulation Model developed by Chinese Academy of Sciences, Beijing, China
FIDA	Rural Program for Inclusive Economic and Climate Resilience
FOB	Free on Bord (with reference to import)
FOD	First Order Decay Method
FSV	Facilitative Sharing of Views
g	Grams
GC	Green Cities
Gcal	Gcal
GCF	Green Climate Fund
gcf	Grams of Conventional Fuel
GCOS	Global Climate Observing System
GD	Government Decision
GDP	Gross Domestic Product
GEF	Global Environmental Facilities
GEFFM	Green Economic and Financial Facility for Moldova
GFDL-CM4	Global Circulation Model developed by National Oceanic and Atmospheric Administration, Geophysical Fluid Dynamics Laboratory, Princeton, USA
GFS	Global Forecast System
GHG	Greenhouse Gases
GIS	Geographic Information Systems
GIZ	German Agency for International Cooperation (German: Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH)
GJ	Gigajoule (1GJ = 10^9 joule)
GOST	Regional standardization system administered by the Euro-Asian Council for Standardization, Metrology and Certification within the Commonwealth of Independent States
GSL	Growing Season Length
GSP	Small Grant Program
Gt	Gigaton (10^9 tone)
GWP	Global Warming Potential
h	Hour
ha	Hectares
HadGEM3-GC31-MM	Global Circulation Model developed by Met Office Hadley Centre, Fitzroy Road, Exeter, Devon, UK
HDDheat18	Heating Degree Days, measure of the energy demand needed to heat a building calculated as an annual sum of n - TM (where n is a user-defined location-specific base temperature and TM<n), n=18 ˚C
HFCs	Hydrofluorocarbons
hl	Hectoliter
HMN	Hydrological Monitoring Network
HMS	Hydrological Monitoring System
HP	Heat Plant
HPP	Hydro Power Plant

HPPPS	Hydroelectric Power Plant with Pumped Storage
HW	Heatwave
HWA	Hottest Day of the Hottest Heatwave, °C
HWD	Length of the Longest Heatwave, days
HWF	Total number of days that contribute to Individual Heatwaves, days
HWM	Average Temperature across all Individual Heatwaves, °C[2]
HWN	Number of Individual Heatwaves, events
IAEA	International Atomic Energy Agency
IBRD	International Bank for Reconstruction and Development
ICA	International Consultation and Analysis
ICAS	Forest Research and Management Institute
ICSID	International Center for the Settlement of Investment Disputes
ICT	Information and Communications Technology
ID	Ice Days
IDA	International Development Association
IE	Included Elsewhere
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
ILO	International Labor Office
IMF	International Monetary Fund
IMP	Import
IMPACT	Emission Calculation Model, part of the ENPEP Model Package
iNDC	intended National Determined Contribution
INM-CM4-8, INM-CM5-0	Global Circulation Models developed by Institute for Numerical Mathematics, Russian Academy of Science, Moscow, Russia
IPCC	Intergovernmental Panel on Climate Change
IPE	Institute of Power Engineering
IPPU	Industrial Processes and Product Use
IPSL-CM6A-LR	Global Circulation Model developed by Institute Pierre Simon Laplace, Paris, France
IWRM	Integrated Water Resources Management
JJA	June - August
JSC	Joint Stock Company
KCA	Key Categories Analysis
kg	Kilogram
kg cc	Kilograms of conventional fuel
km	Kilometer
KMS	Knowledge Management Strategy
kPa	Kilopascal
ktoe	Kiloton of oil equivalent
Kt	Kiloton
kV	Kilovolt
kW	Kilowatt
kWh	Kilowatt-hour
l	Liter
L	Level
LEAP	Long Range Energy Alternatives Planning System
LECBP	Low Emission Capacity Building Program
LEDP	Low Emission Development Program until 2030 and the Action Plan for its implementation
LEDS	Low Emission Development Strategy until 2030 and the Action Plan for its implementation
LMS	Labor Market Sensitivity
LNG	Liquefied Natural Gas
LPAs	Local Public Authorities
LTD	Limited Liability Company
LULUCF	Land Use, Land-Use Change and Forestry
LUS	Land Use Sensitivity
LVI	Livelihood Vulnerability Index
m	Meter
m^2	Square meter
m^3	Cubic meter
M	Millions
MAC-P	Competitive Agriculture in Moldova Project
MAED	Model for Analysis of the Energy
MAFI	Ministry of Agriculture and Food Industry
MAM	March-May
MARCAL	Market Allocation Model
MARDE	Ministry of Agriculture, Regional Development and Environment
MCA	Multi-Criteria Analysis
MCDA	Multicriteria Decision Analysis
MC-EnC	Ministerial Council of the Energy Community
MCF	Methane Correction Factor
MCFDP	Moldova Community Forestry Development Project
MD	Moldova
MDG	Millennium Development Goals
MDL	Moldovan Lei
M&E	Monitoring and Evaluation
MIGA	Multilateral Investment Guarantee Agency
mil.	Million
MIROC-ES2L, MIROC6	Global Circulation Models developed by JAMSTEC (Japan Agency for Marine-Earth Science and Technology, Japan), AORI (Atmosphere and Ocean Research Institute, The University of Tokyo, Japan), NIES (National Institute for Environmental Studies, Japan) and R-CCS (RIKEN Center for Computational Science, Japan)
MJ	Megajoule (10^6 joule)
mg	Milligram
ml	Milliliter
mln.	Millions
mm	Millimeters
MMS	Meteorological Monitoring System
MoD	Ministry of Defense
MoE	Ministry of Environment
MoEI	Ministry of Economy and Infrastructure
MoER	Ministry of Education and Research
MoF	Ministry of Finance
MoH	Ministry of Health
MoIRD	Ministry of Infrastructure and Regional Development
MoJ	Ministry of Justice
MOLDATSA	Moldavian Air Traffic Services Authority
MoLSP	Ministry of Labor and Social Protection
MOP	Meeting of the Parties to the Kyoto Protocol
MoREFF	Moldovan Residential Energy Efficiency Financing Facility
MoSEFF	Moldovan Sustainable Energy Financing Facility
MPI-ESM1-2-HR, MPI-ESM1-2-LR	Global Circulation Models developed by Max Planck Institute for Meteorology, Hamburg, Germany
MRI-ESM2-0	Global Circulation Model developed by Meteorological Research Institute, Tsukuba, Japan
MRV	Monitoring, Reporting and Verification

MSCP	Moldova Soil Conservation Project
MSS	Message Switching System
MSW	Municipal Solid Wastes
MS%	Share of different Manure Management Systems
Mt	Megaton (10^6 tone)
MTPP	Moldovan Thermal Power Plant
MW	Megawatt (10^6 watt)
NA	Not Applicable
NAER	National Agency for Energy Regulations
NAFS	National Agency for Food Safety
NAMA	Nationally Appropriate Mitigation Actions
NAP	National Adaptation Planning
NAP-1	First Cycle of National Adaptation Planning Process
NAP-2	Second Cycle of National Adaptation Planning Process
NAPEE	National Action Plan in Energy Efficiency
NARD	National Agency for Research and Development
NATO	North Atlantic Treaty Organization
NBM	National Bank of Moldova
NBS	National Bureau of Statistics
NC	National Communications
NC1	First National Communication
NC2	Second National Communication
NC3	Third National Communication
NC4	Fourth National Communication
NC5	Fifth National Communication
NCCC	National Commission on Climate Change
NDA	National Designated Authority
NDC	National Determined Contribution
NDS	National Development Strategy
NE	Not Estimated
NECP	Integrated National Energy and Climate Plan
NEET	NEET - Persons Not in Employment, Education or Training
NEF	National Ecological Fund
NESM3	Global Circulation Model developed by Nanjing University of Information Science and Technology, Nanjing, China
NFARD	National Fund for Agriculture and Rural Development
NFRD	National Fund for Regional Development
NFRLD	National Fund for Regional and Local Development
NGOs	Non-Governmental Originations
NIF	Neighborhood Investment Facility
NIR	National Inventory Report
NIS	National Inventory System
NMVOC	Non-Methane Volatile Organic Compounds
NO	Not Occurring
N_2O	Nitrous Oxide
No.	Number
NOAA	National Oceanic and Atmospheric Administration
NPAI	National Public Audiovisual Institution
NPB	National Public Budget
NMRS	National Monitoring and Reporting System
ODA	Official Development Assistance
ODIMM	Organization for Small and Medium Enterprises Sector Development
ODS	Ozone Depleting Substances

OECD	Organization for Economic Cooperation and Development
OPL	Overhead Power Line
OSCE	Organization for Security and Cooperation in Europe
p	Statistical significance of the trend
PCSM	Soil Conservation in Moldova Project
PD	Parliament's Decision
PDD	Project Design Document
PDSFCM	Development of the Communal Forestry in Moldova Project
PE	Polyethylene
PET	Polyethylene terephthalate
PFC	Perfluorocarbons
PFRA	Preliminary Flood Risk Assessment
PI EPIU	Public Institution "Environmental Projects Implementation Unit"
PJ	Petajoule (10^{15} joule)
PM	Post Meridiem
ppb	Parts per billion of volume
ppm	Parts per million of volume
PPP	Purchasing Power Parity
ppt	Parts per trillion of volume
PRCPTOT	Total Wet-Day Precipitation
PRTRs	Pollutant Release on Transfer Registers
PS	Phytotechnical Sensitivity
PS	Pest by species, ha, Forestry Vulnerability Indicator
q	Quintals
QA	Quality Assurance
QC	Quality Control
R^2	Determination Coefficient
R10mm	Number of Heavy Precipitation Days – number of days where daily precipitation amount ≥ 10 mm
R20mm	Number of Very Heavy Precipitation Days, where daily precipitation amount ≥ 20 mm
R95p	Very Wet Days
R95pTOT%	Contribution from Very Wet Days
R99p	Extremely Wet Days
R99pTOT%	Contribution from Extremely Wet Days
RCP	Representative Concentration Pathway
RDI	Research, Development and Innovation
RES	Renewable Energy Sources
RETScren	Clean Energy Management Software
RoM	Republic of Moldova
RX1day	Max 1-day precipitation
RX3day	Max 3-day precipitation
RX5day	Max 5-day precipitation
$	US Dollar
S	Sensitivity to Climate Hazards
SA	Sensitivity Analysis
SACET	Central Heat Supply Systems
SAP	Sensitivity of Animal Production
SAPs	Sectorial Adaptation Plans
SAR	IPCC Second Assessment Report
SAUM	State Agricultural University of Moldova
SDGs	Sustainable Development Goals
SDII	
SESI	Socio-Economic Sensitivity Index
SE	State-Owned Enterprise
SF_6	Sulfur Hexafluoride
SGP	Small Grants Program

SHS	State Hydrometeorological Service
SIDA	Swedish International Development Cooperation Agency
SLCS	Soil Conservation Works System
SMEs	Small and Medium-Sized Enterprises
SMW	Solid Municipal Waste
SO_2	Sulphur Dioxide
SOE	State Owned Enterprise
SON	Autumn Season: September, October, November
SPH	Sensitivity of Public Health
SS	Social Sensitivity
SSPs	Shared Socio-Economic Pathways
STARS	EU Project "Support for Modernization of the Energy Sector in the Republic of Moldova"
STP	Science and Technology Park
SU	Summer Days
SWDS	Solid Waste Disposal Sites
SWSS	Sensitivity of Water and Sewerage Supply
t	Ton
T1	Tier 1
T2	Tier 2
ΔT	Air Temperature Change
TAP	Technology Action Plan
tcc	Tons of Conventional Fuel (Coal)
TIMES	Integrated MARKAL EFOM System
TJ	Terajoule (10^{12} joule)
TNA	Technology Needs Assessment
TN10p	Cold Nights
TN90p	Warm Nights
TNn	Minimum Daily Minimum Temperature
TNx	Maximum Daily Minimum Temperature
toe	Tons of Oil Equivalent
TR	Tropical Nights
TTE	Team of Technical Experts
TUM	Technical University of Moldova
TX10p	Cold Days
TX90p	Warm Days
TXn	Minimum Daily Maximum Temperature
TXx	Maximum Daily Maximum Temperature
UCTE	Union for the Coordination of Electricity Transports (Fr.: Union pour la Coordination du Transport de l'Electricité)
UKESM1-0-LL	Global Circulation Model developed by Met Office Hadley Centre, Fitzroy Road, Exeter, Devon, UK
UN	United Nations
UNDAF	United Nations Development Action Framework
UNDP	United Nations Development Program
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
US AID	United States Agency for International Development
US EPA	United States Environment Protection Agency
USA	United States of America
USD	US$
USSR	Union of Soviet Socialist Republics
VAT	Value Added Tax
WAM	With Additional Measures Scenario
WAN	Wide Area Network
WASP	Wien Automatic System Planning
WB	World Bank
WEM	With Existing Measures Scenario
WG	Working Group
WHO	World Health Organization
WMO	World Meteorological Organization
WMRs	Waste Management Regions
WP	Wood production by species, in thousand m^3 (Forestry Vulnerability Indicator)
WPPP	Wind and Photovoltaic Power Plants
WSDI	Warm Spell Duration Index
ZAMG	Institute of Meteorology and Geodynamics in Austria
%	Percent
‰	Promile
′	Seconds

CONTENTS

INTRODUCTION

INTRODUCTION

The Republic of Moldova (RoM) has become a Party to the United Nations Framework Convention on Climate Change (UNFCCC) on 16 March 1995, while on 13 February 2003 the country ratified the Kyoto Protocol, recognizing the importance of the complex issue of climate change for the fate of humankind.

As a developing country Party to the Convention, the RoM is committed to promoting the principles of sustainable development, to contributing to achievement of final goals of the Convention and to assisting the Parties included in Annex I to fulfil the commitments of quantified limitation and reduction of greenhouse gas emissions.

In this context, the following areas are of concern for the country: greenhouse gas (GHG) inventory; identification and implementation of measures to mitigate greenhouse gas emissions; identification and implementation of climate change adaptation measures; transfer of environmentally friendly technologies; improving the national observation system and environmental monitoring networks; improving information systems for data collection, processing and storage; developing, maintaining and updating databases associated with climate change; as well as various capacity building activities, education, awareness building and training of society, the young generation in climate change issues.

The Fifth National Communication (NC5) of the RoM to UNFCCC reflects the degree to which the provisions of the Convention are complied with at the national level, the update having been carried out for the year 2020, to the extent allowed by availability of statistical data.

The report is based on the results produced within the GEF/UNEP Project *"Enabling Activities for the Preparation of the Fifth National Communication to the United Nations Framework Convention on Climate Change"*, initiated in August 2019 and completed in October 2022, implemented by the Public Institution "Environmental Projects Implementation Unit" of the Ministry of Environment and the United Nations Environment Programme, with the financial support provided by the Global Environment Facility.

The NC5 of the RoM to the UNFCCC outlines a series of actions in the above-mentioned fields, indicating directions of activity for the future and laying the basis for effective partnerships.

The widespread dissemination of information related to the climate change phenomenon has contributed to a wider awareness in the population, the scientific community and decision makers of the RoM.

Thus, it can be stated that the process of developing NC5 has strengthened the country's potential for promoting and implementing strategies, policies, action plans and programs focused on mitigating the effects caused by these changes.

It is also worthwhile to specify the need for continuity in this direction, which would not only make it possible for the RoM to engage in global efforts to mitigate climate change, but would also involve in this activity the scientific and technical potential of the country, qualified professionals in the process of adapting the economic, social and environmental components to the new climate conditions at national level.

The RoM has been fully committed to the UNFCCC negotiation processes for adoption of the Paris Agreement at the COP 21. The Agreement has full legal force in accordance with the provisions of the UNFCCC, applicable in relation to all Parties, and it is consistent with the target of maintaining global warming by 2100 at a projected growth below 2°C as compared to the pre-industrial period.

The Paris Agreement was signed by the Prime Minister of the Republic of Moldova in New York on 21 September 2016, and it was subsequently ratified by the Parliament by Law no. 78 of 04.05.2017 on ratification of the Paris Agreement.

On 25 September 2015, the Republic of Moldova has officially submitted its Intended Nationally Determined Contribution[1] and provided associated information to facilitate clarity, transparency and understanding in relation to the stipulations of decisions 1/CP.19 and 1/CP.20.

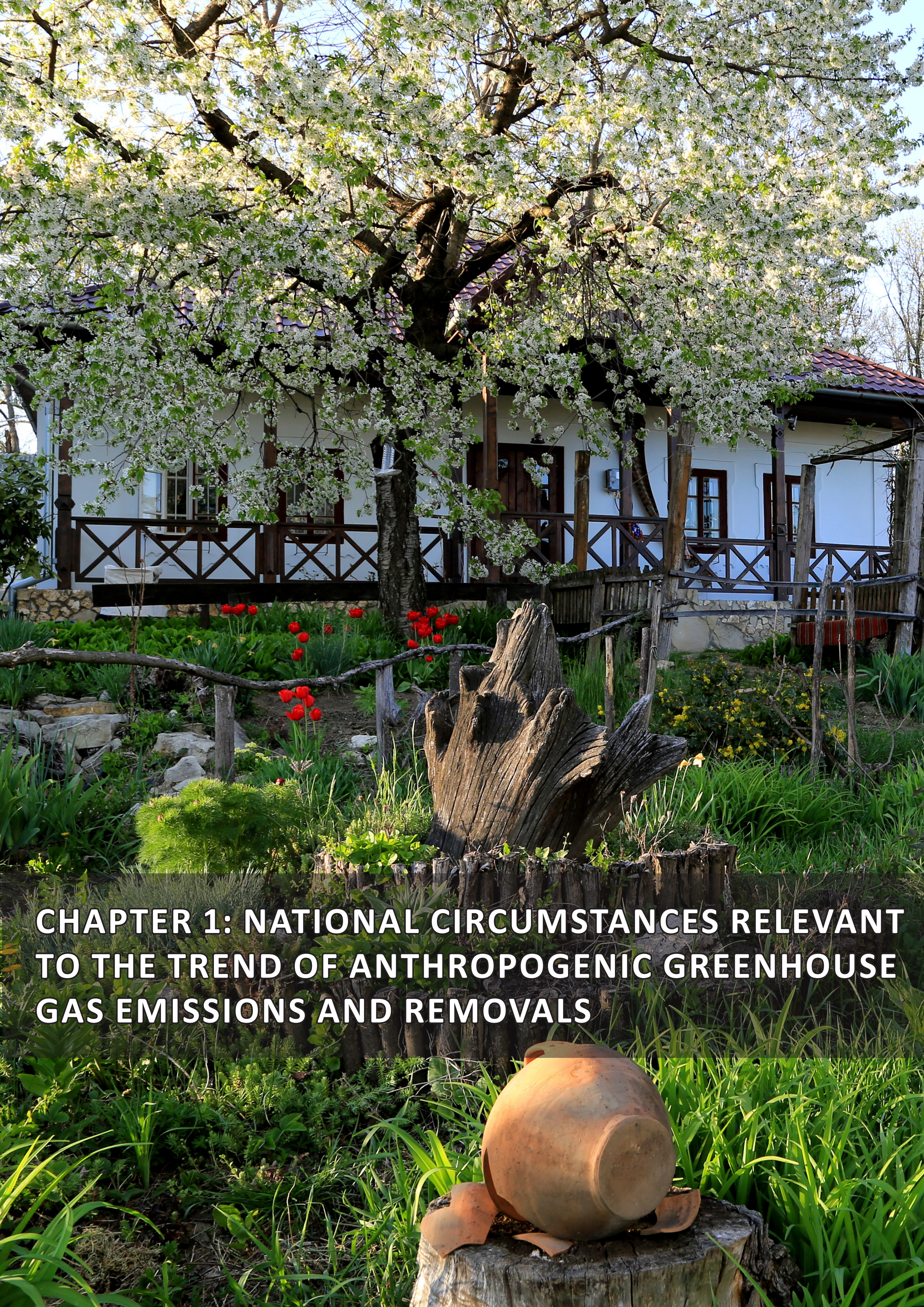
Accordingly, the Republic of Moldova has committed to reaching by 2030 the unconditional target for reducing GHG emissions by 64-67% compared to the level recorded in the reference year (1990), and the country will make every effort to reduce GHG emissions by 67% as compared to 1990. The reduction commitment could be conditionally increased to around 78%, in line with the global agreement, which addresses important issues such as provision of low-cost financial resources, technology transfer and technical cooperation, access to all of these to an extent appropriate to the challenges of global climate change. GHG reduction targets have been set in an emissions budget, covering the period from 1 January 2021 to 31 December 2030.

The GHG emission reduction targets, set in the Intended Nationally Determined Contribution of the Republic of Moldova, were subsequently officially approved at the national level by Government Decision no. 1470 of 30.12.2016 on approval of the Low Emission Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation.

On 4 March 2020, the RoM has submitted to the UNFCCC Secretariat the updated version of its Nationally Determined Contribution[2]. Accordingly, the RoM is committed to achieving more ambitious GHG reduction targets by 2030. Thus, the unconditional target is to be increased from 64-67% to 70% compared to the level recorded in the reference year (1990), and the conditional target is to be increased accordingly from 78% to about 88% compared to the level recorded in 1990.

The new GHG emission reduction targets are to be introduced in the Low Emission Development Programme by 2030 and the Action Plan for its implementation; to be considered and approved by the Government in 2023.

[1] <http://www4.unfccc.int/submissions/INDC/Published%20Documents/Republic%20of%20Moldova/1/INDC_Republic_of_Moldova_25.09.2015.pdf>
[2] <https://www4.unfccc.int/sites/NDCStaging/Pages/All.aspx>



CHAPTER 1: NATIONAL CIRCUMSTANCES RELEVANT TO THE TREND OF ANTHROPOGENIC GREENHOUSE GAS EMISSIONS AND REMOVALS

CHAPTER 1. NATIONAL CIRCUMSTANCES RELEVANT TO THE TREND OF ANTHROPOGENIC GREENHOUSE GAS EMISSIONS AND REMOVALS

1.1. Relevant Institutional Arrangements for the Continuous Reporting of National Communications and Biennial Update Reports to UNFCCC

1.1.1. Government Institutions

The Republic of Moldova (RoM) declared its independence on 27 August 1991, although it continued to be part of the Soviet Union until the official dissolution of the USSR in December 1991. The new constitution was approved by referendum and ratified by the Parliament on July 28, 1994. According to this, the RoM is a neutral country. The constitution guarantees the right to vote to all citizens over the age of 18 and provides for various civil rights and freedoms.

The President is the head of state and is directly elected for a four-year term (they may hold this position at most during two consecutive terms). The President may dissolve Parliament. The constitution stipulates that the President may be charged with criminal or constitutional offences.

The President appoints the Prime Minister and, on his recommendation, the Cabinet of Ministers. The Prime Minister and the Cabinet must be endorsed by the Parliament. The current Government was sworn in on August 6, 2021.

The structure of the Executive consists of 13 ministries, including:

1. Ministry of Infrastructure and Regional Development;
2. Ministry of Foreign Affairs and European Integration;
3. Ministry of Justice;
4. Ministry of Finance;
5. Ministry of Economy;
6. Ministry of Agriculture and Food Industry;
7. Ministry of Defense;
8. Ministry of Internal Affairs;
9. Ministry of Education and Research;
10. Ministry of Culture;
11. Ministry of Health;
12. Ministry of Labor and Social Protection;
13. Ministry of Environment.

The supreme legislative body is the unicameral Parliament. Its membership includes 101 Members who are directly elected for a term of four years. The Parliament meets in two ordinary sessions per year, but may also convene extraordinary sessions. In addition to passing laws and carrying out other basic legislative functions, Parliament can declare a state of emergency, martial law or a state of war.

The judicial system includes: the Supreme Court of Justice, the Courts of Appeal (Chisinau, Balti, Cahul and Comrat), the district and the sector courts of the municipality of Chisinau. In the Republic of Moldova, the Constitutional Court – the supreme authority on constitutional issues whose decisions cannot be appealed, does not belong to the judicial system, but represents an independent entity of power in the state, empowered to control the constitutionality of normative acts issued by the Parliament, the Government and the President of the country. Courts and tribunals administer justice at the local level. The President appoints the judges of the Supreme Court of Justice and the Court of Appeal, upon the recommendation of the Superior Council of Magistracy. The composition of the Superior Council of the Magistracy consists of 12 members. Its composition includes judges and tenured law professors, as well as the President of the Supreme Court of Justice, the Minister of Justice and the Attorney General, who are ex officio members. Three members of the Superior Council of the Magistracy from among the tenured law professors are appointed by the Parliament, with the vote of the majority of the elected deputies, based on the proposals of the Legal, Appointments and Immunities Parliament Commission. Six members of the Superior Council of Magistracy from among judges are elected by secret ballot by the General Assembly of Judges, as follows: four - from the courts, one - from the courts of appeal and one - from the Supreme Court of Justice. The specialized bodies within the Superior Council of Magistracy are: the college for the selection and career of judges, the college for evaluating the performance of judges, the disciplinary college and the judicial inspection.

1.1.2. Institutional Arrangements Associated with the Continuous Reporting of National Communications and Biennial Update Reports to the UNFCCC

The Ministry of Environment (MoE) of the RoM is the state authority responsible for developing and promoting state policies and strategies in the field of environmental protection, climate change and natural resources.

On behalf of the Government, the MoE is responsible for the implementation of the international environmental treaties to which the country is a Party (including the UNFCCC, signed by the RoM on June 12, 1992, ratified by the Parliament on March 16, 1995, as well as the Kyoto Protocol, ratified by the RoM on February 13, 2003, the official date of accession being April 22, 2003). Representatives of the MoE are also the focal point of the UNFCCC.

In accordance with the Government Decision no. 444 of 01.07.2020 on the establishing the mechanism for coordinating activities in the field of climate change, the *National Commission on Climate Change* has been established.

The nominal composition of the National Commission is approved by the Government and consists of representatives of central and local public administration authorities, educational and scientific institutions, as well as of non-governmental organizations and the private sector:

- Minister for the Environment, Chairman of the National Commission;
- State Secretary of the Ministry of Environment, Vice-Chair of the National Commission;
- Minister of Finance;
- Minister of Infrastructure and Regional Development;
- Minister of Economic Affairs;
- Minister of Health;
- Minister of Labor and Social Protection;
- Minister of Education and Research;
- Minister of Culture;
- Governor (Bashkan) of the Autonomous Territorial Unit (ATU) of Gagauzia;
- Representative of the Congress of Local Authorities of Moldova;
- Director of the State Hydrometeorological Service;
- Director of "Moldsilva" Agency;
- Representative of higher education institutions (appointed by the Council of Rectors of the RoM);
- Representative of organizations in the fields of research and innovation (appointed by the Board of Directors of Research Institutes);
- Two representatives of environmental NGOs (appointed by the National Council of Environmental NGOs);
- A representative of NGOs promoting and defending women's rights (appointed by the National Council for Participation);
- Two representatives of the private sector (appointed by the Chamber of Commerce and Industry of the RoM).

The National Commission is an inter-institutional body, without legal personality, established for the purpose of coordinating and promoting measures and actions necessary for universal application of the UNFCCC and the Paris Agreement provisions on the territory of the Republic of Moldova.

The National Commission shall ensure the institutional coordination framework in monitoring, reporting and verification, as well as facilitation of climate change aspects integration into national and sectoral programs and plans and shall aim at coordinating, at national level, the process of implementing the provisions of the UNFCCC and other international treaties in the field of climate change to which the Republic of Moldova is a party, the national reports in the field of climate change, as well as at ensuring the achievement of the tasks and objectives, within the limits of the competence established in the Regulation on its activity.

The Commission shall have the following tasks:

1) promotes and coordinates the instruments for implementing the climate change policy;
2) coordinates the streamlining the climate change mitigation and adaptation issues into national and sectoral policy documents;
3) examines and approves the reports on the climate change implementation strategies;
4) examines and endorses methodologies, operational manuals, guidelines and eligibility criteria for climate change adaptation and mitigation projects;
5) monitors the implementation of climate change projects and programs at national and sectoral level in the context of the country sustainable development;
6) monitors the implementation of national and sectoral climate change adaptation plans;
7) examines climate change projects and programs and recommends their financing by development partners and relevant international funds, in accordance with national and sectoral priorities for sustainable development;
8) facilitates the process of international collaboration on climate change;
9) coordinates the reports related to the implementation of the international treaties in the field to which the RoM is a party;
10) sets up technical committees of experts assisting the National Commission in fulfilling its duties, within the limits of their competence;
11) draws up proposals and recommendations to be included in the relevant strategies and programs to prevent and overcome the adverse effects of climate change;
12) assesses the results of the National Commission's recommendations implementation and submits proposals to improve government policies in the field of climate change in accordance with the commitments undertaken in the framework of the AA EU-RoM;
13) informs the public about the work of the National Commission.

The Commission has the right to:

1) to involve in its activity specialists from central public administration authorities, public and private sector institutions, as well as independent experts;
2) to make decisions on climate change issues;
3) to ask the central public administration authorities for information on evolution of planning and implementation of climate change activities;
4) to request from the beneficiaries of climate change projects implemented on the territory of the Republic of Moldova, reports on the implementation of climate change adaptation and mitigation measures;
5) to establish cooperation relations with local public administration authorities, international structures and bodies in the field of competence.

The members of the National Commission shall:

1) attend the Commission's meetings and examine the topics included in the agenda;
2) participate by vote in the adoption of National Commission's decisions;
3) ensure transparency in selection and promotion of public, private and civil society climate change projects and programs;

4) ensure the confidentiality of information containing personal data.

The National Commission shall have the following working bodies:

1) The Secretariat, represented by:
   a. the subdivision responsible for climate change within the MoE, which ensures the organization and protocol of the of the National Commission meetings and oversees the execution of its decisions;
   b. The Public Institution "Environmental Projects National Implementation Office" (PI "EPNIO"), which ensures the cooperation with the technical committee experts, monitoring indicators database administration, development of the climate change progress annual report, representation of the National Commission in case of litigation in court;
2) technical committees for climate change adaptation and mitigation.

The Chairman of the Commission has the following duties:

1) lead the work of the National Commission convene and chair its meetings;
2) invite to meetings of the National Commission, as appropriate, heads and specialists of central and local public authorities, other institutions, as well as independent experts;
3) represent the National Commission in relations with the third parties, other national and international authorities and organizations, within the limits of its competences, and is responsible for the activities related to the National Commission;
4) sign the decisions of the National Commission, the minutes of the meetings of the National Commission, other documents related to the activity of the National Commission;
5) delegate some of their duties to the Deputy Chairman of the National Commission if necessary;
6) exercise other tasks in accordance with the Regulation on the National Commission's activity.

The Deputy Chairman of the National Commission has the following duties:

1) cooperate, in accordance with national law, with relevant institutions abroad in the field of climate change and inform the members of the National Commission of the trends and decisions adopted;
2) propose for approval the list of experts for technical committees to the National Commission;
3) coordinate and monitor the activity of technical committees;
4) based on the Chairman's decision and in the absence of the Chairman chair the meetings of the National Commission;
5) countersign the minutes of the National Commission's meetings;
6) organize and direct the work of the National Commission Secretariat and is responsible for the efficiency of its work;
7) exercise other powers, within the limits of his authority.

The Secretariat of the National Commission has the following duties:

1) draw up and submit the agenda of the National Commission meetings to the Chairman for approval;
2) organize the meetings of the National Commission;
3) make available the documents and materials which make the subject of the meetings to the members of the National Commission and to the experts of the technical committees;
4) implement the dispositions of the Chairman of the National Commission;
5) draw up the minutes and other internal acts of the National Commission;
6) make available the relevant documents and information for the stakeholders;
7) collect sectoral reports on climate change mitigation and adaptation and prepare the annual report on climate change progress;
8) monitor the management of the database of indicators for monitoring and assessment of climate change adaptation and appropriate mitigation actions at national level;
9) supervise the implementation of the National Commission decisions;
10) organize the procedure for competitive selection of experts within the technical committees;
11) inform the National Commission about the execution of its previous decisions;
12) inform the public about the National Commission's activity;
13) fulfil other tasks set at the meetings of the National Commission.

To fulfil its duties, the National Commission is assisted by Technical Committees. The Technical Committees are established and operate on the basis of the National Commission's decision and Regulation on the establishment and operation of Technical Committees, approved by the National Commission. Technical committees are made up of experts with competences in the following fields: agriculture, energy, transport, industry, water resources, waste, forestry, health, as well as in related sectors: gender equality, finance, climate prospecting, vulnerability, green development. The list of experts of the technical committees is drawn up on the basis of the competitive selection results by the National Commission. The Secretariat of the National Commission shall publish the Terms of Reference and the conditions for the competitive selection on the official website of the MoE.

The Technical Committees exercise the following tasks:

1) ensure technical evaluation of the concept notes and project proposals submitted by the applicants for funding;

2) ensure technical evaluation of climate change adaptation and mitigation projects and programs at the stage of their completion.

The experts of the Technical Committees are responsible for:

1) objective and impartial evaluation of the concept note and project proposals submitted for evaluation;
2) objective and impartial assessment of regular progress reports on climate change adaptation and mitigation projects and programs implementation;
3) presenting opinions on the documents evaluated at the meetings of the National Commission;
4) ensuring the confidentiality of the information containing personal data.

The remuneration of the Technical Committees experts work is based on the contract with the PI "EPNIO", from the budget allocations planned for this purpose or from external sources.

The National Commission shall meet as often as necessary, but no less frequently than once every six months. For the purpose of exercising its powers, the National Commission shall make decisions. Meetings of the National Commission shall be convened by its Chairman or at the Vice-Chairman's request. Extraordinary meetings shall be convened at the request of at least one third of the total number of permanent members of the National Commission. Materials relating to matters to be considered by the National Commission shall be submitted to the Secretariat at least 15 days before the date of the meeting. The invitation to attend the meeting and the related materials shall be sent to the members of the National Commission by the Secretariat at least 10 days before the date of the meeting – in the case of ordinary meetings and at least 3 days before – in the case of extraordinary meetings. The invitation to attend the meeting of the National Commission shall indicate the date, time, venue and agenda, with materials proposed for consideration attached.

The Chairman of the National Commission may invite to the meeting other representatives of central and local public administration authorities, international and national donor organizations, non-governmental organizations and civil society, experts and other interested persons, who can contribute to the quality of debates on the topics on the agenda of the respective meeting. The invited person may participate in the meeting of the National Commission and in the debates with no voting right.

Meetings shall be deliberative if they are attended by at least 2/3 of the members of the National Commission. If not available, the permanent member of the National Commission may appoint another person from their institution to represent them at the meeting of the National Commission, including with the right to vote. The appointment shall be made on the basis of a Power of Attorney, which shall be submitted to the Chairman of the National Commission before the beginning of the meeting. The document confirming the respective person's powers shall be attached to the minutes of the meeting.

Decisions on the matters considered shall be taken with 3/4 of the votes of the National Commission members present at the meeting. The National Commission members have the right to propose, at the meeting, topics within the competence of the National Commission, to take part in the adoption of decisions. Members of the National Commission may propose amendments and additions to the agenda in writing in advance and at the meeting. Amendments shall be accepted by a majority of the members of the National Commission present at the meeting. Members of the National Commission who disagree with the adopted decision shall have the right to a separate opinion, which shall be recorded in the minutes of the meeting.

The minutes of the National Commission meeting shall be drafted by the Secretariat within 3 days of the date of the meeting and signed by the Chairman of the National Commission. The copy shall be sent within three days to the members of the National Commission. The keeping and archiving of minutes and other documents related to the National Commission activity shall be ensured by the National Commission Secretariat in the manner established by the legislation on official documents.

The agenda, decisions, reports and other documents on the activity of the National Commission, intended to be made public, shall be placed on the official website of the Ministry of Environment. The meetings of the National Commission shall be open to the public and may be attended by representatives of all stakeholders.

In accordance with the Government Decision no. 549 of 13.06.2018 regarding the establishment, organization and functioning of the Environmental Agency[3], it has been assigned the following powers *in the field of air protection and climate change*: implementation of provisions of the policy documents and international environmental treaties to which the RoM is a party in the field of quality and protection of the atmospheric air and of the ozone layer, *in the field of greenhouse gas emissions reduction and adaptation to climate change*, development and submission to the MoE of information regarding their realization; participation in the activity of the *NCCC*; ensuring the implementation *of the system of monitoring, reporting and verification of greenhouse gas emissions*; carrying out the *process of collection, centralization, validation and processing of the data and information necessary for the development of inventories and reports on atmospheric pollutants and greenhouse gas emissions; providing technical support to MoE in development of national communications and biennial update reports*, according to the provisions of the UNFCCC.

At the same time, in accordance with the Government Decision no. 1277 of 26.12.2018 on the establishment and operation of the National Monitoring and Reporting System (NMRS) of GHG emissions and other climate change relevant information, the Environmental Agency was designated as the *competent authority* responsible for ensuring the operation of NMRS of greenhouse gas emissions and other climate change relevant information, given that the NMRS operates on the account and within the limits of the state budget means approved for the institutions which are part of the system, as well as from other sources provided for by the legislation, including external financing (*activities carried out based on technical assistance and capacity building projects*).

[3] <https://www.legis.md/cautare/getResults?doc_id=119162&lang=ro>

In the above context, it is important to note that, in accordance with Government Decision No. 1249 of 19.12.2018 on the organization and operation of the PI "EPNIO"[4], the latter has the mission to support MoE and organizational structures in its area of competence, in order to effectively implement external and internal financial and technical assistance projects, in the field of environmental protection and use of natural resources (protection of atmospheric air, ozone layer and climate change; waste and chemicals management; prevention of environmental pollution; water resources management; biosecurity; biodiversity conservation and management of natural areas protected by the state), in accordance with the provisions of the normative acts related to implementation of the requirements of the international treaties to which the RoM is a part and the alignment with the international standards in the field of environmental protection, given that the basic functions of the PI "EPNIO" consist of: efficient implementation of projects in the fields of its competence in accordance with the established objectives; supervision and verification of the quality of the services provided, works and supplies provided within the established deadlines; management of the financial means allocated to projects in the fields of competence, in accordance with the assistance agreements and the approved budget; provision of the founder support for development of project proposals in the fields of competence; development and submission of progress reports on projects implementation and use of financial means intended for the projects.

The management of the PI "EPNIO" is ensured by the director of the institution (executive body), respectively by a Supervisory Committee – a higher collegial body, which manages and supervises the activity of the institution. The Committee consist of five members who are appointed for a period of four years. The nominal composition of the Committee is established by the Order of the MoE, with the mandatory inclusion of at least one representative of the State Chancellery, the Ministry of Finance, the MoE and civil society in the areas of competence of the PI "EPNIO". The Minister of Environment is the Chairman of the Committee who chairs the meetings of the Committee and fulfils any other assigned duties. In absence of the Chairman, the meetings shall be chaired by one of the members, elected by the members of the Committee who attend the meeting.

The NMRS of greenhouse gas emissions and other climate change relevant information to UNFCCC, approved by GD no. 1277 of 26.12.2018, includes two subsystems as integral parts:

1. The national inventory system, which provides institutional, legal and procedural framework for the estimation of anthropogenic emissions by sources and removals by sinks of all greenhouse gases compiled in the national inventory of GHG emissions, as well as for the reporting and archiving of inventory information, in accordance with decisions made under the UNFCCC and the Paris Agreement;
2. The national system for policies, measures and forecasts, which provides the institutional, legal and procedural framework for assessing progress in implementing climate change mitigation policies, for developing projections of anthropogenic greenhouse gas emissions by sources or removals by sinks.

Implementation of NMRS ensures collection, proper processing of data and information necessary for: (1) developing and reporting of the national inventory and of the forecasts of anthropogenic greenhouse gases emissions from sources or removals by sinks and (2) evaluation and reporting of: the progress in mitigation policies implementation; vulnerability to climate change, the impact of climate change and progress in implementation of adaptation actions; and the aggregated financial and technological support, provided by the developed industrial countries, listed in Annex I to UNFCCC, for the implementation of climate change mitigation and adaptation actions, of technical assistance and capacity building projects in the field of climate change.

In the context of GD no. 1277 of 26.12.2018, the NMRS has the objective to ensure the transparent, accurate, coherent and full monitoring and reporting of greenhouse gases to the UNFCCC Secretariat, through the provided reporting instruments, including the actions undertaken to adapt to the consequences of climate change, respectively to ensure evaluation, reporting and verification of information on the progress achieved at national level in terms of compliance with the commitments assumed made under the UNFCCC, Paris Agreement and decisions adopted on the basis thereof.

With reference to the National Inventory System (NIS), it is designed and managed so as to ensure the principles of transparency, consistency, comparability, completeness in the development of the national greenhouse gas emissions inventory, in accordance with the provisions of the 2006 IPCC Guidelines on the development of greenhouse gas inventories.

The Environmental Agency, as the competent authority, in direct collaboration with the responsible authorities and institutions that are part of the NMRS and with the support of the central authority for natural resources and the environment (MoE), ensures the organization and operation of the NIS, by periodically improving the institutional, legal and procedural framework, in accordance with the national and international legal framework.

Within the NIS, the competent authority shall draw up a national greenhouse gas inventory every two years. The national inventory data are displayed according to the format set out in Table 1 of Annex no. 1 to GD no. 1277 of 26.12.2018.

For direct GHG emissions, the National Inventory is developed in accordance with the 2006 IPCC Guidelines, by means of reporting software recommended by UNFCCC, and in the case of indirect greenhouse gas emissions, the National Inventory is developed in accordance with the updated editions of the Air Pollutant Emission Inventory Guidebook , the Technical Guidance for National Emissions Inventory, published and regularly updated by the European Environment Agency in the framework of the European Monitoring and Evaluation Program.

[4] <https://www.legis.md/cautare/getResults?doc_id=113696&lang=ro>

Based on the national greenhouse gas inventory, the competent authority is responsible for drawing up, every two years, the National Inventory Report (NIR) in the state and English languages, using the structure set out in the relevant decisions of the Conferences of the Parties to the UNFCCC, as follows: (1) Introduction; (2) Trends in Greenhouse Gas Emissions; (3) Energy Sector; (4) Industrial Processes and Product Use Sector; (5) Agriculture Sector; (6) Land-Use, Land Use Change of and Forestry Sector; (7) Waste Sector; (8) Recalculations and Planned Improvements; (9) Bibliography; and (10) Annexes.

Every two years the competent authority (the Environmental Agency) publishes the National Inventory Report (NIR), as well as the National Inventory of Greenhouse Gas Emissions in tabular format on its official website (<http://am.gov.md/>). Summary tables show the trends in greenhouse gas emissions by gas and by sector.

The competent authority shall ensure the quality of the national inventories through planning, preparation and management steps, which include collection of activity data, the appropriate selection of estimation methods and emission factors, estimation of anthropogenic greenhouse gas emissions, implementation uncertainty analysis, quality assurance and quality control activities and the procedures for verifying the data included in the national inventory.

Central Authority for Natural Resources and Environment (MoE), through the competent authority (Environmental Agency):

1) continuously monitors and improves the National Reporting System on policies, measures and forecasts regarding anthropogenic emissions of greenhouse gases by sources and removals by sinks;
2) ensures the timeliness, transparency, accuracy, consistency, comparability and completeness of the reported information on policies and measures, as well as projections of anthropogenic greenhouse gas emissions by sources or removals by sinks, and where necessary, the use and application of data, methods and models, as well as the implementation of quality assurance and quality control activities and sensitivity analysis.
3) establishes the structure, format and procedure for reporting the information provided in the National System for Policies, Measures and Projections to the UNFCCC.-

The competent authority shall communicate to the central authority for natural resources and the environment, by 15 December of the reporting year (year X), and every two years thereafter, the following:

1) description of the National reporting system on policies, measures and projections / groups of measures and projections of anthropogenic greenhouse gas emissions by sources and removals by sinks;
2) progress in implementing the low-carbon development strategy and the national determined contribution;
3) information on policies and measures/groups of measures that limit/reduce emissions from sources or increase the retention by sequestration by the greenhouse gases sinks, structured by sectors and by gas or groups of gases (HFCs and PFCs), provided in Annex no. 3 to GD nr. 1277 of 26.12.2018. The information shall include:
   a) the name of the mitigation policy or measure;
   b) the objective of the policy or measure and its short description;
   c) the type of policy instrument (economic, fiscal, voluntary, regulatory, other);
   d) the status of the policy and measure/ group of measures implementation (planned, approved, under implementation, achieved);
   e) the year of the policy and measure/group of measures implementation process initiation;
   f) the organizations/institutions responsible for implementing the policy and measure/group of measures;
   g) indicators for monitoring and evaluation progress over time, if any;
   h) the affected sector (energy, transport, industry/industrial processes and product use, agriculture, land use, land use change and forestry, waste/waste management, other sectors and sub-sectors, as appropriate);
   i) greenhouse gases concerned (CO_2, CH_4, N_2O, HFC, PFC, SF_6, NF_3);
   j) the mitigation impact or quantitative estimation of the greenhouse gases effects on emissions from sources and removals by sinks, where available, broken down into: the results of the ex-ante assessments of the effects of each policy and policy group/s and of climate change mitigation measures (provided for a succession of four future years ending with 0 or 5 immediately following the reporting year) and the results of the ex-post assessments of the effects of each policy and policy group/s and of climate change mitigation measures;
   k) an estimate of the costs and benefits, including non-GHG benefits (reductions of other types of pollutants or benefits to human health) expected for policies and measures, and an assessment of the costs and benefits of policies and measures implementation where available;
   l) all references to the assessments and related technical reports referred to in point 26, where available;
4) contribution to the attainment of the Convention's objective as a result of the CDM projects implementation.

The information on the policies and measures is a component part/chapter of the Biennial Update Report and National Communication and shall be submitted by the central authority for natural resources and environment to the UNFCCC Secretariat by 31 December of the reporting year.

When available, the competent authority shall make any relevant assessment of the costs and effects of national policies and measures publicly available, in electronic form, as well as any relevant information on the implementation of policies and measures that limit or reduce emissions from sources and increase greenhouse gas sequestration retention, including any existing technical report supporting those assessments. The assessments have to include descriptions of the models and methodological approaches used, definitions and assumptions related thereto.

The competent authority (the Environmental Agency) shall communicate national projections of anthropogenic greenhouse gases emissions by sources and removals by sinks, by gas or gas group (HFC and PFC) and by sector of activity to the central authority for natural resources and the environment (MoE) by 15 December of the reporting year (year X), and every two years thereafter. The projections shall include quantitative estimates for a sequence of four future years ending with 0 or 5 immediately following the reporting year.

National projections shall cover any policies and measures adopted at national level and shall include:

1) mitigation projections and additional measures projections, where available;
2) total greenhouse gas projections and estimates for individual greenhouse gases;
3) the impact of policies and measures as set out in point 24 of Annex no. 1 to GD no. 1277 of 26.12.2018;
4) results of the sensitivity analysis performed for the projections;
5) the relevant references to the assessments and technical reports underlying the forecasts set out in point 29 of Annex no. 1 to GD no. 1277 of 26.12.2018.

The competent authority shall make publicly available in electronic form national projections of greenhouse gas emissions from sources and removals by sinks, including the relevant technical reports underlying such projections. Forecasts include description of models and methodological approaches used, definitions and related assumptions.

In order to ensure the transparency of the reporting of information on the models or methodological approaches used in the forecasting process, the competent authority shall indicate:

1) the forecasting model used for each type of greenhouse gas and sector;
2) the type and basic characteristics of the model used (top-down, bottom-up, calculation or expert judgement);
3) the brief characteristic of the model, the purpose of its development, its adaptation to the needs of the study, the strengths and weaknesses of that model.

In order to ensure the information reporting transparency of the working assumptions and basic variables used in projections, the competent authority shall indicate:

1) the expected rate of GDP growth or decline;
2) projected population number;
3) the anticipated rate of tax growth or decrease;
4) the forecast of the international fuel price;
5) other relevant data.

The information on national projections is part/chapter of the Biennial Update Report and National Communication and shall be submitted by the central authority for natural resources and environment to the Secretariat of the UNFCCC by 31 December of the reporting year.

In accordance with the UNFCCC reporting schedule, by 15 December of the reporting year (year X), and every four years thereafter, the competent authority (the Environmental Agency) shall communicate to the central authority for natural resources and the environment (MoE) the updated information on:

1) climate models, projections and scenarios, considered to be relevant for the assessment of climate change vulnerability and climate change impact categories addressed, such as extreme temperatures, droughts, floods and other extreme weather events;
2) key economic, social and/or environmental vulnerabilities or risks associated with the current or anticipated impact of climate change;
3) the actual observed impact, i.e., the potential or future impact of climate change;
4) the institutional framework for adaptation to climate change, national and sectoral strategies and action plans, implemented or planned to facilitate adaptation to climate change and which would illustrate the medium- and long-term approaches associated with the assessment and consideration of risks and vulnerabilities at national and sectoral level;
5) the approaches used in monitoring and evaluating progress, associated with the implementation of national and sectoral policies, strategies and action plans in climate change adaptation, and the effectiveness of already implemented adaptation measures.

Information on climate change vulnerability, climate change impacts and adaptation actions is part/chapter of the National Communication and shall be submitted by the MoE to the UNFCCC Secretariat by 31 December of the reporting year.

By 15 December of the reporting year (year X), and every two years thereafter, the competent authority (the Environmental Agency) shall communicate to the central authority for natural resources and the environment, the summary of information on the support provided by the developed industrial countries referred to in Annex I to the UNFCCC to fulfil their obligations towards the UNFCCC, including information on the financial resources received through:

1) The Global Environment Fund, the Special Climate Change Fund, the Adaptation Fund, the Green Climate Fund and the UNFCCC Trust Fund;
2) other multilateral funds in the field of climate change;
3) multilateral financial institutions, including regional development banks;
4) UN specialized structures;

5) contributions received through bilateral, regional or other channels.

The summary information on the support provided by developed countries shall be presented in textual and tabular form for the last two calendar or financial years, and shall include:

1) the financial resources amount received from developed countries (in national currency and equivalent in US dollars);
2) the type of support received (for mitigation, adaptation, cross-sectoral activities);
3) status (planned or actually disbursed);
4) sources of funding (official development assistance, other official financial flows);
5) financial instrument (grant, concessional loan, non-concessional loan, capital financing);
6) sector (energy, industry, transport, buildings, agriculture, forestry, waste management, water and sanitation, cross-sectoral).

The competent authority (the Environmental Agency) shall provide the central authority for natural resources and the environment the information based on the 'Rio Benchmarks', on the financial flows provided by developed countries for support in climate change mitigation and adaptation, and methodological information on the implementation of the 'Rio Benchmarks' methodology on climate change, when relevant or applicable under the UNFCCC.

This will include:

1) the definitions and methodologies used to determine the medium offered;
2) data on the amount of greenhouse gas emissions mitigated, climate change adaptation measures implemented, capacities enhanced and technologies transferred in accordance with the decisions made by the bodies established by the UNFCCC, the Kyoto Protocol, the Paris Agreement or on the basis of agreements resulting from or succeeding them.

The information on financial and technological support provided by the developed industrial countries is part/chapter of the BUR and NC and shall be submitted by the central authority for natural resources and environment to the UNFCCC Secretariat by 31 December of the reporting year.

The competent authority draws up the BUR every two years, and the NC – every four years.

The BUR shall be prepared in accordance with the UNFCCC requirements and shall contain the following components:

1) the executive summary;
2) description of national circumstances relevant to the trends in anthropogenic greenhouse gas emissions by sources and removals by sinks;
3) the national inventory of greenhouse gas emissions;
4) description of the progress of implementation and achievement of the national determined contribution, climate change mitigation policies and measures;
5) the projection of greenhouse gas emissions and the anticipated effect of climate change mitigation policies and measures;
6) description of the financial, technical and capacity constraints and needs;
7) description of the national system for monitoring, reporting and verifying the progress of the low-carbon development strategy and appropriate mitigation actions at national level;
8) other relevant information on the achievement of the Convention's objectives.

The NC is developed in accordance with the UNFCCC requirements and contains the following components:

1) the executive summary;
2) description of the national circumstances relevant to the trends in anthropogenic greenhouse gas emissions by sources and removals by sinks;
3) the national inventory of greenhouse gas emissions;
4) description of the progress of implementation and achievement of the national determined contribution, climate change mitigation policies and measures;
5) the projection of greenhouse gas emissions and the anticipated effect of climate change mitigation policies and measures;
6) the results of the vulnerability assessment and climate change adaptation measures;
7) description of the financial, technical and capacity-building needs;
8) other information concerning the fulfilment of the Convention's objectives.

In accordance with the Decisions 1/CP16 and 2/CP.17, the central authority for natural resources and the environment shall submit the BUR to the UNFCCC Secretariat every two years by 31 December of the reporting year, and the NC, respectively – every four years, in accordance with Article 12 of the UNFCCC and Decision 17/CP.8.

The competent authority shall publish the NCs and the BURs of the RoM to the UNFCCC in the Romanian and English languages on its official website.

The competent authority shall provide the responsible authorities and institutions that are part of the NMRS, as well as the identified respondents that hold the information, emission factors and activity data, needed to estimate anthropogenic greenhouse gas emissions, as provided in Tables 2-6 of Annex no. 1 to GD no. 1277 of 26.12.2018, the format of the reporting questionnaires.

Collecting and processing the data needed for drawing up the national inventory, as provided in Tables 2-6 of Annex no. 1 to GD no. 1277 of 26.12.2018, is the obligation of the concerned authorities and institutions, given their participation in the Statistical Works Program, annually approved by the Government.

Where there is a discrepancy between the information and data for the same indicator, the competent authority shall use official data and information at national level provided by the central statistical body.

For the data and information needed to assess and estimate the level of greenhouse gas emissions not covered by the Statistical Works Program, the competent authority shall carry out consultations with the responsible authorities and institutions that are part of the NMRS. The results of the consultations shall be recorded in a protocol setting out the procedures for drawing up specific studies and the responsibilities for them.

The competent authority shall request from the public administration body ensuring the economic security of the state, implementing the customs policy and directly managing the customs activity in the RoM, the data needed to draw up the national inventory, according to Tables 2-6 of Annex no. 1 to GD no. 1277 of 26.12.2018, by tariff headings of the Combined Nomenclature of Goods, approved by the Law no. 172 of 25 July 2014.

The exchange of data between the competent authority and the authorities and institutions that are part of NMRS is free of charge and within the deadlines provided for by the corresponding Regulation, provided that the provisions of Chapter VII of Law no. 93/2017 on official statistics are observed.

In order to ensure the accuracy and proper identification of the uncertainty degree for the activity data and the processed emission factors, as necessary, the competent authority shall contract consultancy services, studies for the development of emission factors, development of specific software, as well as any other studies, analyses and research needed to ensure the proper functioning of NMRS.

The data provided in Tables 2-6 of Annex no. 1 to GD no. 1277 of 26.12.2018 shall be updated by Government Decision, at the proposal of the central authority for natural resources and the environment, according to the dynamics and evolution of data and information, as well as changes in the institutional framework or of any other nature.

The environmental control body shall exercise the function of supervision and control regarding the compliance with the provisions of the Regulation on the establishment and operation of the NSMR, in accordance with Article 26 of Law no. 1515/1993 on Environmental Protection and Law no. 131/2012 on the state control over the entrepreneurial activity. Failure to comply with the provisions of the Regulation entails disciplinary, contravention or criminal liability according to the legislation in force.

As the competent authority responsible for the operation of the NSMR, the Environmental Agency, by Letter no. 3471 of 25.09.2019 requested the Climate Change Office within the PI "EPNIO" to examine and identify the possibility of providing the necessary support in carrying out the climate change attributions by organizing the entire process of developing the BUR3 of the RoM to UNFCCC, respectively the NC5 of the RoM to the UNFCCC, in accordance with the rules, procedures and decisions of the Conference of the Parties to the UNFCCC.

For this purpose, the Climate Change Office within the PI "EPNIO" was authorized to request and receive, directly or through the Environmental Agency, the information from the central public authorities, the local public administration authorities, organizations and institutions, economic agents that operate in the fields that have the primary information necessary for the preparation of these two national reports; to collect, process and validate the data and information needed for the development of greenhouse gas emissions national inventories and reports; to train specialists within the Environmental Agency in the process of processing collected data and information to develop their capacities in the areas concerned.

It is worth noting that, within the MoE (between February 2004 and December 2018), and more recently within the PI "EPNIO" (January 2019 - July 2020), the Climate Change Office held the responsibility for the activities associated with the preparation of NCs, BURs, NIRs and National GHG Inventories. During the period indicated above, the Climate Change Office had full responsibility for the activities associated with the preparation of the NCs, and since 2014, the BURs.

There are three working groups within the climate change projects implementation units of the PI "EPNIO": "National Greenhouse Gas Inventory", "Climate change mitigation, monitoring, reporting and verification of GHG emissions reduction" and "Climate modelling, vulnerability assessment, climate change impacts and adaptation measures" (Fig. 1-1).

The functional responsibilities of the participants in the process are summarized as follows:

- National experts (contract-based employment) are responsible for the process of activity data collection, selecting evaluation methods, evaluating at sectoral level, taking corrective measures in response to verification, quality control and quality assurance activities, as well as for the drafting the component parts of the key chapters of NCs, BURs and NIRs.
- The coordinators of the working groups are responsible for coordinating the compilation process of the key chapters of the NCs, BURs and NIRs. They oversee the evaluation process at sectoral level, are responsible for the interpretation of the results obtained by the national experts, coordination of the verification and quality control activities, the process of documentation and archiving the materials used and the synthesis of reports submitted by the national experts.

The information associated with the legal and institutional framework for collecting the activity data needed for compilation of NCs, BURs and NIRs is described in Chapter 2.2 "Institutional arrangements, inventory process".

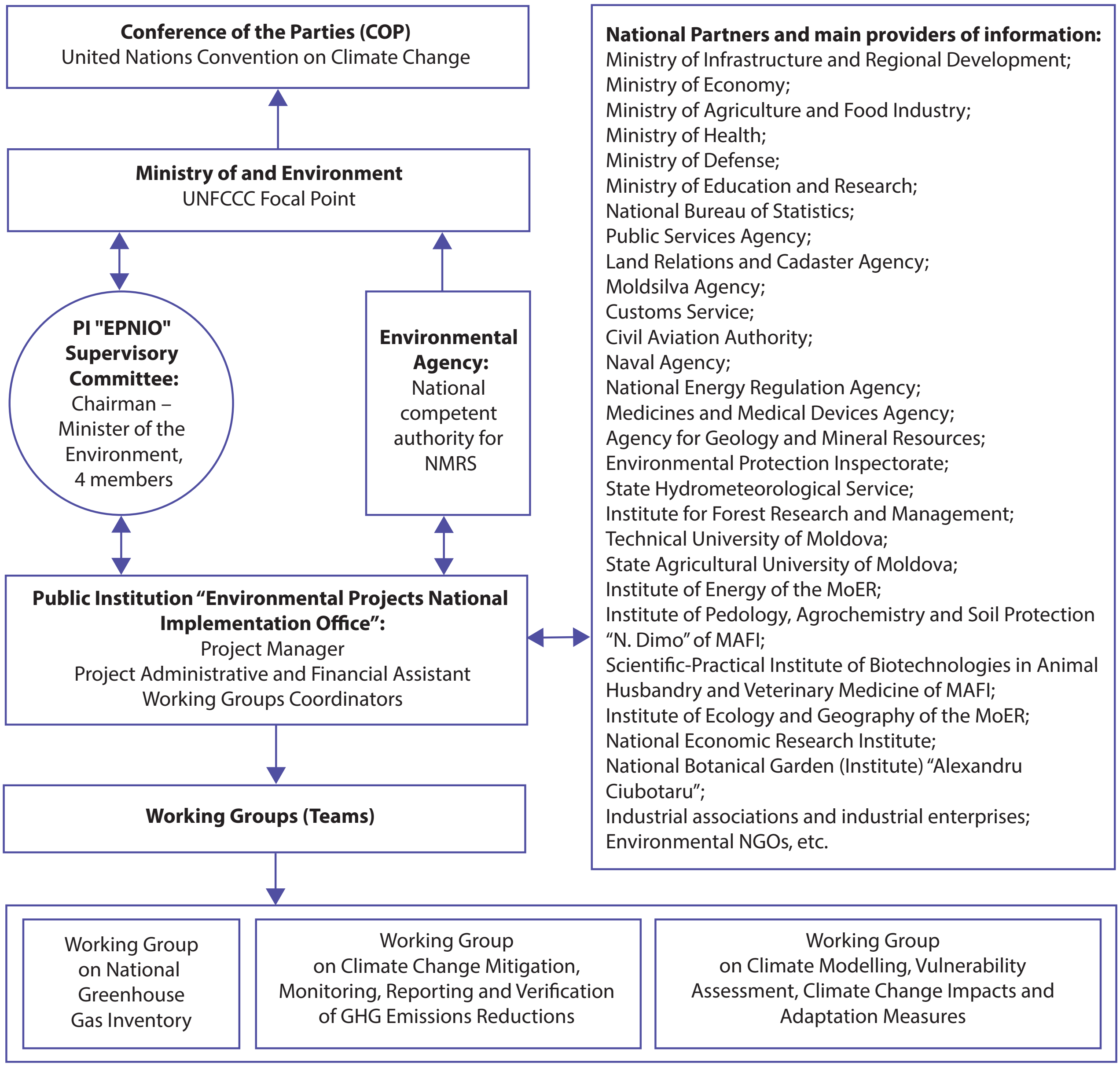


Figure 1-1: Institutional arrangements on reporting to the UNFCCC.

1.2. Administrative-Territorial Organization, Population Profile and Demographic Situation

1.2.1. Administrative-Territorial Organization

According to the Law no. 764 of 27.12.2001, the territory of the RoM is administratively organized in 32 districts, 13 municipalities and two administrative-territorial units (Fig. 1-2).

In most districts (Anenii Noi, Basarabeasca, Briceni, Cahul, Cantemir, Calarasi, Causeni, Cimislia, Criuleni, Donduseni, Drochia, Edinet, Falesti, Floresti, Glodeni, Hancesti, Ialoveni, Leova, Nisporeni, Ocnita, Orhei, Rezina, Rascani, Sangerei, Soroca, Straseni, Soldanesti, Stefan Voda, Taraclia, Telenesti, Ungheni) the administrative center is located in the cities and only the Dubasari district has its residence in Cocieri commune. On January 1, 2020, the population number in districts varied from minimum 28 thousand inhabitants (Basarabeasca district) to maximum 124 thousand inhabitants (Orhei district).

In the RoM, municipalities are urban-type localities with a special role in the economic, social-cultural, scientific, political and administrative life of the country, with important industrial, commercial structures and institutions in the field of education, health and culture. In most cases the municipalities comprise several localities. For example, Chisinau municipality, which is also the capital of the country, comprises 35 localities, including five districts, six cities and 12 communes (which comprise 26 localities). The other 12 municipalities are: Balti, Bender, Cahul, Ceadir-Lunga, Comrat, Edinet, Hincești, Orhei, Soroca, Straseni, Tiraspol and Ungheni.

The division of the country's territory into administrative-territorial units is aimed at ensuring the implementation of principles of local autonomy, decentralization of public services, eligibility of local public administration authorities, ensuring the access of citizens to governing bodies and their consultation on local issues of special interest. All local matters fall within the competence of the elected local councils.

Figure 1-2: Administrative-territorial map of the Republic of Moldova.

In the RoM there are two autonomous territorial units (ATU): ATU Gagauzia and the administrative-territorial units on the left side of the Dniester River (ATULBD) (according to Art. 16 and Annex No. 5 of the Law No. 764 as of 27.12.2001 on the organization administrative-territorial of the RoM, they can be assigned special forms and conditions of autonomy; it include: 1 municipality, 9 cities, 2 localities in the components of cities, 69 communes and 135 localities in the components of communes). ATU Gagauzia has an area of about 3000 km^2 (160 thousand inhabitants)[5] and ATULBD has an area of about 4163 km^2 (465 thousand inhabitants)[6]. With the beginning of the breakup of the USSR, the ATULBD promoted a separatist policy towards the Central Public Administration. Currently, this area is only partially monitored by the constitutional authorities of the RoM.

[5] <http://statbank.statistica.md/pxweb/pxweb/ro/20%20Populatia%20si%20procesele%20demografi-ce/20%20Populatia%20si%20procesele%20demografice__POP010/POP010300reg.px/?rxid=2345d98a-890b-4459-bb1f-9b565f99b3b9>|

[6] <http://mer.gospmr.org/gosudarstvennaya-sluzhba-statistiki/informacziya/ezhegodnik-gosudarstvennoj-sluzhby-statistiki.html>

1.2.2. Population Profile

On January 1, 2021, the population of the RoM (including ATULBD) was 3109.7 thousand inhabitants, its density being about 92 inhabitants/km² (Table 1-1). According to the number of inhabitants, the RoM exceeds such states as Bosnia and Herzegovina, Lithuania or Slovenia.

Table 1-1: Population present at the beginning of the year in the RoM, 1990-2020

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Total inhabitants, thousands	4 361.6	4 347.9	4 303.5	4 087.4	3 686.8	3 345.4	3 298.9	3 250.6	3 199.4	3 151.2	3 109.7
Men, thousands	2 077.8	2 076.7	2 061.0	1 948.1	1 754.5	1 594.1	1 574.7	1 547.5	1 518.2	1 493.9	1 473.8
Women, thousands	2 283.8	2 271.2	2 242.5	2 139.4	1 932.3	1 751.3	1 724.2	1 703.0	1 681.2	1 657.3	1 635.9
Men, %	47.6	47.8	47.9	47.7	47.6	47.7	47.7	47.6	47.5	47.4	47.4
Women, %	52.4	52.2	52.1	52.3	52.4	52.3	52.3	52.4	52.5	52.6	52.6
Density, pers./km²	129.2	128.4	127.2	120.8	108.9	98.8	97.5	96.0	94.5	93.1	91.9

Source: National Bureau of Statistics of the Republic of Moldova (2021) and State Statistical Service of UAT on the left Bank of the Dniester River (2021).

Over the period 1990-2020, the number of inhabitants decreased by about 28.7% or by 1251.9 thousand. This decrease is determined by the negative natural balance and the negative balance of external migration. As a result of this dynamics, the average density of the population decreased from 129 persons/km² in 1990 to 92 persons/km² in 2020.

In the gender structure, women predominate – 52.6%, compared to only 47.4% male population. The high proportionality in the gender structure in favor of women places Moldova among the top 10 countries in the world with this indicator and negatively influences the demographic processes. The population is mainly concentrated in rural areas, the 1614 rural settlements accounting to 55.0% of the total number of settlements, on average with about 1400 inhabitants in a settlement. Urban population is 45.0%.

The level of urbanization is one of the lowest in Europe. The urban settlements have small size, on average 27 thousand inhabitants and only five municipalities and four cities have a population of over 33 thousand inhabitants: Chisinau (832.9 thousand inhabitants), Balti (151.8 thousand inhabitants), Tiraspol (127.7 thousand inhabitants), Bender (Tighina) (83.4 thousand inhabitants), Ribnița (44.0 thousand inhabitants), Cahul (39.4 thousand inhabitants), Ungheni (38.3 thousand inhabitants), Soroca (37.9 thousand inhabitants) and Orhei (34.1 thousand inhabitants).

According to the data of the population censuses, of 2014 year for the territory on the right bank of the Dniester River and of 2015 year for the territory of the ATULBD, the country was inhabited by 73.1% of Moldovans/ Romanians (64.5% in 1989), Ukrainians – 8.8% (13.8% in 1989), Russians – 7.6% (13.0% in 1989), Gagauzians – 4.0% (3.5% in 1989), Bulgarians – 1.9% (2.2% in 1989), Roma – 0.3% (0.3% in 1989), other ethnicities – 0.7% (1.3% in 1989) (Tab. 1-2).

Table 1-2: Distribution of stable population by nationality in the RoM (according to the data of the 2004 and 2014/2015 population censuses)

	Persons		in % of total population		in % of total population that declared their ethnicity	
	2004	2014/2015	2004	2014/2015	2004	2014/2015
Total population on the right bank of the Dniester River	**3 383 332**	**2 804 801**	**100.0**	**100.0**	**x**	**x**
Population that declared their ethnicity, *including:*	**3 369 312**	**2 754 719**	**99.6**	**98.2**	**100.0**	**100.0**
Moldovans	2 564 849	2 068 058	75.8	73.7	76.1	75.1
Ukrainians	282 406	181 035	8.3	6.5	8.4	6.6
Russians	201 218	111 726	5.9	4.0	6.0	4.1
Gagauz	147 500	126 010	4.4	4.5	4.4	4.6
Romanians	73 276	192 800	2.2	6.9	2.2	7.0
Bulgarians	65 662	51 867	1.9	1.8	1.9	1.9
Roma	12 271	9 323	0.4	0.3	0.4	0.3
Other ethnicities	22 130	13 900	0.7	0.5	0.7	0.5
Non-ethnic population	14 020	50 082	0.4	1.8	x	x
Total population on the left bank of the Dniester River	**555 347**	**475 665**	**100.0**	**100.0**	**x**	**x**
Population that declared their ethnicity, *including:*	**538 148**	**409 548**	**96.9**	**86.1**	**100.0**	**100.0**
Moldovans	177 382	135 565	31.9	28.5	33.0	33.1
Ukrainians	160 069	108 927	28.8	22.9	29.7	26.6
Russians	168 678	138 419	30.4	29.1	31.3	33.8
Bulgarians	13 858	11 416	2.5	2.4	2.6	2.8
Gagauz	4 096	5 232	0.7	1.1	0.8	1.3
Belarusians	3 811	2 378	0.7	0.5	0.7	0.6
Germans	2 071		0.4	0.0	0.4	0.0
Hebrew	1 259		0.2	0.0	0.2	0.0
Transnistrians		952	0.0	0.2	0.0	0.2
Other ethnicities	6 924	6 659	1.2	1.4	1.3	1.6
Non-ethnic population	17 199	66 117	3.1	13.9	x	x
Total population in the Republic of Moldova	**3 938 679**	**3 280 466**	**100.0**	**100.0**	**x**	**x**
Population that declared their ethnicity, including:	**3 907 460**	**3 164 267**	**99.2**	**96.5**	**100.0**	**100.0**

	Persons		in % of total population		in % of total population that declared their ethnicity	
	2004	2014/2015	2004	2014/2015	2004	2014/2015
Moldovans	2 742 231	2 203 623	69.6	67.2	70.2	69.6
Ukrainians	442 475	289 962	11.2	8.8	11.3	9.2
Russians	369 896	250 145	9.4	7.6	9.5	7.9
Gagauz	151 596	131 242	3.8	4.0	3.9	4.1
Romanians	73 276	192 800	1.9	5.9	1.9	6.1
Bulgarians	79 520	63 283	2.0	1.9	2.0	2.0
Roma	12 271	9 323	0.3	0.3	0.3	0.3
Other ethnicities	32 384	21 511	0.8	0.7	0.8	0.7
Non-ethnic population	31 219	116 199	0.8	3.5	x	x

1.2.3. Demographic Situation

Over the period of 1990-2020, the demographic processes were marked by a negative dynamic (Table 1-3), manifested by the instability of demographic indicators and phenomena such as the reduction of birth rate, the increase in mortality, depopulation, demographic ageing and other.

Table 1-3: Evolution of demographic indicators in the RoM, persons, 1990-2020

	Live births	Deaths	Deaths in children under 1 year	Natural growth	Marriages	Divorces
1990	77 085	42 427	1 482	34 658	40 809	13 135
1995	56 411	52 969	1 214	3 442	32 775	14 617
2000	36 939	41 224	681	-4 285	21 684	9 707
2005	37 695	44 689	468	-6 994	27 187	14 521
2010	40 474	43 631	476	-3 157	26 483	11 504
2015	40 547	39 800	364	747	24 709	11 199
2016	39 640	38 412	353	1 228	21 992	10 605
2017	36 363	36 779	334	-416	20 924	9 312
2018	34 537	37 263	311	-2 726	20 399	10 721
2019	32 423	36 411	271	-3 988	20 301	10 736
2020	30 730	40 656	268	-9 926	15 540	8 665

Source: National Bureau of Statistics of the Republic of Moldova, Statistical data base, <https://statbank.statistica.md/pxweb/pxweb/ro/20%20Populatia%20si%20procesele%20demografice/20%20Populatia%20si%20procesele%20demografice__POPrec__POP010/?rxid=b2ff27d7-0b96-43c9-934b-42e1a2a9a774>.

In 2020, the birth rate of 11.7‰ decreased sharply compared to 1990 (17.7‰), well below the mortality rate – 15.5‰, which increased compared to 1990 (9.7‰) (Table 1-4). Infant mortality continues to be one of the highest in Europe – 8.7‰, though decreasing compared to 1990 (19.0‰). In 2020, the natural balance of the population was negative (-3.8‰), a sharp decrease compared to 1990 (8.0‰).

Table 1-4: Rates of natural population movement in the RoM, ‰, 1990-2020

	Live births	Deaths	Deaths in children under 1 year	Natural growth	Marriages	Divorces
1990	17.7	9.7	19.0	8.0	9.4	3.0
1995	13.0	12.2	21.2	0.8	7.5	3.4
2000	10.2	11.3	18.3	-1.1	6.0	2.7
2005	10.5	12.4	12.4	-1.9	7.6	4.0
2010	11.4	12.3	11.7	-0.9	7.4	3.2
2015	14.3	14.0	9.0	0.3	8.7	4.0
2016	14.1	13.7	8.9	0.6	7.8	3.8
2017	13.2	13.3	9.2	-0.1	7.6	3.4
2018	12.8	13.8	9.1	-1.0	7.5	4.0
2019	12.2	13.7	8.4	-1.5	7.6	4.0
2020	11.7	15.5	8.7	-3.8	5.9	3.3

Source: National Bureau of Statistics of the RoM, Statistical data base <https://statbank.statistica.md/pxweb/pxweb/ro/20%20Populatia%20si%20procesele%20demografice/20%20Populatia%20si%20procesele%20demografice__POPrec__POP010/?rxid=b2ff27d7-0b96-43c9-934b-42e1a2a9a774>.

One of the consequences of this dynamics is the demographic ageing, manifested by the increase in the average age of the population. Thus, over the period of 1990-2020, the average age of the population of both sexes increased in the RoM from 32.0 years in 1990 to 39.2 years in 2020 (in men, the value of the indicator increased from 30.3 to 37.4 years, and in women, respectively, increased from 33.5 to 40.9 years) (Table 1-5).

Table 1-5: Average age by sex of the population in the RoM, years, 1990-2020

	Both sexes	Men	Women
1990	32.0	30.3	33.5
1995	32.4	30.7	33.9
2000	33.4	31.8	34.9
2005	34.9	33.2	36.5
2010	36.2	34.6	37.8
2015	37.7	35.9	39.3
2016	37.9	36.1	39.5
2017	38.1	36.4	39.8
2018	38.5	36.7	40.1
2019	38.8	37.0	40.5
2020	39.2	37.4	40.9

Source: National Bureau of Statistics of the Republic of Moldova, Statistical data base, <https://statbank.statistica.md/PxWeb/pxweb/ro/20%20Populatia%20si%20procesele%20demografice/20%20Populatia%20si%20procesele%20demografice__POPrec__POP020/POP021000rcl.px/table/tableViewLayout1/?rxid=b2ff27d7-0b96-43c9-934b-42e1a2a9a774>.

Over the period 1990-2020, the RoM there featured an insignificant increase in the "life expectancy at birth" indicator - from 68.0 years in 1990 to 69.8 years in 2020 (in men, the value of the indicator increased from 63.9 years to 65.9 years, and in women, respectively, increased from 71.9 years to 73.9 years) (Table 1-6). Compared to other countries, the values of "life expectancy at birth" indicator are modest, placing the RoM on one of the last places in Europe by this indicator.

Table 1-6: Life expectancy at birth in the RM, years, 1990-2020

	Both sexes	Men	Women
1990	68.0	63.9	71.9
1995	65.8	61.8	69.7
2000	67.6	63.9	71.2
2005	67.9	63.8	71.7
2010	69.1	65.0	73.4
2015	69.4	65.2	73.7
2016	69.9	65.7	74.2
2017	70.8	66.7	74.9
2018	70.6	66.3	75.0
2019	70.9	66.8	75.1
2020	69.8	65.9	73.9

Source: National Bureau of Statistics of the Republic of Moldova, Statistical data base, <https://statbank.statistica.md/PxWeb/pxweb/ro/20%20Populatia%20si%20procesele%20demografice/20%20Populatia%20si%20procesele%20demografice__POPrec__POP020/POP020700rcl.px/table/tableViewLayout1/?rxid=b2ff27d7-0b96-43c9-934b-42e1a2a9a774>.

At the beginning of 2021, there were 584.0 thousand people aged 60 and over, which is 22.5% of the total population with habitual residence in the RoM[7]. Of the total number of the elderly population, 349.5 thousand persons were women (or 59.9%), each third person was between 60-64 years old, and 61.2 thousand persons (or 10.5%) were persons over the age of 80.

The share of people over the age of 60 is steadily increasing. In the last five years, the share of the elderly in the age group of 70-74 years has increased the most – by 6.0% (from 13.0% at the beginning of 2017 to 19.0% at the beginning of 2021).

At the beginning of 2021, the population ageing coefficient was 22.5%, which corresponds to a high level of demographic ageing. Compared to the beginning of 2017, it increased by 3.3%. Differences can also be seen in distribution by sex, the aging coefficient of the female population at the beginning of 2021 being by 6.9% higher than that of men and was 25.8% compared to 18.9% for men.

On 1 January 2021, the ratio between men and women aged 60 and over was 67.1 men per 100 women (versus 66.4 men per 100 women on 1 January 2017). In the 80-84 age group, changes in gender ratios are more noticeable, falling from 48 to 45 men per 100 women.

The average life span of the population aged 60 years decreased by 0.5 years for men and by 0.2 years for women over the period 2016-2020. As a result, the gap between the average life span of men and women aged 60 increased, from 4.2 years (in 2016) to 4.5 years (in 2020) in favor of women. A 60-year-old woman is likely to live another 18.6 years, while the average life span of a 60-year-old man is 14.1 years, according to 2020 data.

The main causes of mortality of the elderly were diseases of the circulatory system (64.4% of the total deceased in this age group), malignant tumors (13.4%) and diseases of the digestive system (5.5%). Male supra-morality, characterized by higher mortality in elderly men compared to mortality in elderly women, was observed in all major causes of death.

According to the data of the Ministry of Health, in 2020, about 68% of new cases of malignant tumors were reported in people aged 60 years and over. On average, every day, 16 elderly people were diagnosed for the first time with malignant tumors, with a total of 5.9 thousand elderly people. On average 1011 new cases of malignant tumors were reveled per 100 thousand elderly population compared to 1129 cases in 2016. Malignant tumors are more common in men, with an average of 1351 new cases of malignant tumors per 100,000 men aged 60 years and older compared to 782 new cases per 100,000 women of the same age. The highest rate of incidence with malignant tumors was reported in both men and women for the age segment 65-69 years old – 1396 new cases per 100,000 men of that age and 758 new cases per 100,000 women.

In 2020, at the country level, there were 1.1 thousand new cases of active tuberculosis, almost every fourth case (26.4%) being a person aged 55 and over. At the same time, about 63% of these cases were registered in the population aged 55 years and over in rural areas. For 100 thousand inhabitants aged 55-64 there were 57 new cases of active tuberculosis and 21 new cases of active tuberculosis per 100 thousand inhabitants aged 65 and over.

[7] National Bureau of Statistics, Press release "Elderly in the Republic of Moldova in 2020" <https://statistica.gov.md/newsview.php?l=en&idc=168&id=7137>.

According to the data of the Ministry of Health, from the beginning of the COVID-19 pandemic in the RoM (March 7, 2020) until April 10, 2022, about 515,488 thousand cases of infection with the new type of Coronavirus were confirmed, and 11,470 thousand people died[8]. The descriptive analysis of deaths caused by COVID-19 reveals that the average age of the deceased was 68.8 years. Of the total number of registered deaths, 7,091 thousand were reported after the beginning of the immunization campaign (March 2, 2021), of which 528 deaths in fully vaccinated people. By April 10, 2022, a total of 2,133,658 doses were administered, and the national coverage with the complete vaccination scheme was 30.9%.

1.3. Geographical Profile and Natural Resources

1.3.1. Geographical Position

The RoM is located in the central part of Europe, in the North-Western Balkans, on a territory of 33,846 thousand km^2. The capital of the country is Chisinau, attested in 1436, with a population of about 833 thousand inhabitants (NBS, 2020). To the north, east and south it is surrounded by Ukraine, and to the west – separated from Romania by the Prut River (Fig. 1-3).

The total length of the national border is 1389 km, including 939 km – with Ukraine, 450 km – with Romania.

The territory is crossed by the 28˚ 50' E meridian and the 47˚ N parallel. The extreme points of the RoM are located as follows: the northernmost point of the country is the commune of Naslavcea (48˚ 21' N 27˚ 35' E), the southernmost – the commune of Giurgiulesti (45˚ 28' N 28˚ 12' E), which is also the only locality on the Danube bank, the westernmost point is the commune of Criva (48˚ 16' N 26˚ 30' E), and the easternmost – the commune of Palanca (46˚ 25' N 30˚ 05' E). The distances between the extreme points are about 350 km between Naslavcea and Giurgiulesti and only 120 km from west to East, on the latitude of Chisinau municipality.

The RoM is part of the Black Sea Basin countries. Its southern border stretches as far as the Black Sea, the exit to the sea opening through the harbor of the Dniester River and the Danube River.

1.3.2. Relief

The area between the Prut and the Dniester is part of the Moldovan Plateau, which extends from the piedmont of the Obcinelor Bucovinei and the Subcarpathians of Moldova in the West to the Dniester River in the East. The south-western branches of the Podolie Plateau cut into the land on the left of the Dniester River. Within these major units, apart from the plateau relief, there are hills and plains. The absolute altitudes are between 429 m (Balanesti Hill) and 4 m in the Dniester River meadow (Palanca commune).

The relief, in addition to other geoecological, biotic and sociohumanic elements, contributed to the formation and evolution of geographical landscapes and ecosystems. The formation of the geoecological complex occurred at the end of the Upper Pleistocene and in the first half of the Holocene. The biotic complex (vegetation, animal world, and soils) formed in the second half of the Holocene.

[8] Ministry of Health of the Republic of Moldova, < https://msmps.gov.md/comunicare/se-atesta-o-scadere-a-numarului-de-cazuri-noi-de-covid-19-in-randul-copiilor/>.

Figure 1-3: Map of the Republic of Moldova.

1.3.3. Land Resources

The RoM has unique land resources, which are distinguished by predominance of chernozem soils with high productivity potential, a very high degree of land usage (>75%) and a rugged terrain (over 80% of cropland is located on slopes).

On January 1, 2020, the total area of lands accounted for 3384.7 thousand ha (NBS, 2021), including 2492.1 thousand ha (73.6%) – agricultural lands; of which 1841.9 thousand ha (54.4%) – arable lands, 283.5 thousand ha (8.4%) – perennial plantations; 339.9 thousand ha (10.1%) – meadows and pastures; 26.7 thousand ha (0.7%) – fallow land; 467.5 thousand ha (13.8%) – forests and lands with forest vegetation; 96.4 thousand ha (2.9%) – rivers, lakes, basins and ponds; and 328.7 thousand ha (9.7%) – other lands (Tab. 1-7).

Table 1-7: Distribution of land by categories of lands in the RoM, thousand ha, 1992-2020

	1992	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Lands – total, including:	**3376.0**	**3385.1**	**3384.4**	**3384.6**	**3384.4**	**3384.6**	**3384.6**	**3384.6**	**3384.6**	**3384.7**	**3384.7**
Agricultural land	2565.9	2556.7	2550.3	2521.6	2501.1	2499.7	2499.6	2499.8	2496.6	2496.4	2492.1
of which:											
Arable land	1736.3	1758.7	1813.8	1840.2	1816.7	1817.4	1822.9	1827.3	1832.3	1838.5	1841.9
Perennial plantations	474.8	430.7	352.3	297.8	301.0	291.7	288.9	288.8	290.1	286.6	283.5
of which:											
Orchards	224.5	208.3	170.8	131.9	132.5	134.5	132.5	133.5	132.5	131.2	129.8
Vineyards	215.8	202.6	168.9	155.5	153.5	137.5	136.2	135.3	135.8	133.1	130.6
Grasslands	350.5	365.2	373.9	370.8	352.1	346.4	345.0	342.8	340.2	339.1	337.8
Grazing lands	4.3	2.1	2.5	2.7	2.2	2.2	2.1	2.1	2.1	2.0	2.1
Waste land	0.0	0.0	7.8	10.1	29.1	42.0	40.6	38.8	31.9	30.2	26.7
Forests and other land under forest vegetation	421.7	425.3	422.7	439.5	462.8	464.5	465.2	465.3	466.3	467.2	467.5
Rivers, lakes, pools and pools	88.7	92.6	95.5	96.8	96.4	96.8	96.7	96.1	96.1	96.5	96.4
Other lands	299.7	310.5	315.9	326.7	324.3	323.6	323.1	323.4	325.7	324.7	328.7

Source: Statistical Yearbooks of the Republic of Moldova for 2021, 2017, 2016, 2014, 2012, 2008, 2003, 1999 and 1994.

The soil cover of the RoM is very varied, being made up of over 745 varieties of soils. Chernozems make up about 73.7% of the country's surface; grey forest soils (they are found predominantly on heights with an altitude of over 200 m of the North Plateau, the Nistrean and Codri Hills) occupy about 9.4%, and brown forest soils (found on heights with an altitude of over 300 m, currently or in the past covered with beech, hornbeam and oak forests), respectively about 0.6%; alluvial soils (they are found in the floodplains of the rivers on recent alluvial deposits) occupy about 10.2%; and diluvial soils (they are formed at the base of the slopes and in the valleys on the account of the soil particles transported by erosion), respectively – about 3.7%; vitreons (they are formed on the limestone under the influence of the grasslands associations of steppe and forests) – about 1.0%; cernosomoide soils, muddy and turboidal soils (they are found at the base of the forests) – about 0.7%; vitreons (they are formed in steppe and silvosteppe under the grassy vegetation on heavy clay soils)) – about 0.4%; and saline alkali soil– about 0.2% of the country's territory. The extremely high degree of land usage in agriculture requires rational use, improvement and protection of soils against erosion, landslide and other reckless human interventions.

1.3.4. Water Resources

The rivers. In the RoM there are 3621 permanent or temporary rivers, rivers and streams with a length of over 16 thousand km, 90% of which have a length of less than 10 km and only 9 exceed the length of 100 km.

All rivers are part of the Black Sea basin and can be grouped as follows: the rivers of the Dniester basin, the rivers of the Prut basin and the southern rivers that flow into the Danube or Black Sea estuaries. Small rivers predominate. The largest are the Dniester River (1,352 km, of which 657 km on the territory of the country, with an annual flow of about 10 km^3), Prut River (976 km, of which 695 km on the territory of the country, with an annual flow of about 2.4 km^3), Raut river (286 km), Cogalnic (243 km, on the territory of the country – 125 km), Bic (155 km), Botna (152 km). The average density of the hydrographical network in Moldova is 0.48 km/km^2, ranging from 0.84 km/km^2 in the north of the country to 0.12 km/km^2 on the left bank of the Dniester River.

The main sources of river water supply are snow and rains, the role of the groundwater being much smaller. Most precipitations fall in the form of rain showers, and only 10% of the rainfall comes in the form of snow. A high level of water occurs in spring due to the melting of snow (40-50% of the annual runoff). In the summer season, with the downfall of heavy rains, river levels, especially of the smaller ones, can rise considerably, sometimes causing catastrophic flooding.

The lakes. There are 4275 aquatic basins with an area of about 43 125.4 ha on the territory of the country, of which only about 60 are natural lakes[9]. Most are lakes in the floodplains of the Prut River (Beleu – 6.26 km^2, Dracele – 2.65 km^2, Rotunda – 2.08 km^2) and Dniester River (Salaş – 3.72 km^2, Roş – 1.16 km^2, Nistrul Vechi – 1.86 km^2). However, there are over 4250 accumulations of water arranged for various household purposes (irrigation, fishing, rest, industrial and domestic needs, protection against flooding). Large lakes, including hydroelectric power plants, were created on the Prut River in collaboration with Romania – Costeşti-Stanca (59 km^2), on the Nistru river – Dubasari (67.5 km^2), Cuciurgan (27.3 km^2) and on the Bic – Ghidighici river (8.8 km^2).

Groundwaters. Groundwaters plays a special role in the aboveground water balance in the Republic of Moldova. They are actively included in the hydrological cycle as part of the underground water flow. The distribution of groundwater resources on the territory of the country is not uniform, most of them being concentrated in the floodplains of the Dniester and Prut rivers. As we move away from these rivers, the water supply to the underground aquifer horizons decreases. Thus, groundwater resources in the Republic of Moldova include 17 complexes and aquifers of different ages, which have an uneven distribution on the territory of the country[10]. More important are six aquifer horizons: the Freatic Quaternary (22 mil. m^3), the Medium Sarmatian (110 mil. m^3), the Lower Sarmatian + Badian (770 mil. m^3), the Cretaceous (110 mil. m^3), the Upper Sarmatian and the Pontic (44 mil. m^3). In most aquifer horizons about 50% of the water has drinking qualities, except for the phreatic one, about 20-30%. The reserves of the deep waters account for a total of 1100 mil. m^3, and about 255 thousand. m^3/day approved as good water for economic needs.

Approximately 40% of the rural population is supplied with water from underground layers with hydrostatic pressure, reportedly from about 4970 wells (in 2020 only 2614 wells were exploited, including 1666 for drinking water, and 662 for technical use, 47 for agricultural use, 224 for industrial purposes, and 16 for treatment), respectively in most cases water from the first aquatic layer (without pressure) is used (out of about 178.7 thousand wells, of which well-developed – 144.9 thousand wells and 3,094 thousand springs, of which well-developed – 2,060 thousand springs), which ensures about 1.8 million m^3/day confirmed reserves. Of the total quantity of groundwater available on the territory of the country, only 50% may be used for drinking purposes without prior treatment.

Mineral waters. Currently, on the territory of the RoM there are about 50 types of mineral waters in about 170 deposits, of which about half (mostly due to the fluorine and hydrogen sulphide that exceeds the maximum allowable limit by ten and respectively, eight times) are not exploited[11]. Of these, about 25 deposits (Varniţa-III, Brăneşti, Purcari, Edineţ-II, Micăuţi, Cotiujeni, Orhei, Bălţi-III, Ialoveni, etc.), including the deposits of curative mineral waters (spring no. 3 from Gura Căinarului village) are new deposits, appreciated after recent prospecting. Water mineralization is 1.0-10.0 g/dm^3. The curative mineral waters are characteristic for the south and northeast of the country, they are hydrocarbon and hydrocarbonate-sulphates with the prevalence of sodium and calcium cations. They contain hydrogen sulphide (30.0-80.0 mg/dm^3), iodine (17.0-26.0 mg/dm^3), bromine (132.0-139.0 mg/dm^3) and other chemical elements (lithium, radon, strontium).

Industrial waters. On the territory of the RoM, industrial groundwater contains rare chemical elements that can be extracted from water. The most common are the water deposits with iodine, bromine, strontium, caesium, rubidium, boron and helium. The maximum concentration of elements in water with mineralization of 70-100 g/dm^3 is 60 mg/dm^3 iodine; 360 mg/dm^3 bromine; 380 mg/dm^3 strontium; 1.0 mg/dm^3 caesium; 3 mg/dm^3 rubidium; 15.0 ml/dm^3 helium.

Thermal waters. The thermal waters are spread in the RoM in the Prut River floodplain and in the southern part of the country. The temperature of the water is 20.0-80.0°C, and the drilling flow is 10-100 m^3/day.

[9] <http://ipm.gov.md/sites/default/files/2021-09/IPM_ANUAR_2020.pdf>.

[10] <http://moldova-suverana.md/article/apa-este-dimensiunea-ecologic-fundamental-a-existenei_423>

[11] <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=319952>.

1.3.5. Biological Resources

Vegetation. The geographical location, the climate and the relief determined the formation of a varied vegetation rich in species – the flora of the RoM comprising at present about 5513 species of plants: 1989 superior species and 3524 inferior species[12]. By floristic composition, the forest ecosystems are the richest (over 850 species), followed by the steppe ecosystems (over 600 species), the meadow ecosystems (about 650 species), petrophytes (about 250 species), aquatic ecosystems and palustras (about 160 species). There are about 1200 species of fungi, including 836 species of macromicetes in the Republic of Moldova.

At the landscape level, the territory of the country is located in two natural areas: the forest-steppe and steppe. The steppe area occupies the plains and plateaux down south of the Codri Plateau and to the south and east of the Tigheci Hills. Apart from these regions, the steppe vegetation is found in the north, in the Plain of Cubolta, in the Ciulucului Hills and in the Plain of Middle Prut.

At present, most of the steppe lands are used in agriculture, and given these circumstances, the typical steppe vegetation, represented by *Stipa capillata*, fescue with various herbs, has been preserved only on small sectors of the slopes with old landslides or on the more inclined slopes, prone to erosions. Of the total number of steppe species, 18 are included in the Red Book of the Republic of Moldova, of which nine species (*Astragalus dasyanthus Pall., Belevallia sarmatica (Georgi) Woronow, Bulbocodium versicolor (Ker.-Gawl.) Spreng., Colchicum triphyllum G.Kunze, C. Fominii Bordz. Galanthus elwesii Hook. fil.* Ornithogalum *amphibolum Sucrose, O. oreoides Sucrose., Stembergia colchiciflora Waldst. et Kit.*) are also mentioned in the Red Book of Ukraine (1996) and in the Red List of Superior Plants in Romania (1994).

On the highest peaks in the forest-steppe area, more frequently in the forest region, in addition to the steppe vegetation, the forest vegetation is also found. Deciduous forests (97.8%) specific to Central Europe (including oak groves – 39.6%, acacia groves - 36.1%, ash groves – 4.6%, hornbeam groves – 2.6%, poplars – 1.6%, etc.) predominate, resinous species accounting for as little as 2.2%[13].

The country's forest ecosystems contain 45 native species of trees, 81 native species of shrubs, and three native species of vine trees. Among the most widespread native species of woody plants found in our forests are the common oak *(Quercus robur)*, the sessile oak *(Quercus petraea)*, the downy oak *(Quercus pubescens)*, the European ash *(Fraxinus excelsior)*, the European hornbeam *(Carpinus betulus)*, the common elm *(Ulmus laevis)*, the sycamore maple *(Acer pseudoplatanus)*, the common linden *(Tilia cordata)*, the European birch *(Betula pendula)* and the European beech *(Fagus sylvatica)*.

The animal world. The fauna of the RoM is relatively rich and varied. There are over 15.0 thousand species of animals in the country, including 461 species of vertebrates and over 14 thousand species of invertebrates. The vertebrates include 70 species of mammals, 281 species of birds, 14 species of reptiles, 14 species of amphibians and 82 species of fish. Of the vertebrate animals, the most numerous is the class of birds – 281 species and subspecies, and of the invertebrates – insects: over 12 thousand species.

The most widespread native species of mammals are the ear bat *(Plecotus auritus)*, the common hedgehog *(Erinaceus europaeus)*, the European mole *(Talpa europaea)*, the common kite *(Sorex araneus)*, the nictal *(Nyctalus noctula)*, the common squirrel *(Sciurus vulgaris)*, the common rabbit *(Lepus europaeus)*, the European meercat *(Citellus citellus)*, the spotted meercat *(Citellus suslicus)*, the domestic mouse *(Mus musculus)*, the grey rat *(Rattus norvegicus)*, the forest mouse *(Apodemus sylvaticus)*, the field mouse *(Apodemus flavicollis)*, the common fox *(Vulpes vulpes vulpes)*, the deer *(Capreolus capreolus)*, the wild boar *(Sus scrofa)*, the badger *(Meles meles)*, the rock marten *(Martes foina)*, the European ferret *(Mustela putorius)* and the weasel *(Mustela nivalis)*.

Rare and endangered animals are under protection of the law, so 126 species of plants and 116 species of animals were included in the 2nd edition of the Red Book of the Republic of Moldova (2002): mammals – 14, birds – 39, reptiles – 8, amphibians – 1, fish – 12, cyclostomates – 1, insects – 37, crustaceans – 1 and mollusks – 3; already 219 species of animals were included in the 3rd edition of the Red Book (2015) - (3 species of the *Soricidae* family from the *Insectivora* order, 16 species from 2 families from the *Chiroptera* order, most numerous (14 species) being of the *Vespertilionidae* family of *Myotis* genus (Small Common Bat, Large-eared Bat, etc.), of which 7 species are critically endangered, 5 – vulnerable and 4 – endangered species. The *Rodentia* order includes 5 species protected by law, which are part of 4 families; the *Carnivora* order includes 6 species from 2 families, including European Mink. There are also 62 species of Birds, which fall into 12 orders and 23 families; all are species protected by law, the majority being representatives of the *Anatidae* (9 species) and *Accipitridae* (15 species) families of the *Anseriformes* order. Among the reptiles protected by law, there are 9 species, which fall into 2 orders and 4 families, most numerous species being of *Squamata* order; also there are 9 species of Amphibians, belonging to 2 orders (*Caudata* – 2 species and Ecaudata – 7 species) and 6 families; most of them, according to the statute, are vulnerable species; the fish are present with 23 species protected by the law, which are part of 7 orders and 9 families; according to the statute, 13 species are vulnerable and 10 species are endangered; some fish species –– long-tailed Cnipovicia, Perch, Eastern *Cottus gobio*, *Alburnoides bipunctatus* are protected at the European level; the largest number of species – 80, included in the 3rd edition of the Red Book are the Insects, which are part of 8 orders and 28 families; the larger number are from the *Hymenoptera* order, the *Apidae* family – 11 species, of which 6 species are of the *Bombus* genus; the *Lepidoptera* order – 31 species and the *Coleoptera* order – 25 species, of which 8 species are of the *Carabidae* family, the *Carabus* genus. According to the statute, 40 species of insects are critically endangered, 33 are vulnerable, and 7 are endangered).

The mammals mostly populate in forest ecosystems – 47 species, meadows – 33 species and agricultural lands – 25

[12] <http://ipm.gov.md/sites/default/files/2021-09/IPM_ANUAR_2020.pdf>.
[13] <http://ipm.gov.md/sites/default/files/2021-09/IPM_ANUAR_2020.pdf>.

species, while birds mostly populate aquatic ecosystems– 109 species, forest ecosystems – 106 species, agricultural lands– 76 species, steppes and petrophytes – 45 and 23 species, respectively.

There are five scientific reserves with a total area of 19,497 thousand ha in the Republic of Moldova. Two forest reservations – "Codrii" and "Plaiul Fagului" – are in the center of Moldova; two others – "Prutul de Jos" and "Padurea Domneasca" – are located in the valley of the Prut River; the fifth reservation – "Iagorlac" in Dubăsari district – aims to protect and study the unique aquatic ecosystem of the Dniester River.

1.3.6. Mineral Resources

Underground minerals mostly used on the territory of the RoM are: (1) the carbonated rocks of the lower Sarmatian and of the Badenian – are used in the industry of construction of residential and industrial buildings, in cement production, sugar refining, roads construction, as a feed addition, etc.; (2) the siliceous rocks (siliceous limestone, diatomites, tripoli) – are used in the food industry, in production of mock leather, paper, thermal and electrothermic materials, etc. (3) the clayey rocks (clay shale, bentonite clays, common clays) – are used for manufacturing cement, keramite, bricks, tiles and roofing tiles; (4) the sands and gravels (pebbles) – are used for the production of glass, concrete, in various branches of construction including roads; (5) the sulphatic rocks (gyps) – are used in constructions, medicine, pharmaceutical industry; (6) the crystalline rocks (gabbro, granite, gabbro-norites) - are used for production of reinforced concrete and road construction; (7) as oil-burnets, coal (petrol, gas, brown coal) are available in insignificant amounts (Valeni, Victorovca, Vladiceni).

Currently, more than 400 deposits of useful mineral substances (limestone, clay, sands, sandstone, gypsum, granite, tripoli, diatomaceous earth) are registered by the prospection bodies on the territory of the country. About 40% of the total number are being used, of which about 130 deposits are being exploited now, and about 50 deposits are in underground exploitation.

The most frequently used underground minerals are carbonated, siliceous, clayey rocks, sands and gravels, and less commonly used – caustobiolite rocks (oil, gas, brown coal), because their quantities are insignificant.

The deposits of non-metallic mineral substances are presented by granite and gabronorite (for finishing slabs and gravel of different fractions), sandstone (for finishing slabs and blocks), gypsum (for construction materials industry, medicine, export), chalk, limestone (for cutting limestone blocks of different sizes, for sugar factories, for cement factories, for disaggregating it in different fractions of gravel), clay (for cement production, ceramics, tiles, pipes, seams, bricks, terracotta, in the chemical and food industry for purifying wines, juices, oils – "bentonite", etc.), sands (for glass, mortar, and for forming – "sticky sand"), sands - primrose (for construction), tripol (diatomite) and marlage, which are the basis of construction materials and construction sites with raw materials.

The deposits of metalliferous (metal) substances are represented, according to the geophysical investigations carried out in the post-war years, by sectors with major concentrations of lead, zinc, copper and iron, located along the middle course of the Dniester River (sector located between village Naslavcea and Rezina town). Iron ore composed of quartz-pyroxenmagnetite is studied more extensively, the predicted reserves of which are about 280.0 million tons. This deposit, discovered near the Varancau village, Soroca district is represented by a series of stratigraphic bodies, located at a depth of 200 – 370 m. Their thickness varies from 1 – 2 m to 20 – 50 m. The extraction of the given deposit is unprofitable.

Modest reserves of hydrocarbons were identified in the south of the country, such as oil (Valeni, Cahul), natural gas (Victorovca, Cantemir) and brown coal (Etulia, ATU Gagauzia). Solid fuel is represented by 4 deposits of brown coal (reserves valued at about 1.2 million tons), the layers of which are 1 m to 2 m thick and are located at depths between 6 m and 60 m and 400–650 m in sand-clayey deposits, neogeneous (N). Coal is of a relatively low quality, with a high content of ash (12–49%) and sulphur (4–15%), therefore taking into account the complicated mining-technical conditions (depth, low thickness, overhydration) its extraction by current methods is not profitable and does not represent an industrial interest. According to estimates, oil reserves are about 1.7 million tons and natural gas deposits are about 960 million cubic meters. As a result of the exploitation of the Valeni oil and of the Victorovca natural gas deposits, about 6 thousand tons of crude oil and about 88.5 thousand m^3 natural gas were extracted in 2020.

The mining industry affects the environment in a special way, at all stages of the technological production processes. The entire mining activity produces multiple and varied negative effects on the environment, illustrated by changes in the landscape, landscape degradation, occupation and degradation of large areas of land, hydrological disbalance, etc.

1.4. Economic Profile

After the collapse of the USSR and the declaration of its independence, the Republic of Moldova was affected by a proportionate, severe crisis, even if compared to other countries with economies in transition. In 1991, the RoM was placed in the group of low middle-income countries, and now it is one of the poorest states in Europe with a gross domestic product (GDP) per capita below the average of the Commonwealth of Independent States (CIS) and the countries of Central Europe. Structurally, its economy is more like that of the countries of Central Asia than that of other states in the western part of the former USSR.

1.4.1. Gross Domestic Product

The secession of the industrialized ATULBD in 1992 left the RoM with an undiversified economic base, depending almost entirely on agricultural and food production. In 1995, the agricultural sector accounted for 29.3% of GDP, while the extractive and processing industry accounted for 22.5% of GDP. In 2020, the share of agriculture decreased to 9.6% of

GDP, and the extractive and processing industry accounted to 10.8% of GDP (Table 1–8).

It should be noted that the economy was in decline before 1991, but the breakup of the USSR hastened this process. The GDP declined continuously from 1990 to 1999, when it reached 34% of 1990 levels. The only exception was in 1997, when thanks to excellent agricultural production, determined by favorable weather conditions, there was a slight increase by 1.6% compared to the previous year. The causes of this economic collapse were manifold.

Table 1-8: GDP structure in the RoM, %, 1995-2020

	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Structure (in %)	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Gross value added	88.6	87.5	84.0	86.1	87.2	87.6	86.5	86.5	87.0	87.1
Goods, total	54.2	41.9	32.2	24.9	27.0	26.8	26.4	25.0	24.1	23.5
Agriculture	29.3	25.4	16.4	11.2	11.5	11.4	11.5	10.3	10.2	9.6
Mining and quarrying	22.5	14.1	13.5	10.2	12.2	12.1	11.8	11.4	10.9	10.8
Production and supply of energy, gas, hot water	2.0	1.8	2.0	2.9	2.5	2.5	2.4	2.5	2.3	2.3
Sanitation	0.5	0.5	0.4	0.7	0.8	0.8	0.8	0.8	0.8	0.8
Services – total	36.7	48.0	53.8	61.2	60.2	60.8	60.1	61.5	62.9	63.6
Wholesale and retail trade	8.0	12.5	10.4	12.6	13.8	14.3	15.0	15.2	15.6	15.4
Transport and storage	2.9	4.5	5.0	4.1	4.6	4.8	4.7	4.9	4.9	4.3
construction	3.5	2.7	3.3	6.7	7.2	6.9	6.9	7.9	8.6	9.2
Other financial activities	3.7	5.3	4.6	4.0	2.5	3.3	3.2	3.1	3.6	4.1
Other branches	18.6	23.1	30.4	33.9	32.1	31.6	30.3	30.3	30.3	30.6
Intermediary services	-2.2	-2.4	-2.0							
Net taxes on product and import	11.4	12.5	16.0	13.9	12.8	12.4	13.5	13.5	13.0	12.9

Source: National Institute of Economic Research of the Ministry of Education and Research (September 2021).

First, RoM was fully integrated into the Soviet economic system, and independence led, among other things, to the cessation of any subsidies or transfers from the centralized government.

Secondly, the end of the Soviet era with well-established trade links has led to numerous obstacles to the free movement of products and restrictions on access introduced by emerging markets.

Thirdly, the lack of energy resources and its own raw materials meant that the country's economy remained heavily dependent on the rest of the former USSR. This dependence has caused shocks in imports, due to higher energy prices in Russian Federation.

Finally, internal causes should also be mentioned: the transition from the centralized economy to a market economy, the loss of industries based in ATULBD, frequent droughts and the Transnistrian dispute. However, the steady considerable GDP growth since 2000 (except for 2009, when the RoM was affected by the regional economic crisis, namely 2012, 2015 and 2020, when the country was affected by severe droughts) indicates that the economic recovery occurred, although it should be remembered that, according to the last accessible data, the value of GDP in 2020 was only 75.8% of the 1990 level (Table 1-9).

Table 1-9: Gross Domestic Product, billion MDL, 1990-2020

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
GDP, billion MDL (real)	13.0	6.5	16.0	37.7	86.3	145.8	160.8	178.9	192.5	210.4	206.4
in % compared to the previous year	97.6	98.6	102.1	107.5	107.1	99.7	104.4	104.7	104.3	103.7	93.0
in % compared to 1990	100.0	39.4	34.8	49.0	57.4	68.9	71.9	75.3	78.5	81.4	75.8

Source: National Institute of Economic Research of the Ministry of Education and Research (September 2021).

Also, the substantial inflow of funds from Moldovans working abroad has reduced the effect of the decline of economic activity.

Table 1-10: Gross Domestic Product in 1990-2020, US$ billion, updated to the level of 2015

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
GDP, US $billion (updated to 2015)	11.250	4.435	3.913	5.508	6.452	7.745	8.087	8.466	8.830	9.135	8.784
in % compared to the previous year	97.6	98.6	102.1	107.5	107.1	99.7	104.4	104.7	104.3	103.5	96.2

Source: situation at 1/8/2021, <https://www.ers.usda.gov/data-products/international-macroeconomic-data-set.aspx#.UXFRIKJTCQo>

Table 1-11: Gross Domestic Product in the RoM, US$ billion, 1995-2020

	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
GDP, US $ billion (real)	**1.441**	**1.288**	**2.988**	**6.977**	**7.746**	**8.071**	**9.674**	**11.457**	**11.970**	**11.916**
in % compared to the previous year	123.7	110.0	115.0	128.3	81.5	104.2	119.9	118.4	104.5	99.5
GDP, US $ billion (PPC)	**7.586**	**7.687**	**8.492**	**17.742**	**26.145**	**29.998**	**31.949**	**34.123**	**36.255**	**35.375**
in % compared to the previous year	69.3	103.7	116.2	175.8	100.7	114.7	106.5	106.8	106.2	97.6
GDP per capita, thousand MDL	**1.798**	**4.401**	**10.473**	**24.221**	**51.421**	**57.389**	**64.926**	**71.083**	**78.942**	**78.756**
in % compared to the previous year	100.7	102.3	107.8	129.1	100.5	105.6	106.5	106.1	105.4	94.6
GDP per capita, thousand US $	**0.400**	**0.354**	**0.831**	**1.959**	**2.733**	**2.880**	**3.511**	**4.230**	**4.492**	**4.547**
GDP per capita, thousand US $(PPC)	2.105	2.112	2.362	3.722	6.027	6.379	6.803	7.168	13.604	13.499

Source National Institute of Economic Research of the Ministry of Education and Research (September 2021).

1.4.2. Trade Balance Deficit

The RoM's expenditures for imports far exceed the country's earnings from exports, causing a very serious problem related to the trade balance deficit (Table 1-12). This deficit amounted to 23.7% of GDP in 2000 and to over 24.7% of GDP in 2020.

Table 1-12: Trade balance deficit of the RoM, 1995-2020

	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Gross Domestic Production, US $ billion	1.441	1.288	2.988	6.977	7.746	8.071	9.674	11.457	11.970	11.916
Export (C.I.F.), US $ billion	0.746	0.471	1.091	1.541	1.967	2.045	2.425	2.706	2.779	2.467
in % compared to the previous year	131.9	101.7	110.7	120.1	84.1	104.0	118.6	111.6	102.7	88.8
Import (F.O.B.), US $ billion	0.841	0.776	2.292	3.855	3.987	4.020	4.831	5.760	5.842	5.416
in % compared to the previous year	127.5	132.4	129.6	117.6	75.0	100.8	120.2	119.2	101.4	92.7
Trade balance deficit, US $ billion	-0.095	-0.305	-1.201	-2.314	-2.020	-1.976	-2.406	-3.054	-3.063	-2.949
Coverage of IMP by EXP, %	88.7	60.7	47.6	40.0	49.3	50.9	50.2	47.0	47.6	45.6
% of GDP: export	51.7	36.6	36.5	22.1	25.4	25.3	25.1	23.6	23.2	20.7
Import	58.3	60.3	76.7	55.3	51.5	49.8	49.9	50.3	48.8	45.5
Balance	-6.6	-23.7	-40.2	-33.2	-26.1	-24.5	-24.9	-26.7	-25.6	-24.7

Source: National Institute of Economic Research of the Ministry of Education and Research (September 2021).

This reflects the country's dependence on the import of energy resources and the increasing demand for imported products (Table 1-13). The rise of imports is boosted by massive inflows of remittances from abroad, which are channeled into household consumption.

Table 1-13: Structure of imports by groups of goods, %, 1997-2020

	1997	2000	2005	2010	2015	2016	2017	2018	2019	2020
Import, total, including:	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Live animals; animal products	1.9	1.4	1.1	1.7	2.6	2.4	2.5	2.5	3.2	3.8
Vegetable products	**3.2**	**3.2**	**1.3**	**2.8**	**4.1**	**4.3**	**3.6**	**4.3**	**4.9**	**5.1**
Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes	0.4	0.3	0.3	1.0	1.1	1.6	1.3	0.8	0.8	1.1
Foodstuffs; alcoholic beverages, soft drinks, vinegar; tobacco	**7.5**	**9.2**	**9.0**	**14.4**	**14.1**	**15.7**	**15.3**	**11.7**	**12.2**	**12.8**
Mineral products	**35.3**	**33.0**	**40.7**	**42.2**	**36.5**	**30.7**	**30.0**	**32.8**	**28.7**	**22.0**
Products of the chemical or related industries	**9.6**	**9.6**	**6.1**	**5.7**	**8.5**	**9.2**	**8.9**	**8.9**	**9.8**	**9.4**
Plastics and articles thereof; rubber and articles thereof	**3.1**	**3.1**	**4.8**	**3.8**	**4.7**	**5.4**	**5.4**	**5.1**	**5.4**	**5.8**
Raw hides and skins [raw material], tanned hides and skins, and products thereof	0.3	0.3	6.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Wood, charcoal and wooden articles, cork and cork articles, manufactures of straw, other plaiting materials, basketwork and wickerwork	1.7	1.3	2.0	2.5	4.2	4.7	5.2	4.9	5.5	5.9
Pulp of wood or of other fibrous cellulosic material; paper and paperboard, recycled from waste and scrap; paper, paperboard (waste and scrap) and articles thereof	4.1	3.6	3.9	2.6	2.5	2.5	2.6	2.6	2.7	2.8
Textiles and textile articles	**5.3**	**10.0**	**0.7**	**0.9**	**1.6**	**1.9**	**1.9**	**1.6**	**1.8**	**1.9**
Footwear, headgear, sun umbrellas, walking canes, seat-sticks, wipes, riding crops and parts thereof, treated feathers and articles made therewith; artificial flowers; articles of human hair	0.3	0.3	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.3
Articles of stone, plaster, cement, asbestos, mica or similar materials; ceramic products; glass and glassware	3.9	2.1	4.0	3.8	4.0	4.4	4.5	4.0	4.2	4.3
Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal, and articles thereof; imitation jewelry; coin	0.2	0.2	0.4	0.2	0.4	0.4	0.4	0.4	0.6	0.4
Base metals and articles of base metal	**4.4**	**4.1**	**8.3**	**7.4**	**6.6**	**6.8**	**7.3**	**8.4**	**7.5**	**8.0**
Machinery and apparatus, electrical equipment and parts thereof; sound or video recording or reproducing apparatus	**12.9**	**12.7**	**6.3**	**6.0**	**5.6**	**5.8**	**6.8**	**7.3**	**8.0**	**8.9**
Vehicles, aircraft, vessels and auxiliary transport equipment	**3.0**	**2.0**	**3.6**	**3.0**	**1.7**	**2.2**	**2.0**	**2.6**	**2.4**	**5.3**
Optical, photographic or cinematographic instruments and appliances, medical or surgical apparatus; clocks and watches; musical instruments; parts and accessories thereof	1.7	2.5	0.3	0.3	0.2	0.2	0.2	0.3	0.2	0.2
Miscellaneous manufactured articles	1.2	1.1	1.0	1.5	1.4	1.4	1.5	1.4	1.5	1.8
Works of art, collectors' pieces or antiques	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	0.0	0.0

Source: National Bureau of Statistics. Statistical database (<http://www.statistica.md/category.php?l=en&idc=336&>)

The range of exported products is relatively small, which complicates the efforts to enter Western markets. Exports are dominated by vegetal products, foodstuffs and alcoholic beverages, animal or vegetable fats and oils, chemical or related industry products, textiles and related industries products, articles of stone, plaster, cement, asbestos, mica or similar materials, ceramics, glass and glassware, base metals and products thereof, machinery and apparatus, electrical equipment, etc.

In 2020, food and beverages, chemical and related industries products, textile materials and products thereof, along with machinery, appliances and electrical equipment, other goods and miscellaneous products (see the text marked in bold in Table 1-14) accounted for about 87.2% of total exports.

Table 1-14: Structure of export by groups of goods, %, 1997-2020

	1997	2000	2005	2010	2015	2016	2017	2018	2019	2020
Import, total, including:	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Live animals; animal products	8.6	4.8	1.6	1.7	1.9	2.0	1.9	1.7	1.4	1.4
Vegetable products	**8.6**	**14.0**	**12.1**	**22.1**	**25.5**	**25.9**	**27.3**	**25.4**	**25.9**	**23.2**
Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes	**0.9**	**0.8**	**3.5**	**3.1**	**3.7**	**2.7**	**2.2**	**2.5**	**2.5**	**4.2**
Foodstuffs; alcoholic beverages, soft drinks, vinegar; tobacco	**54.8**	**42.1**	**36.3**	**20.6**	**15.4**	**15.7**	**15.2**	**13.6**	**13.7**	**15.4**
Mineral products	0.4	0.6	1.8	1.1	0.9	0.7	1.2	1.2	0.9	1.0
Products of the chemical or related industries	**1.5**	**1.8**	**1.4**	**4.8**	**6.1**	**4.4**	**4.1**	**3.8**	**4.3**	**3.2**
Plastics and articles thereof; rubber and articles thereof	0.6	0.4	1.1	1.7	2.1	1.7	1.4	1.5	1.7	1.6
Raw hides and skins [raw material], tanned hides and skins, and products thereof	1.4	2.8	6.6	1.6	1.3	1.2	0.9	0.8	0.7	0.6
Wood, charcoal and wooden articles, cork and cork articles, manufactures of straw, other plaiting materials, basketwork and wickerwork	1.2	1.5	5.6	0.3	0.3	0.2	0.2	0.1	0.1	0.1
Pulp of wood or of other fibrous cellulosic material; paper and paperboard, recycled from waste and scrap; paper, paperboard (waste and scrap) and articles thereof	0.1	0.2	0.2	0.4	0.4	0.5	0.4	0.7	0.8	0.8
Textiles and textile articles	0.4	0.4	1.1	0.8	0.5	0.6	0.5	0.6	0.6	0.6
Footwear, headgear, sun umbrellas, walking canes, seat-sticks, wipes, riding crops and parts thereof, treated feathers and articles made therewith; artificial flowers; articles of human hair	**6.7**	**17.7**	**17.8**	**17.4**	**13.9**	**15.0**	**14.3**	**13.6**	**11.7**	**11.7**
Articles of stone, plaster, cement, asbestos, mica or similar materials; ceramic products; glass and glassware	0.6	0.8	2.4	2.0	1.2	1.4	1.4	1.3	1.3	1.4
Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal, and articles thereof; imitation jewelry; coin	**1.4**	**3.1**	**1.7**	**2.3**	**2.1**	**2.2**	**1.7**	**2.1**	**2.0**	**2.4**
Base metals and articles of base metal	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0
Machinery and apparatus, electrical equipment and parts thereof; sound or video recording or reproducing apparatus	**1.0**	**2.5**	**4.5**	**3.8**	**2.2**	**2.1**	**2.0**	**1.7**	**1.6**	**2.3**
Vehicles, aircraft, vessels and auxiliary transport equipment	**5.2**	**5.1**	**4.2**	**11.1**	**15.0**	**14.6**	**16.1**	**20.9**	**22.4**	**21.1**
Optical, photographic or cinematographic instruments and appliances, medical or surgical apparatus; clocks and watches; musical instruments; parts and accessories thereof	5.9	1.1	1.4	1.4	0.9	1.3	1.7	0.8	1.0	1.3
Miscellaneous manufactured articles	0.4	0.7	0.7	0.8	1.4	1.4	1.3	1.1	1.3	1.2
Works of art, collectors' pieces or antiques	**1.4**	**1.1**	**1.6**	**3.3**	**5.5**	**6.5**	**6.4**	**6.6**	**6.1**	**6.6**
Import, total, including:	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: National Bureau of Statistics. Statistical database (<http://www.statistica.md/category.php?l=en&idc=336&>)

1.4.3. Money Transfers and Remittances

Money transfers from abroad, especially remittances from people working abroad, are of great importance for the Moldovan economy. Globally, RoM is among the leaders in terms of the share of remittances in GDP. In 2020, net inflows of foreign currency from Moldovans abroad amounted to about US $1.8765 billion or about 15.7% of GDP (Table 1-15).

Table 1-15: Remittances from citizens working abroad, 1997-2020

	1997	2000	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
GDP, US$ million	1 928.7	1 288.4	2 988.2	6 976.7	8 415.5	8 708.6	9 493.7	9 508.1	7 746.2	8 071.5	9 674.4	11 456.7	11 970.2	11 915.5
Remittances, US$ million	114.3	177.6	915.1	1 752.8	1 813.1	1 986.4	2 191.5	2 075.9	1 540.1	1 467.2	1 637.9	1 837.6	1 909.6	1 876.5
in % compared to the previous year	131.3	160.8	130.5	129.6	103.4	109.6	110.3	94.7	74.2	95.3	111.6	112.2	103.9	98.3
in % of GDP	5.9	13.8	30.6	25.1	21.5	22.8	23.1	21.8	19.9	18.2	16.9	16.0	16.0	15.7

Source: World Bank, 2021 (<https://data.worldbank.org/indicator/BX.TRF.PWKR.CD.DT?end=2019&start=1990>)

Despite the trade balance deficit of products and services, the increasing amounts of money coming from those working abroad contributed to the decrease of the current account deficit of the RoM. The fact that the country relies very much on remittances from citizens working abroad is a phenomenon potentially generating problems and lacking sustainability, as the money flow from abroad stimulates consumption to a greater extent than production, thus increasing imports and inflation, and in case of a rapid decrease of remittances, it is likely to generate an immediate negative shock for the economy. In recent years, the amounts sent to the country from abroad tend to decrease, as some immigrants settle permanently outside the borders of the RoM.

1.4.4. Investments, International Investment Position and Gross External Debt

A major role in the process of economic growth of RoM is played by investments, which have increased significantly compared to previous years. In 2020, about 1,737 US$ billion (14.6% compared to GDP) (Table 1-16).

Table 1-16: Investments in the national economy of the RoM, 1993-2020

	1993	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
GDP, US $ billion	1.358	1.441	1.288	2.988	6.977	7.746	8.071	9.674	11.457	11.970	11.916
Investments, US $ billion	0.128	0.188	0.141	0.619	1.116	1.123	0.987	1.271	1.635	1.778	1.737
in % of GDP	9.4	13.0	10.9	20.7	16.0	14.5	12.2	13.1	14.3	14.9	14.6

Source: National Institute of Economic Research of the Ministry of Education and Research (September 2021).

At the same time, in 2020, foreign direct investments (FDI) attracted to the national economy (net inflows) amounted to 157.4 US$ million (1.3% compared to GDP) (Table 1-17), well below the level of 2008, when foreign direct investments attracted to the national economy amounted to 726.6 US$ million (12.0% in relation to GDP).

Table 1-17: Foreign direct investments (net inflows) attracted to the national economy of the RoM in the period 1993-2020

	1993	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Gross domestic product, US$ million	1 358.3	1 441.4	1 288.4	2 988.2	6 976.7	7 746.2	8 071.5	9 674.4	11 456.7	11 970.2	11 915.5
Foreign direct investment	14.0	66.9	127.5	190.7	290.2	225.6	88.4	149.5	288.7	501.6	157.4
in % compared to the previous year	82.4	224.0	336.6	126.3	110.8	63.2	39.2	169.2	193.1	173.8	31.4
in % of GDP	1.0	4.6	9.9	6.4	4.2	2.9	1.1	1.5	2.5	4.2	1.3

Source: World Bank <https://data.worldbank.org/indicator/BX.KLT.DINV.CD.WD?locations=MD>

According to preliminary data, the international investment position of the RoM, as of December 31, 2020, was -5,493.85 million US$ (or 46.1% relative to GDP), the debit balance deepening by 10.2% compared to the end of 2019[14].

The balance of external financial assets amounted to 5,823.14 million US$, up by 10.1% from the beginning of the year, and of the liabilities – 11,316.99 million US$, up 10.1%.

The increase in the position of external financial assets during 2020 was determined by the 23.7% increase in the balance of official reserve assets. They amounted to 3,783.54 million US$ as of December 31, 2020, which corresponds to all sufficiency criteria: (i) coverage of at least 3 months of imports of goods and services (they covered 7.7 months of actual import); (ii) full coverage by reserves of short-term external debt (they covered 158.6%); (iii) coverage of 20% of the money supply M2 (they covered 85.8%), etc.

The evolution of the external liabilities position was determined by the article Other Investments, in particular, by the increase of the external loans balance. The balance of liabilities in the form of loans (excluding intra-group loans) increased by 20.5% compared to 31 December 2019 and accounted for 4,122.13 million US$. Debt position in the form of trade loans and advances received increased by 12.6 % compared to the end of 2019 and amounted to 1,918.89 million US$.

The balance of commitments in the form of direct investments increased by 2.5% from the beginning of the year and amounted to 4,851.39 million US$, representing 42.9% of total external liabilities. The balance of direct investments in equity capital owed to investors from the EU-27 countries (82.2 % of total accumulated equity capital) increased by 4.1% compared to the end of 2019; the balance of direct investments in equity in CIS countries (5.5% of the total) decreased by 6.2% during the year, and that of investments in other countries (12.3% of the total) increased by 4.0%.

According to preliminary data, the gross external debt of the RoM increased by 12.7% during 2020 and totaled 8,357.73 million US$ at 31.12.2020, which is 70.2% of GDP (+8.2% compared to 31.12.2019)[15].

Public and publicly guaranteed external debt accounted for 29.1% of total external debt, totaling 2,430.27 million US$ (+26.6 % since the beginning of the year). The structure of the public external debt by creditors, as of December 31, 2020, shows that the main creditor of the state remained the World Bank Group with a share of 32.6% of the total, followed by the IMF with 25.5% and the EIB with 16.9%. The unsecured private external debt amounted to 5,927.46 million US$, increasing by 7.8% compared to 31.12.2019.

The largest share of the gross external debt balance is related to the long-term debt (71.5%), which accounted for 5,972.68 million US$ at 31.12.2020, growing by 13.3 % since the beginning of the year. Short-term external debt increased by 11.1% during 2020 and accounted for 2,385.05 million US$ as of December 31, 2020.

1.4.5. Social Sphere

In the RoM, the average monthly gross nominal salary in units of the real sector, with 4 and more employees, and all budgetary institutions, in 2020 was 7,943.0 MDL, a 9.8% increase compared to 2019 (Table 1-18).

[14] National Bank of Moldova, <https://www.bnm.md/ro/content/pozitia-investitionala-internationala-la-sfarsitul-anului-2020-date-provizorii>.

[15] National Bank of Moldova, <https://www.bnm.md/ro/content/datoria-externa-la-sfarsitul-anului-2020-date-provizorii>.

Table 1-18: Average monthly salaries and average monthly pension, 1993-2020

	1993	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Nominal salary, MDL	**31.2**	**143.2**	**407.9**	**1 318.7**	**2 971.7**	**4 538.4**	**4 997.8**	**5 587.4**	**6 268.0**	**7 233.7**	**7 943.0**
Nominal salary, %	897.3	132.1	133.9	119.5	108.2	111.0	110.1	111.8	112.2	115.4	109.8
Actual salary, %	69.9	101.6	102.1	106.8	100.7	101.2	103.5	104.9	108.9	110.1	105.8
Nominal salary, US$	**23.3**	**31.9**	**32.8**	**104.7**	**240.3**	**241.2**	**250.8**	**302.2**	**373.0**	**411.6**	**458.6**
Actual salary, US$, %		119.5	113.4	117.0	97.2	82.8	104.0	120.5	123.4	110.3	111.4
Nominal salary, US$ (PPC)	**185.6**	**167.7**	**195.7**	**297.4**	**456.7**	**532.0**	**555.5**	**585.5**	**632.1**	**1 246.6**	**1 361.5**
Actual salary, US$ (PPC), %		66.9	106.8	118.2	98.6	101.6	104.4	105.4	108.0	197.2	109.2
Pension, MDL	**18.8**	**64.3**	**85.1**	**383.4**	**810.9**	**1 165.2**	**1 275.2**	**1 527.9**	**1 709.2**	**1 901.1**	**2 104.5**
Pension US$	14.0	14.3	6.9	30.4	65.6	61.9	64.0	82.6	101.7	108.2	121.5

Source: National Institute of Economic Research of the Ministry of Education and Research (September 2021).

In the fourth quarter of 2020, the average gross nominal monthly salary was 8,859.9 MDL, increasing by 9.7% compared to the previous quarter and by 13.4% compared to the fourth quarter of 2019 (7,813.1 MDL)[16]. The highest values of the average monthly salary in the fourth quarter of 2020 were reported in the following fields: information and communications – 20,310.8 MDL; financial and insurance activities – 16,006.0 MDL; production and supply of electricity and heat, gas, hot water and air conditioning – 14,385.6 MDL.

[16] National Bureau of Statistics, Press release "Average monthly earnings and the index of the average number of employees in the fourth quarter of 2020", <https://statistica.gov.md/newsview.php?l=en&idc=168&id=6930>.

The lowest values of the average monthly salary were reported in: accommodation and public catering activities – 5,141.8 MDL; agriculture, forestry and fishing – 5553.0 MDL; art, recreation and leisure activities – 6,310.0 MDL. Compared to the fourth quarter of 2019, most economic activities reported increases in earnings, the most significant being increases in: health and social assistance – by 32.9%; education – by 20.1%; public administration and defense; compulsory social insurance – by 19.8%; art, recreational and recreational activities – by 19.6%. Decreases in earnings were reported in: accommodation and catering activities – by 6.7%; transport and storage – by 4.2%.

In the fourth quarter of 2020 the budgetary sector reported the average monthly salary of 7,949.3 MDL (+21.1% compared to the fourth quarter of 2019), and the economic sector (real) – 9,198.9 MDL (+11.0% compared to the fourth quarter of 2019).

The index of the real salary in 2020 compared to 2019 (calculated as the ratio between the gross salary index and the consumer price index) was 106.2%. The index of the real salary in the fourth quarter of 2020 compared to the fourth quarter of 2019 was 112.3%.

The average number of employees in the fourth quarter of 2020 compared to the fourth quarter of 2019 decreased by 1.8%. Decreases in the average number of employees were reported in most economic activities. The most significant decreases were reported in: accommodation and catering activities – by 24.5%; transport and storage – by 7.4%; administrative services and support services and processing industry – by 6.2% each. The most significant increases in the average number of employees in the fourth quarter of 2020 compared to the fourth quarter of 2019 were reported in: other services activities – by 21.7%; constructions – by 4.2%; information and communications – by 4.1%. In 2020, the workforce (active population) of the RoM, which includes the employed and unemployed population, was 867.3 thousand people, 5.7% less than in 2019 (919.3 thousand).[17] (Table 1-19). In the structure of the workforce, the share of men (52.4%) was higher compared to that of women (47.6%), and the share of economically active persons in rural areas was higher than the share in urban areas (54.4% and 45.6%, respectively).

The labor force participation rate of the population aged 15 years and over (the proportion of the labor force of 15 years and over in the total population of the same age group) was 40.3%, in decline compared to the previous year (in 2019 – 42.3%). This indicator reached higher values among the male population – 45.1%, compared to the female population – 36.1%. The respective average rates recorded the following values: 46.5% in urban areas and 36.3% in rural areas. In the age category 15-29 years this indicator was 31.4%, and in the 15-64 years age category - 47.6%. The value of this indicator for active age population according to national legislation (16-59 years for women and 16-63 years for men) was 50.7%. The labor force participation rate of people with disabilities was 14.0%, including 13.3% for men, 14.8% for women, 15.6% in urban areas and 13.1% in rural areas.

[17] National Bureau of Statistics, Press release "Labor force in the Republic of Moldova: employment and unemployment in 2020", <https://statistica.gov.md/newsview.php?l=en&idc=168&id=6952>.

Table 1-19: Evolution of the population aged 15 years and over by participation in the economic activity in the RoM, thousands of persons, 2016-2020

	2016	2017	2018	2019	2020
Labor force (active population)	**1035.3**	**999.7**	**1018.1**	**919.3**	**867.3**
Employed population	**993.7**	**960.8**	**988.5**	**872.4**	**834.2**
Under-employed	68.9	63.2	29.3	34.1	41.2
Unemployed BIM	**41.6**	**38.9**	**29.6**	**46.9**	**33.1**
Non-labor population	**1277.9**	**1267.6**	**1202.1**	**1255.9**	**1283.6**
People who do not want to work	1122.6	1108.4	1039.7	1126.3	1177.9
retirees	534.2	527.7	503.9	566.2	580.2
students	209.2	193.4	176.9	161.1	167.6
domestic work	147.1	145.4	135.7	161.7	166.7
intend to go to work abroad/ already have a job abroad	133.2	162.2	144.3	140.6	151.1
Persons working abroad for less than 1 year	128.8	140.6	147.4	105.9	90.4
Potential workforce	14.5	9.7	18.4	16.9	9.6
Young NEETs	**216.4**	**151.8**	**127.1**	**135.0**	**120.9**
Unemployed	15.8	13.2	9.3	13.6	8.2
Domestic work/family care	64.0	62.7	56.4	63.0	55.0
Plans to go to work abroad/ already have a job abroad	44.4	53.0	39.1	34.3	34.6
Employment participation rate	**44.8**	**44.1**	**45.9**	**42.3**	**40.3**
Employment rate	**43.0**	**42.4**	**44.5**	**40.1**	**38.8**
Unemployment rate	6.9	6.6	3.0	3.9	4.9

The employed population was 834.2 thousand persons, 4.4% less than in 2019 (872.4 thousand)[18]. As in the case of the economically active population, the share of men is higher than that of women (52.1% men and 47.9% women), and the share of employed persons in rural areas was higher than that of employed persons in urban areas (54.7% in rural areas and, respectively, 45.3% in urban areas). The employment rate of the population aged 15 and over (the proportion of employed persons aged 15 and over compared to the total population in the same age category) was 38.8%, decreasing compared to the previous year (40.1% in 2019). The employment rate of men (43.1%) was higher compared to that of women (35.0%). In the distribution by residence area, this indicator was 44.4% in urban areas and 35.1% in rural areas. The employment rate of the working-age population (16-59 years for women and 16-63 years for men) was 48.6%, of the population aged 15-64 years – 45.7%, and in the age category 15-29 this indicator accounted for 29.4%

The analysis of employment rates by age groups highlights the largest discrepancies in 25-34-year-olds by gender (15.2% higher gap for men) and by residence (13.8% higher for urban areas). According to gender, large differences are also seen in the age group 55-64 years (14.5% higher for men), and by residence environment and in the age group 35-44 years (11.1% higher for urban). A higher employment rate for women than men is only for people aged 45-54 (by 6.4%). The employment rate of people with disabilities was 13.7%. In the gender distribution this indicator was as follows: 12.8% for men and 14.7% for women. The employment rate of people with disabilities in urban areas was higher (14.9%) compared to the rate for people in rural areas (13.0%).

The distribution of employed persons by economic activities showed that the agricultural sector comprised 175.9 thousand

[18] National Bureau of Statistics, Press release "Labor force in the Republic of Moldova: employment and unemployment in 2020", <https://statistica.gov.md/newsview.php?l=en&idc=168&id=6952>.

persons or 21.1% of the total employed persons (in 2019 – 182.8 thousand and, respectively, 21.0%) (Table 1-20).

Non-agricultural activities covered 658.3 thousand persons, 4.5% less than in 2019 (689.5 thousand). The share of employed persons in industry was 14.6% (in 2019 – 14.7%), including 11.7% in the processing industry (in 2019 – 12.1%), 7.2% in constructions (in 2019 – 7.0%). The number of persons employed in industry was 121.4 thousand, in decline by 5.2% compared to the previous year, and in constructions was 60.4 thousand, in line by 1.6% compared to 2019. The services sector covered 476.5 thousand or 57.1% of the total number of employed persons, by 4.7% less than in 2019 (500.1 thousand or 57.3% of the total number of employed persons in 2019). Distribution by forms of ownership showed that 70.2% of the employed population worked in the private sector and 29.8% – in the public sector (in 2019, 70.7% – the private sector and, respectively, 29.3% – the public sector).

Table 1-20: Evolution of active population in the RoM, thousands of persons, 2016-2020

	2016	2017	2018	2019	2020
Economic activities – total	**993.7**	**960.8**	**988.5**	**872.4**	**834.2**
Agriculture, forestry and fishing	363.4	341.4	388.6	182.8	175.9
Industry	114.6	107.3	108.4	128.0	121.4
Construction	48.3	43.4	45.7	61.4	60.4
Wholesale and retail trade; accommodation and public catering	150.3	154.3	143.3	163.8	148.4
Transport and storage, information and communications	59.7	55.3	54.4	59.9	61.5
Public administration, defense, education, human health and social assistance activities	178.8	182.6	176.0	197.5	193.1
Other activities	78.5	76.5	72.2	78.9	73.5
Employment Status					
Employees	606.2	604.2	589.2	678.4	651.8
Self-employed	333.1	314.2	353.1	153.5	143.4
Unpaid family workers	48.8	39.2	43.3	36.9	35.9
Employers, members of production cooperatives	5.5	3.2	0.0	3.6	3.0
Statistical areas					
Chisinau municipality	262.9	251.5	247.1	266.8	246.6
Statistical area North	292.5	287.3	290.9	260.1	251.1
Statistical Area Center	281.5	268.4	294.7	217.7	215.3
Statistical area South	156.8	153.6	155.8	127.8	121.2
Type of economic unit					
Formal sector enterprises	664.5	649.4	645.2	722.8	693.3
Informal sector enterprises	164.7	148.1	145.9	146.8	139.5
Households	164.5	163.2	197.3	0.0	1.4
Job type					
Formal occupations	613.1	605.2	595.9	670.6	647.5
Informal occupations	380.6	355.5	392.6	201.8	186.7

The number of under-employed persons (persons who had a job with a total number of hours actually worked during the reference period was less than 40 hours per week, who wanted and were available to work overtime) was 41.2 thousand, which represented 4.9% of the total number of employed persons, higher than in the previous year (3.9% in 2019). Of the total number of employed persons, 9.5% stated that they wished to change the situation in relation to the current job because they were not satisfied with the level of remuneration (inadequate situation in relation to income).

The number of unemployed persons, estimated according to the definition of the International Labor Office (ILO), was 33.1 thousand, in decline compared to 2019 (46.9 thousand)[19] (Table 1-19). Unemployment affected men in a larger proportion, accounting for 59.5% of the total number of the unemployed, and 53.2% were people from rural areas. The unemployment rate (the share of unemployed persons in the workforce) at the country level reached 3.8%, being lower than in 2019 (5.1%). The unemployment rate for men was 4.3%, and for women – 3.2%; in urban areas – 4.5% and in rural areas – 3.3%. Among the persons aged 15-24, the unemployment rate was 10.9%, the value of this indicator showed important disparities by gender (12.3% for women, 9.9% for men) and area (14.6% for urban areas, 7.0% for rural areas), and in the age category 15-29 this indicator was 6.2%.

In 2020 the population outside the labor force of 15 years and over was 1,283.6 thousand persons or 59.7% of the total population of the same age category, increasing by 2.2% compared to 2019 (1,255.9 thousand and 57.7% of the total population, respectively). By gender, the share of women (56.9%) was higher compared to men (43.1%), and the share of inactive people in rural areas was higher than the share in urban areas (64.5% and 35.5%, respectively). Among the inactive population, the largest share, over 45.2%, belongs to the category of pensioners. They are followed by students (13.1%) and family caregivers (household workers) (13.0%). Among other inactive population there are also people who do not work and do not seek a job in RoM, because they already have a job abroad or who plan to work abroad (11.8% compared to 11.2% in 2019). Another group are persons (declared by households) who work abroad or are seeking a job for a period of less than one year (7.0% or 90.4 thousand), the number of the latter being in decline by 14.6% compared to 2019 (8.4% or 105.8 thousand respectively). The rest covers other categories of population outside the labor force. Men predominate among people who have a job abroad or intend to go abroad and people

[19] National Bureau of Statistics, Press release "Labor force in the Republic of Moldova: employment and unemployment in 2020", <https://statistica.gov.md/newsview.php?l=en&idc=168&id=6952>.

who went abroad to work or are seeking a job (19.8% and 11.8% respectively versus 5.7% and 3.4% for women, respectively), while family caregiving activities are more characteristic of women (21.9% compared to 1.2% for men).

In 2020, the share of young people who were not part of the employed population, do not study within the formal education system and do not participate in any courses or other training outside the formal education system (NEET – "Persons Not in Employment, Education or Training) accounted for 17.6% of the total number of young people aged 15-24 years, 26.0% – among young people aged 15-29 years and 31.2% - among those aged 15-34 years[20]. In all these age groups, the indicator records higher values among women compared to men.

According to the data of the National Social Insurance House, as of January 1, 2021, the number of pensioners was 686.3 thousand people, of which about 522.8 thousand (76% of all pensioners) were old-age pensioners[21]. Due to the higher share in the number of elderly population and the difference in longevity between women and men, women accounted for 69.8% of the total number of old-age pensioners. People aged 60 and over held a 95.9% share in the total number of old-age pensioners, of whom 68.5% were women.

The average size of the pension for old age at 01.01.2021 was 2,067.6 MDL, an increase by 12.2% compared to the previous year, and compared to the beginning of 2017 it increased by 59.0%. The average size of the old-age pension for men was 2,409.3 MDL compared to 1,919.9 MDL for women. Thus, the gender gap in old-age pensions was 20.3% compared to 18.1% at the beginning of 2017.

The average value of the minimum subsistence for pensioners in 2020 was 1,759.8 MDL, with a 3.1% increase compared with the previous year. The minimum subsistence for pensioners varies depending on the place of residence. Thus, for pensioners in large cities it was 1,955.9 MDL compared to 1,746.8 MDL in other cities and 1,692.8 MDL for pensioners from villages.

The average size of the old-age pension allowed to cover the minimum subsistence for pensioners in a proportion of 117.5% in 2020 compared to 87.0% in 2016. However, the average size of the old-age pension in the agricultural sector covered only 86.5% of the minimum subsistence compared to the non-agricultural sector – 132.4%.

The amount of the minimum pension for old age at 01.01.2021 was 1,143.6 MDL and allowed to cover the minimum subsistence for pensioners in a proportion of 65.0%. At the same time, about 23.7% of pensioners for old age were employed at the time of retirement.

According to the Labor Force Survey, the number of elderly people (aged 60 and over) economically active in 2020 was 80.4 thousand, which is 9.3% of the total active population and 14.0% of the total population in the same age group.

1.5. Evolution of Real Sectors of Economy

1.5.1. Industrial Sector

The industrial production output in 2020 amounted to about 59.7 billion MDL (in current prices). In January-December 2020, compared to the same period of the previous year, the industrial production (gross series) was by 5.5% lower as a result of production decrease in the manufacturing industry (-7.1%). At the same time, there was an increase in the extractive industry (+9.5%) and in production and supply of electricity, gas, hot water and air conditioning (+2.3%) (Table 1-21).

During 1990-2020, the industrial sector evolution was fluctuating, the best results reported in 2001, 2003 and 2011, negative results reported in the years 1992, 1994, 1998, 1999, 2006, 2007, 2009, 2012 and 2020 (Fig. 1-4).

[20] National Bureau of Statistics, Press release "Labor force in the Republic of Moldova: employment and unemployment in 2020", <https://statistica.gov.md/newsview.php?l=en&idc=168&id=6952>.
[21] National Bureau of Statistics, Press release "Elderly in the Republic of Moldova in 2020", <https://statistica.gov.md/newsview.php?l=en&idc=168&id=7137>.

Table 1-21: Evolution of the industrial sector in the RoM, 1990-2020

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Industry, billion MDL	11.5	4.3	8.2	20.8	28.1	45.7	47.6	52.7	56.2	59.3	59.7
in % compared to the previous year		-3.9	7.7	6.7	9.3	0.6	0.9	3.4	3.7	2.0	-5.5
in % compared to 1990		45.0	34.1	57.3	47.1	61.1	61.7	63.8	66.1	67.4	63.7
Industry, US $ billion		0.949	0.657	1.648	2.276	2.426	2.389	2.851	3.345	3.376	3.445

Source: National Institute of Economic Research of the ASM and Ministry of Economy and Infrastructure (September 2021).

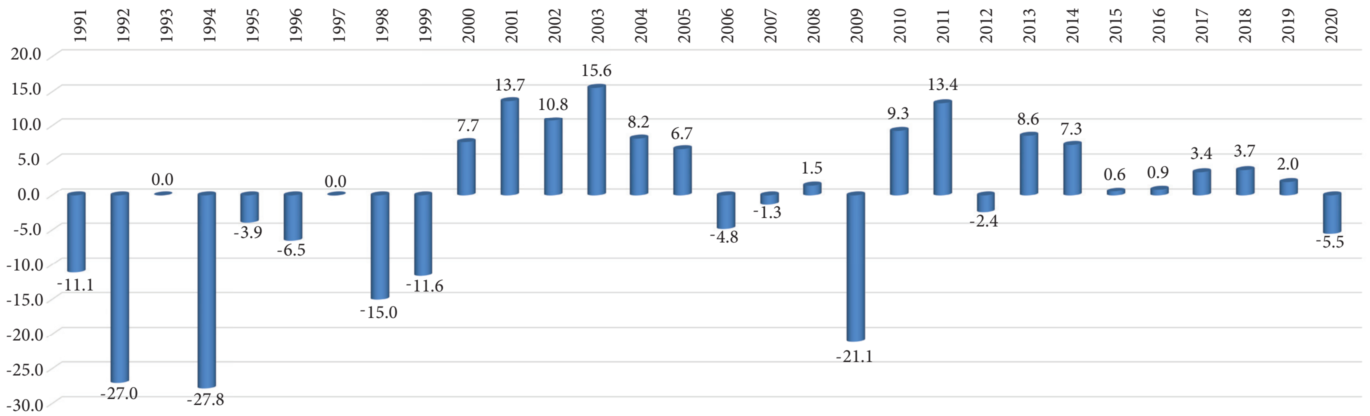


Figure 1-4: Evolution of the industrial sector of the RoM, 1991-2020, in % compared to the previous year.

Manufacturing Industry

The situation in the industrial sector of the economy is mainly determined by the activity of enterprises in the manufacturing industry, which in 2020 accounted for over 80 percent of the total value of the output produced by enterprises with the main industrial activities, included in monthly statistical research. Within the manufacturing industry, the most representative activity is food and beverage industry.

In December 2020 compared to the same period of 2019, the food industry as a whole reported a decrease of industrial production by 6.0%. Substantial decreases were reported in the following activities: processing and preservation of fruits and vegetables – by 33.1%; other food products – by 5.7%; dairy products – by 4.7%; production, processing and preservation of meat and meat products – by 3.1%; vegetable and animal oils and fats – by 2.3%, etc. At the same time, industrial production increased in the following activities of the food industry: processing and preservation of fish, crustaceans and mollusks – by 20.4%; production of milling products, starch and starch products – by 5.4% and production of bakery products and flour products – by 0.5%. In the reference month, other activities of the processing industry reported decreases compared to December 2019, especially in: production of beverages – by 31,.8%; manufacture of motor vehicles, trailers and semi-trailers – by 29.3%; manufacture of textile products – by 13.4%; manufacture of machinery and equipment – by 7.2%; manufacture of electrical equipment – by 5.9%; manufacture of paper and paper products – by 4.3%, etc.

At the same time, in December 2020 compared to the same period of 2019, industrial production reported increases in the following activities: wood processing, manufacture of wood and cork products, except furniture; manufacture of articles of straw and other plaited vegetal materials – by 92.1%; repairs, maintenance and installation of machinery and equipment – by 69.0%; metal constructions and metal products, excluding machinery and equipment – by 45.8%; computers and electronic and optical products – by 42.8%; production of chemicals and chemical products – by 38.3%; manufacture of furniture – by 31.7%; production of basic pharmaceutical products and pharmaceutical preparations – by 8.3%; manufacture of rubber and plastic products – by 6.5%; manufacture of other non-metalliferous mineral products – by 5.2%, etc.[22].

[22] National Bureau of Statistics, Press release "Industrial activity in 2020", <https://statistica.gov.md/newsview.php?l=en&idc=168&id=6918>.

Table 1-22: Production of the main industrial products in the manufacturing industry of the RoM (right bank of the Dniester River) in the period 2005-2020

	2005	2010	2015	2016	2017	2018	2019	2020
Meat, thousand tones	5.9	23.7	44.6	44.2	54.3	60.1	60.5	67.6
Poultry meat, thousands of tones	2.3	12.5	28.5	29.6	36.2	40.5	40.8	40.6
Sausages, thousand tones	14.2	13.2	17.2	16.4	18.4	19.7	21.2	22.3
Canned meat, thousands of tones	0.6	1.5	0.5	0.5	0.5	0.6	0.5	0.6
Fruit and vegetable juices, thousands of liters	25 624.9	27 115.0	39 242.5	49 687.1	55 689.1	63 210.8	81 812.1	42 984.9
Unconcentrated juices	7 170.9	17 460.6	21 534.7	18 755.3	20 080.0	19 000.3	22 320.6	18 919.5
Concentrates	14 641.6	9 654.4	17 707.8	30 931.8	35 609.1	44 210.5	59 491.5	24 065.4
Canned vegetables and fruits, thousands of tones	33.0	29.9	15.7	16.7	19.6	25.6	17.9	19.0
Processed and preserved fruits, thousands of tones	18.3	8.0	7.9	9.4	8.2	12.5	9.4	5.1
Crude oils, not chemically modified, thousand tones	83.2	80.7	109.5	79.9	86.8	106.2	124.6	154.8
Margarines, tones	3 390.0	1 274.0	C	C	C	C	C	C
Milk and cream with fat content <6%, thousand tones	20.8	65.1	80.0	86.0	80.0	69.1	61.3	56.5
Milk and cream in solid form, tones	4 565.0	1 217.0	1 357.0	1 674.6	2 473.6	2 276.1	864.9	953.6
Butter, tones	3 393.0	4 199.0	4 787.0	5 868.7	4 771.9	3 937.8	3 921.9	3 835.5
Fat cheese and cottage cheese, tones	2 380.0	1 779.0	2 469.0	2 402.4	2 868.9	2 821.5	2 582.4	2 873.9
Cured milk, cream, yoghurt, kephir, cream and other fermented products, tones	21 032.0	25 615.0	32 658.9	32 743.6	31 107.0	29 527.1	29 499.6	27 826.8
Ice cream and other forms of ice with or without cocoa, thousands of liters	12 225.0	12 491.0	15 969.0	16 472.9	16 962.6	17 579.6	16 926.4	13 183.5
Flour, thousands of tones	144.0	108.0	113.2	103.8	112.0	105.8	120.9	108.9
Groats, meal and agglomerated, thousands of tons	3.0	5.6	5.7	5.3	6.7	6.2	6.6	6.0
Feeding stuffs ready for use, thousands of tons	48.8	71.6	79.0	95.4	87.5	85.6	70.8	80.6
Bread and bakery products, thousands of tons	108.4	129.0	131.5	129.2	130.1	128.2	130.9	123.1
Fresh bread	105.7	124.3	124.4	121.7	122.2	120.8	122.8	115.3
Baked products	2.7	4.8	7.2	7.5	7.8	7.5	8.1	7.8
Flour confectionery, thousand tones	19.8	26.9	33.6	34.4	35.4	36.8	39.1	38.4
Raw sugar, thousands of tones	133.5	103.2	84.5	100.0	129.0	73.9	86.9	50.5
Molasses, thousands of tones	42.2	36.2	30.6	39.1	45.1	64.5	34.9	21.5
Sugar confectionery, thousand tones	12.3	12.9	14.0	14.2	13.8	13.3	12.9	11.4
Pasta, thousands of tons	7.8	6.3	5.7	5.0	4.2	3.8	3.8	3.9
Mayonnaise and other emulsified sauces, tones	2 578.0	540.0	509.0	606.5	702.8	621.2	634.3	554.7
Divine, thousand L 100% alcohol	4 780.7	1 765.9	2 186.4	1 433.4	2 343.8	2 583.5	2 708.0	2 355.9
Spirits and liqueurs, thousand L 100% alcohol	8 133.4	2 661.5	3 103.4	3 074.5	2 821.0	2 795.5	2 627.1	2 555.4
Vodka, thousands L 100% alcohol	4 905.9	1 289.7	2 736.8	2 631.8	2 516.9	2 439.0	2 330.6	2 256.5
Sparkling wines, thousand dal	1 051.0	556.1	502.3	629.2	642.4	665.4	670.0	649.6
Natural grapes wines, mil. dal	36.3	12.7	13.4	13.3	16.3	17.0	17.6	17.2
Port wines, Madeira, Sherry, Tokay and others, thousands of dals	3 237.9	1 051.1	370.9	470.3	428.3	165.8	213.0	201.2
Mineral and gaseous waters, mil. dal	9.6	11.6	11.9	12.6	14.0	15.4	16.6	16.0
Non-alcoholic beverages, mil. dal	6.4	6.5	6.5	4.6	4.8	5.1	5.2	5.2

	2005	2010	2015	2016	2017	2018	2019	2020
Cigarettes and tobacco cigarettes or mixtures with tobacco substitutes. mil. pcs.	c	c	1 775.8	1 838.7	1 411.0	660.3	650.1	494.1
Fermented tobacco, thousands of tons	8.2	7.3	1.7	1.1	0.1	0.7	0.5	0.5
Fabrics, thousand m2	116.0	55.0	-	-	-	18.3	10.0	10.8
Bed linen, table linen, toilet linen and kitchen linen, tons	103.1	144.3	434.8	444.5	270.9	199.0	209.3	198.3
Pantyhose and tights, thousands of pairs	1 082.0	1 288.0	2 046.0	1 979.2	1 728.2	1 271.5	1 293.4	955.6
Knitted items, mil. pcs.	17.0	20.2	15.2	16.6	23.0	23.6	20.1	18.8
Workwear, thousand pcs.	3 848.2	6 190.7	4 067.1	4 368.4	5 745.9	5 514.3	4 924.8	6 228.1
Overcoats, raincoats, car-coats, capes, cloaks, anoraks (including ski-jackets), wind-cheaters, wind-jackets and similar articles (excluding knitted or crocheted), thousand pieces	938.3	649.8	730.4	840.8	854.2	881.7	849.2	673.0
Costumes and ensembles (excluding knitted or crocheted), thousand pcs.	344.4	97.7	59.6	72.4	135.7	107.4	44.4	33.6
Jackets and blazers (excluding knitted or crocheted), thousands of pieces	513.5	458.4	657.8	476.7	416.8	423.5	297.9	169.7
Full-length trousers, bib and brace overalls and shorts (excluding knitted or crocheted), thousand pieces	2 452.3	1 775.5	1 119.5	1 406.5	1 655.6	1 964.5	1 332.3	1 179.9
Dresses and parapets (excluding knitted or crocheted), thousand pcs.	121.1	798.9	1 124.5	1 071.9	1 191.5	1 188.0	1 460.3	910.9
T-shirts and divided skirts (excluding knitted or crocheted), thousand pcs.	733.2	250.4	530.3	471.7	240.7	274.4	132.6	161.6
Blouses, shirts and shirt-blouses (excluding knitted or crocheted), thousand pieces	2 109.1	2 656.2	2 616.9	2 886.8	3 078.5	2 914.7	3 018.5	1 865.0
Women's or girls' blouses, shirts and shirt-blouses (excluding knitted or crocheted), thousand pcs.	1 983.8	1 915.7	2 169.9	2 506.8	2 722.7	2 587.7	2 637.4	1 450.0
Boxes, suitcases, suitcases and similar items of any material, thousand pcs.	317.1	129.2	82.8	48.8	49.3	54.5	37.7	36.5
Ladies' handbags, of any material, thousands of pieces.	98.9	95.1	136.2	151.4	127.7	123.6	83.1	51.4
Shoes, thousands of pairs	3 650.0	2 717.0	1 886.0	2 078.1	1 921.1	1 794.0	1 729.8	1 476.3
Timber, thousand m3	21.7	24.8	15.9	13.6	16.6	17.6	12.7	10.7
Wooden frames for windows and doors, thous. pcs.	16.4	19.1	11.8	10.1	7.0	8.0	12.1	6.1
Parquet panels, thousand m2	98.4	26.3	10.6	20.0	12.6	9.8	29.9	20.8
Wood briquettes and pellets and other vegetal waste, thousand tons	-	-	20.1	16.0	18.0	26.3	24.3	30.6
Boxes and cases of corrugated paper or paperboard, mil m2	52.3	35.7	-	-	-	-	-	-
Boxes and cases of corrugated paper or paperboard, thousand tones	-	-	11.7	12.0	13.7	14.4	14.4	14.6
Paper and articles thereof, of a kind used for household purposes, tones	1 230.0	4 573.2	6 739.9	5 541.2	5 239.2	5 253.1	5 449.8	5 462.3
Labels of paper or paperboard	3 633.7	1 526.4	2 249.5	2 843.4	2 956.4	3 151.2	2 981.7	3 257.3
Printing services of newspapers and periodicals that appear at least 4 times a week, mln. sheet	57.4	33.0	-	-	-	-	-	-
Printing services of newspapers and periodicals appearing at least 4 times a week, tons	-	-	181.2	379.7	22.5	19.7	18.9	61.7
Notebooks, tons	558.1	723.3	706.1	1 444.6	950.9	893.9	624.5	588.1
Oxygen, thousand m3	1 454.1	1 788.5	460.7	326.6	387.9	370.9	416.5	629.9
Carbon dioxide, tones	3 198.0	1 306.0	C	C	C	3 500.7	4 518.2	C
Wood charcoal whether or not agglomerated (including nut shell charcoal)	-	C	481.6	600.5	508.1	431.5	542.4	522.4
Undenatured ethyl alcohol, with alcohol concentration by volume of not less than 80% vol., thousand dal	928.8	3 396.4	1 125.2	2 847.6	3 851.0	3 678.4	3 326.6	5 106.7
Paints and varnishes, tons	6 269.0	12 864.0	26 857.8	32 746.9	29 554.9	29 597.9	29 358.0	31 152.2
Soaps, tons	317.1	537.5	993.2	994.5	1 243.0	1 261.1	1 540.0	2 042.7
Washing and cleaning preparations, tones	533.0	618.0	1 760.0	2 821.4	2 155.2	2 674.4	3 715.9	3 724.1
Etheric oils	62.5	67.9	42.4	45.5	71.1	36.8	59.6	51.0
Provitamins and vitamins, natural or synthetic (including natural concentrates), as well as their derivatives used mainly as vitamins, mixed or not with each other, even in various solutions, tons	92.4	285.3	799.6	637.5	584.0	305.9	101.9	96.2
Medications containing alkaloids or their derivatives and vitamins, tones	300.2	2 342.0	1 652.6	1 593.6	1 899.4	1 625.2	1 779.0	1 824.0
Plastic tubes and pipes, tones	714.0	1 679.4	2 749.0	2 878.4	2 290.6	2 467.4	2 468.9	2 790.7
Boxes, cases, crates and similar articles of plastics, tones	944.7	298.3	159.0	151.1	140.0	152.2	134.8	129.2
Plastic windows, doors, stained-glass windows and frames, thousands of pcs.	-	292.3	141.1	157.9	187.5	172.4	177.0	210.7
Insulating glass with multiple layers, thousand m^2	31.4	339.6	476.8	403.3	445.9	475.0	529.3	530.4
Glass mirrors, thousand m2	9.8	10.8	-	-	-	-	-	-
Glass mirrors, thousand pcs.	-	-	13.5	8.2	5.1	33.6	26.4	34.3
Bottles and glass bottles, mil. pcs.	354.6	246.2	228.9	218.5	206.0	235.1	215.0	306.8
Ceramic building bricks, thousand m3	114.2	77.3	78.1	71.5	42.6	68.2	75.6	69.4
Dried gypsum mixtures, thousand tones	131.5	142.3	194.9	204.4	198.7	186.9	194.3	217.2
Prefabricated construction elements of cement, concrete or artificial stone, thousands of tons	230.7	202.0	288.5	277.4	396.0	457.5	527.5	603.0
Non-refractory concrete ready for casting, thousand tones	655.9	720.3	1 670.5	1 532.2	1 640.3	1 839.9	2 061.5	1 894.2
Grey iron castings, tones	2 213.5	874.7	674.8	650.7	482.9	789.6	1 147.8	1 252.8
Steel castings, tones	173.3	59.1	70.1	36.1	52.6	25.4	19.3	C
Light non-ferrous metal castings, tones	7.8	6.1	10.3	C	C	4.8	2.5	C
Doors, windows and frames, thresholds, windowsills, of ferrous metals, pcs.	1 718.0	3 110.0	4 012.0	4 614.0	4 460.0	4 024.0	4 575.0	3 814.0
Doors, windows and frames, thresholds, windowsills, made of aluminum, pcs.	36 806.0	64 636.0	25 717.0	21 736.0	21 336.0	25 280.0	25 197.0	26 100.0

	2005	2010	2015	2016	2017	2018	2019	2020
Reservoirs, tanks, vats and similar containers, of iron, steel or aluminum, of a capacity exceeding 300 l, tones	266.0	123.0	711.9	670.6	477.8	779.7	887.0	962.0
Metallic fabrics, grills, netting and fencing, of iron or steel wire, tons	-	4 488.6	5 142.7	5 402.7	6 010.1	6 735.3	7 537.1	10 420.7
Non-portable personal computers, pcs.	4 662.0	5 134.0	5 600.0	5 369.0	4 274.0	2 391.0	1 488.0	C
Electric conductors, with or without connectors, for a voltage≤1000V, thousand pcs.	-	C	10 960.0	10 508.3	16 632.4	21 125.4	21 050.2	11 216.8
Centrifugal pumps, other pumps for liquids or liquid elevators, pcs.	3 704.0	1 537.0	910.0	1 180.0	964.0	1 050.0	931.0	722.0
Ploughs and harrows with discs, pcs.	725.0	846.0	227.0	187.0	285.0	188.0	124.0	81.0
Machinery for the industrial preparation of food or drink, animal or vegetable fats and oils, not included in other categories, pcs.	1 213.0	551.0	297.0	309.0	457.0	200.0	416.0	228.0
Plug sets for spark plugs and other plug sets, of a kind used in means of transport, tones	-	C	13 109.0	12 094.4	13 248.9	20 025.2	26 983.3	21 017.6

Source: National Bureau of Statistics, <https://statbank.statistica.md/PxWeb/pxweb/ro/40%20Statistica%20economica/40%20Statistica%20economica__14%20IND__IND030/IND030100.px/table/tableViewLayout1/?rxid=9a62a0d7-86c4-45da-b7e4-fecc26003802>.

The aggregated information on production of the main industrial products with an impact on the direct and indirect GHG emissions evolution in the RoM in the period 1990-2020 is presented below for the entire country (the right and left banks of the Dniester River) (Table 1-23). As shown in the table, with few exceptions, the production of the main industrial products in the RoM showed a clear decreasing trend during the period 1990-2020.

Table 1-23: Production of the main industrial products with an impact on the GHG emissions evolution in the RoM, 1990-2020

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Cement, kt	2 288.0	518.8	431.9	772.8	861.4	1 122.8	900.2	1 045.9	1 174.9	1 220.2	1 164.1
Clinker, kt	1 801.3	459.7	320.3	678.7	655.6	830.9	809.0	759.1	958.2	982.1	876.4
Lime – commercial, kt	204.3	38.8	15.1	9.1	3.4	8.2	4.1	22.4	24.8	27.9	22.2
Lime – self-producers, kt	151.8	66.3	27.2	28.4	17.3	13.0	14.3	16.4	12.6	9.2	6.2
Sterilization glass jars, mil. conventional pieces	657.6	87.4	156.2	103.1	99.8	C	C	C	C	C	C
Glass bottles and flasks, mil. pieces	165.5	184.0	260.5	354.6	246.2	228.9	218.5	206.0	235.1	215.0	306.8
Brick, mil. conventional pieces	235.5	59.2	52.9	73.7	49.0	46.8	43.9	39.1	38.5	43.3	42.7
Polymer film, kt	5.2	0.7	1.7	4.6	3.8	3.6	3.5	3.4	3.7	3.9	4.5
Synthetic resins, kt	17.5	1.4	1.1	1.0	1.5	0.9	1.5	1.3	2.1	2.5	2.2
Steel, kt	711.9	656.8	908.1	1 049.4	242.4	431.8	129.6	471.7	505.0	394.3	467.1
Laminate, kt	614.2	357.0	636.0	890.0	237.7	318.8	222.5	451.4	497.9	394.6	455.6
Bituminous concrete	1 220.3	370.0	69.6	215.1	194.4	250.4	214.3	273.7	767.0	523.4	844.3
Paint and varnishes	11.7	0.8	2.1	6.3	12.9	26.8	32.7	29.5	29.5	29.3	31.0
Rubber articles	46.9	1.4	1.6	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.0
Pharmaceutical products	1.9	0.3	0.5	0.7	5.0	4.1	3.8	4.4	3.5	3.6	3.7
Restored tires, thousand pieces	75.3	6.6	7.0	3.2	6.7	6.0	7.3	7.4	8.6	8.1	9.6
Shoes, mil pairs	23.2	7.6	5.9	7.5	6.2	5.5	5.2	4.6	4.4	3.8	3.3
Timber, thousand m3	265.0	25.1	14.9	23.1	25.6	16.5	14.3	17.1	18.5	13.4	11.3
Cigarettes and cigars, bill. pieces	9.1	7.1	9.3	6.2	6.3	1.8	1.8	1.4	0.7	0.7	0.5
Meat, kt	257.9	58.4	13.4	6.7	24.7	46.0	45.9	55.9	62.2	62.6	70.5
Fish and fish products, kt	9.5	0.0	1.9	3.0	1.3	10.0	8.1	7.8	10.7	10.1	10.3
Dry cereals in elevators, kt	2 169.8	1 581.1	899.6	814.7	764.9	724.7	987.6	1 115.5	1 161.5	1 100.0	551.3
Sugar, kt	435.8	218.7	105.4	133.5	103.2	84.5	100.0	129.0	73.9	86.9	54.4
Confectionery flour products, kt	24.3	5.2	8.7	20.7	27.7	34.3	35.1	36.5	37.9	40.2	39.4
Bread, kt	601.9	268.4	138.1	142.0	160.4	161.3	157.6	158.0	156.3	158.1	148.8
Feeding stuffs ready for use, kt	1 037.3	333.6	59.8	50.8	74.4	80.1	101.7	94.0	89.7	74.8	87.2
Crude oils	125.6	50.7	31.3	83.4	80.7	109.5	80.0	86.8	106.3	124.7	154.9
Refined oils, kt	57.5	23.2	14.4	38.2	26.5	16.7	25.7	13.7	13.9	11.3	26.4
Grape wines, thousand hl	1 630.0	996.9	1 092.2	3 643.5	1 285.5	1 356.5	1 345.8	1 652.3	1 717.3	1 787.2	1 746.2
White grapes wine, thousand hl	764.5	467.5	512.3	1 710.2	591.7	622.5	576.2	775.7	774.9	781.5	801.4
Red grapes wine, thousand hl	865.5	529.4	580.0	1 933.3	693.8	734.0	768.4	880.8	932.5	979.2	922.5
Port, Madeira, Sherry, Tokay and other wines, thous. hl	0.2	0.1	0.2	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Sparkling wines, thousand hl	80.4	94.8	41.6	105.1	55.6	50.2	63.3	65.2	67.4	67.9	66.3
Brandy (divine), thousand hl	139.4	102.7	71.8	171.1	74.6	70.2	50.1	84.0	87.7	91.9	73.3
Spirits and liqueurs, thousand hl	55.9	412.7	48.9	238.8	127.1	162.3	162.8	156.9	151.9	143.0	137.0
Beer, thousand hl	760.0	302.9	257.9	777.8	952.6	994.5	847.8	866.5	819.5	839.3	832.6

Source: Statistical Yearbooks of the RoM for the years 1988, 1991, 1994, 1999, 2003, 2005, 2007, 2009, 2012, 2015, 2017, 2020, 2021; PRODMOLD-A Statistical Reports "Production in total natural expression, by types of products in 2005-2020".

Energy industry. In 2020, companies in the energy industry accounted for about 9.7% of the total production output produced by large companies with main industrial activities. The value of these enterprises' output in 2020 reached 5,778.6 billion MDL (in current prices), 1.1% less than in 2019 (5,840.2 billion MDL, in current prices).

Short description of the power system of the Republic of Moldova

In the RoM, the electricity generating capacity includes: the Moldovan Thermal Power Plant (MTPP) in the city of Dnestrovsk (located on the left of the Dniester River), with a nominal installed power of 2520 MW, operating on natural gas, fuel oil and coal, built between 1964-1982; CHP-2 Chisinau, with a nominal installed power of 240 MW electrical capacity (available 210 MW) and 1200 Gcal/h thermal capacity, built between 1976-1980; CHP-1 Chisinau, with a nominal installed power of 66 MW electrical capacity (available 40 MW) and 254 Gcal/h h thermal capacity, built between 1951-1961; CHP-North Balti, with a nominal installed capacity of 28.5 MW electrical capacity (available 24 MW) and 200 Gcal/h thermal capacity, built between 1956-1970; HPP Dubasari on the Dniester River, with a nominal installed capacity of 48 MW (available 30 MW), with 75% tear and wear, built between 1954-1966; HPP Costești on the Prut River, with a nominal installed capacity of 16 MW (available 10 MW), with 67% tear and wear, built in 1978; other power plants, including nine CHPs in sugar refineries with a nominal installed capacity of 97.5 MW operating on gas and fuel oil, built in 1956-1981.

Of the relatively high total nominal capacity (2,996.5 MW), only about 346 MW can be used for cogeneration in Chisinau and Balti, and only about half of the MTPP capacity (especially due to the difficult commercial conditions) is used on hydro base. Most of the country's consumption (about 75-78% in the period 2007-2020) was covered by electricity imports from Ukraine, respectively by deliveries from the MTPP. During 1990-2020, the production of electricity decreased in the RoM by about 60.6%, and the consumption of electricity by about 52.2% (Table 1-24).

Table 1-24: Electricity generation and consumption in the national economy from 1990 to 2020, billion kWh

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production	15.690	6.168	3.624	4.225	6.115	6.050	5.852	4.963	5.389	5.697	6.179
Consumption	11.426	7.022	4.510	5.838	5.257	5.455	5.227	5.259	5.463	5.513	5.466

Source: Statistical Yearbooks for 1994, 1999, 2003, 2006, 2009, 2012; 2014, 2017, 2020, 2021.

The operator of the electricity transmission network (SE Moldelectrica) manages the internal transport network on the right bank of the Dniester River, including 400 kV (203 km), 330 kV (377.34 km), 110 kV (3,337.04 km) and radial lines of 35 kV (807.59 km) and 6-10 kV. Interconnections include 7 330 kV lines and 12 110 kV lines with Ukraine, 4 110 kV lines with Romania and 1 400 kV line with Romania and from there with Bulgaria.

In 2000 the RoM privatized a large part of the distribution sector (approximately 70%), i.e., three out of five electricity distribution units, which later merged into the State Enterprise for Electricity RED "Union Fenosa" SA (currently – Enterprise for Electricity RED "Premier Energy" SRL), while the other two remained state-owned enterprises: S.A. "RED North" and S.A. "RED Nord-West" (which later merged into the State Enterprise for Electricity Supply North). On the left bank of the Dniester River the service is provided by SA 'RED East' and 'RED South East'.

Production of electricity

In the power system of the Republic of Moldova there is only one thermoelectric power plant (MTPP) with condensation, located in the town of Dnestrovsk (on the left side of the Dniester River). The plant is equipped with eight condensing power groups with electrical capacity of 200 MW each operating on coal (put into operation in the period 1964-1971), of which only five power groups are currently operational. Not operated during 1999-2007. Two condensing power groups with an electrical capacity of 210 MW each operating on fuel oil and natural gas (put into operation in 1973 - 1974, both operational) and two energy groups with an installed power of 250 MW each, which operate on natural gas based on combined gas-seam cycle (put into operation in 1980, both operational).

The technological processes used in MTPP are based on the classic steam turbines cycle with condensation and involve burning of fossil fuel for production of electricity, the production of thermal energy being only a secondary process. The production of electricity at MTPP in the period 1990-2020 decreased by about 65.7% (Table 1-25).

Table 1-25: Electricity generation at MTPP from 1990 to 2020, billion kWh

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Production of electricity	13,569	4.747	2,463	2,701	4.723	4,610	4.447	3,557	3,930	4.211	4,655

Source: Express information. Main industrial indicators of the republic in 2009-2020 years (except small businesses entities). State Statistical Service of the TMR.

With the rise of the price of natural gas deliveries from Russian Federation, the MTPP has changed its tariff policy, increasing the price of electricity delivered to Moldova. In these circumstances, during November 2005-September 2009, the RoM stopped purchasing electricity from the MTPP, opting for cheaper electricity imports from Ukraine. Given no demand for the full load, during 09.11.2005-11.01.2007 at MTPP was used only one energy group that operated after the mixed steam-gas cycle on natural gas consumption.

In the period 1995-2020, the annual electricity production on the left bank of the Dniester River (MTPP and HPP in Dubasari) ranged between 1.7-5.2 billion kWh, of which about 40-65% was delivered on the right bank of the Dniester River, respectively intended for export to the southern regions of Ukraine (Table 1–26). The long-term strategy of the Russian company Inter RAO EES, owner of MTPP, is to create operating conditions for the plant at a capacity of at least 1500 MW, ensuring energy exports to the countries in the region of more than 6.0 billion kWh annually. In order to implement the plant modernization plans, starting with 2005, the Russian company has invested about 100 million dollars in the rehabilitation of the MTPP.

Table 1-26: Electricity production on the territory of ATULBD during the period 1995-2020

	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Electricity produced, billion kWh, including:	**4.987**	**2.720**	**2.996**	**5.051**	**5.111**	**4.946**	**4.067**	**4.435**	**4.756**	**5.196**
at MTPP Dnestrovsk, billion kWh	4.747	2.463	2.701	4.723	4.610	4.447	3.557	3.930	4.211	4.655
at HPP Dubasari, billion kWh	0.240	0.257	0.295	0.328	0.218	0.188	0.237	0.232	0.236	0.229
Imported electricity, billion kWh	0.000	0.014	0.659	0.002	0.002	0.001	0.002	0.002	0.002	0.002
Electricity consumption, billion kWh	**2.878**	**2.031**	**2.108**	**1.670**	**1.770**	**1.605**	**1.790**	**1.893**	**1.901**	**1.946**
Electricity exported, billion kWh	2.109	0.703	1.547	3.391	3.343	3.343	2.279	2.544	2.857	3.252

Source: Statistical yearbooks of the TMR 2000, 2006, 2009, 2010, 2011, 2012, 2014, 2016, 2017, 2020, 2021.

Combined heat and power generation

There are three power plants with combined cycle on the right bank of the Dniester River: CHP-1 and CHP-2 in Chisinau municipality, and CHP-North in Balti municipality. There are also several small cogeneration power plants at sugar factories. The installed capacity of cogeneration power plants on the right bank of the Dniester River accounts for only about 14% of the total installed capacity of power plants in Moldova. Of the total nominal capacity installed on the right bank of the Dniester River, the largest share is represented by CHP-2 in Chisinau municipality, about 55% of the total, followed by CHP-1 in Chisinau municipality, with a share of about 14%, respectively by CHP-North in Balti municipality, with a share of about 7%. The total rated capacity installed on the right bank of the Dniester River satisfies its own electricity needs only in a proportion of about 30%.

The total production of electricity on the right bank of the Dniester River decreased from about 1,901 billion kWh in 1990 to about 0.983 billion kWh in 2020 (Tab. 1-27). In the context of the recent increase in electricity consumption, this situation is a negative factor, including in terms of energy security.

Table 1-27: Generation of electricity on the right bank of the Dniester River from 1990 to 2020, billion kWh

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Electricity production	1.901	1,181	0.904	1.229	1.064	0.939	0.906	0.896	0,954	0.941	0.983

Source: NBS, Energy Balances of the Republic of Moldova for 1990 and 1993-2020.

Heat generation

There are many thermal plants in the RoM, which operate on natural gas and fuel oil, less on coal and biomass. The amount of fuel consumed is accounted for in the Energy Balances of the RoM. In the period 1990-2020, the total amount of heat produced in the RoM decreased by about 83.0%, from 22,212 million Gcal in 1990 to 3,783 million Gcal in 2020 (Tab. 1-28).

Table 1-28: Heat generation in the RoM, including ATULBD, million Gcal, 1990-2020

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Heat generation	22.212	9.827	4.986	5.324	4.601	3.979	4.125	4.084	4.137	3.884	3.783
Heat consumption	20.983	8.796	4.501	4.765	3.988	3.473	3.628	3.551	3.697	3.441	3.376

Source: Energy Balances of the Republic of Moldova for 1990, 1993-2020; Statistical yearbooks of the TMR 2000, 2006, 2009, 2010, 2011, 2012, 2014, 2016, 2017, 2020, 2021.

The continuous trend of reducing the amount of heat produced is also specific for the right bank of the Dniester River, for example during 1995-2020 the reduction was about 68.5% (from 7,097 million Gcal in 1995 to 2,235 million Gcal in 2020), and for the left of the Dniester River, during 1995-2020, the reduction was about 43.3% (from 2,730 million Gcal in 1995 to 1,575 million Gcal in 2020).

Table 1-29 presents the information on thermal energy generation on the right bank of the Dniester River. As it can be seen, in 2020 about 65.3% of the heat produced was generated by combined cycle power plants (CHPs), respectively another 34.7% - by thermal plants (TPs) (for comparison, in 1990 the situation was the reverse, 32.5% of the heat produced was generated by CHPs, respectively 66.6% by TPs).

Table 1-29: Heat generation in the RoM, 1990-2020, since 1995 only for the right bank of the Dniester River, million Gcal

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Thermal energy, including:	22.212	7.097	3.057	3.591	2.874	2.397	2.531	2.447	2.544	2.308	2.235
at CHPs	7.220	3.528	1.847	2.140	1.874	1.585	1.650	1.645	1.697	1.508	1.458
at TPs	14.802	3.568	1.207	1.451	1.000	0.812	0.881	0.802	0.847	0.800	0.777
other generating installations	0.190	0.001	0.003	-	-	-	-	-	-	-	-

Source: Energy Balances of the Republic of Moldova for 1990 and 1993-2020.

Evolution of the fuel and energy balance in the Republic of Moldova

The fuel and energy balance of the RoM for the period 1990-2014 is presented below (Table 1-30), as available in the Statistical Yearbooks of the RoM published between 1992-2015 (in more recent publications, the format of presentation of statistical information was modified, so that it was not possible to present the information for the years 2015-2020).

Table 1-30: Fuel and energy balance of the RoM, kt of conventional fuel (in kt of conventional coal equivalent), 1990-2014

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Resources – total	**18225**	**5617**	**2837**	**3520**	**3471**	**3374**	**3444**	**3304**	**3434**	**3494**	**3373**	**3420**	**3263**
Fuel extraction	67	83	84	101	112	99	110	116	95	113	130	132	420
Hydroelectric power generation	84	28	19	10	9	4	10	7	10	9	4	6	5
Import	16703	5109	2535	3123	3082	3025	3006	2820	2960	3075	2918	2977	2826
Fuel stocks (at the beginning of the year)	1371	397	199	272	258	223	281	308	324	254	278	265	297
Distribution – total, including:	**18225**	**5617**	**2837**	**3520**	**3471**	**3374**	**3444**	**3304**	**3434**	**3494**	**3373**	**3420**	**3263**
Internal consumption, of which:	14269	5085	2647	3257	3242	3090	3128	2960	3157	3201	3068	3091	2837
for transformation into other types of energy (electrical and thermal)	7724	3156	1337	1202	1166	1095	1091	1025	1055	1025	1008	1025	703
for technological production needs and miscellaneous (including transportation and storage losses)	6545	1929	1310	2055	2076	1995	2037	1935	2102	2176	2060	2066	2134
Export	2449	45	5	5	6	10	7	21	25	19	39	60	43
Fuel stocks (at the end of the year)	1507	487	185	258	223	274	309	323	252	274	266	269	280

Source: Statistical Yearbooks of the Republic of Moldova for 1994 (p. 271), 1999 (p. 309), 2003 (p. 398), 2006 (p. 315), 2007 (p. 314), 2008 (p. 310), 2009 (p. 308), 2010 (p. 309), 2014 (p. 307-308) and Energy Balance of the Republic of Moldova for 2014.

Table 1-30 shows that during 1990-2014 the total distributed energy resources decreased by 82%, import of energy resources decreased by 83%, domestic consumption of energy resources decreased by 80%, and local energy sources (especially biomass) increased by 527%.

At the same time, from the information presented in Table 1-31 it turns out that during 1990-2014 domestic energy resources increased by about 206%, import of liquid fuels decreased by about 84%, import of solid fuels decreased by about 96%, and import of gaseous fuels decreased by about 74%. At the same time, domestic consumption of energy resources for electricity and thermal energy production in the period under review decreased by about 92%, consumption of energy resources in industry and construction sector decreased by about 85%, agriculture by about 91%, transport sector by about 51%, trade sector and communal needs by about 67 %, and residential sector by about 58%.

Table 1-31: Energy balance of the RoM, kt of conventional fuel (in kt of conventional coal equivalent), 1990-2014

	1990	1995	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Internal sources	**151**	**111**	**103**	**125**	**131**	**126**	**157**	**176**	**150**	**165**	**177**	**178**	**462**
Liquid fuels	–	–	–	14	10	23	37	53	45	43	43	40	37
Solid fuel	67	83	84	101	112	99	110	116	95	113	130	132	420
Hydro power	84	28	19	10	9	4	10	7	10	9	4	6	5
Import	**16703**	**5109**	**2535**	**3123**	**3082**	**3025**	**3006**	**2820**	**2960**	**3075**	**2918**	**2977**	**2826**
Liquid fuels	7032	1509	593	891	862	922	953	944	952	1060	967	1016	1144
Natural gas	4604	2186	1268	1721	1716	1585	1511	1395	1476	1450	1387	1331	1215
Solid fuel	3608	765	94	147	150	158	178	120	160	179	162	221	142
Electricity	1458	649	580	364	354	360	364	361	372	386	402	409	410
Export	**2449**	**45**	–	**5**	**6**	**10**	**7**	**21**	**25**	**19**	**39**	**60**	**43**
Changes in inventories	136	90	-14	-14	-35	51	28	15	-72	20	-12	4	-17
Domestic consumption	**15054**	**5085**	**2647**	**3257**	**3242**	**3090**	**3128**	**2960**	**3157**	**3201**	**3068**	**3091**	**2837**
for production of electricity and thermal energy	8631	3156	1337	1202	1166	1095	1091	1025	1055	1025	1008	1025	703
for other purposes, including:	6489	1929	1310	2055	2076	1995	2037	1935	2102	2176	2060	2066	2134
industry and construction	1054	164	147	230	234	224	207	124	154	172	178	187	156
agriculture	980	314	98	87	87	74	73	67	69	64	61	67	84
transport	1753	514	244	381	406	466	479	416	515	548	525	723	866
commerce and communal needs	508	151	79	171	175	171	173	248	222	227	224	152	169
sold to the population	2025	613	602	1004	986	856	906	943	984	1012	914	746	859
other (including storage and transport losses)	169	173	140	171	188	204	199	137	158	153	158	191	103

Source: Statistical Yearbooks of the RoM for 1994 (p. 274), 1999 (p. 310), 2003 (p. 399), 2006 (p. 317), 2007 (p. 316), 2008 (p. 312), 2009 (p. 309), 2010 (p. 310), 2014 (p. 307-308) and Energy Balance of the Republic of Moldova for 2014.

The Energy Balances of the RoM for the years 2015-2020 have been published in accordance with the common framework for production, transmission, evaluation and dissemination of comparable energy statistics in the EnC, as established at international level by Regulation (EC) No. 1099/2008 of the European Parliament and of the Council of 22 October 2008 on energy statistics, as amended, and at national level by the Decision of the Collegium of the NBS no. 6/3 of 23 December 2014.

The differences observed when comparing the information presented above in Table 1-30 and Table 1-31 and those in Table 1-32 is due to the fact that data on the consumption of biofuels and waste in the residential sector (population) have been revised for the period 2010-2014. The recalculation of activity data was carried out with the support of Energy Community experts and was based on the results achieved in the framework of "Research on energy consumption in households", carried out by the NBS for the reference year 2015.

Table 1-32: Energy balance of the RoM, kt conventional fuel (in kt conventional coal equivalent), 2010-2020

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Primary production	748	792	850	853	934	934	1 010	1 100	1 137	953	973
Inputs from other sources	369	304	298	230	320	405	408	279	312	351	399
Import	2 590	2 771	2 620	2 748	2 575	2 522	2 597	2 874	3 013	2 903	2 763
Export	18	20	27	48	31	24	22	48	40	13	30
Stock changes	72	-20	12	-4	17	-5	-4	10	12	1	27
Gross domestic consumption	**3 761**	**3 827**	**3 753**	**3 779**	**3 815**	**3 832**	**3 989**	**4 195**	**4 410**	**4 193**	**4 078**
Transformations, inputs	707	668	636	623	638	590	604	584	613	556	552
Transformations, outputs	570	539	512	501	500	474	495	481	493	451	450
Energy used for other purposes	25	24	21	17	23	24	25	25	23	26	25
Losses	258	239	229	221	218	188	182	185	177	148	135
Final consumption	**3 341**	**3 435**	**3 379**	**3 419**	**3 436**	**3 504**	**3 673**	**3 882**	**4 090**	**3 914**	**3 816**
Industry	325	341	343	369	330	305	290	308	357	338	328
Transport	855	914	817	851	884	943	1 023	1 050	1 083	1 099	971
Other activities	2 117	2 139	2 156	2 137	2 151	2 193	2 295	2 454	2 541	2 384	2 389
Residential sector (population)	1 631	1 664	1 692	1 675	1 705	1 722	1 797	1 916	1 979	1 817	1 848
Commerce and Public Services	385	378	380	372	354	368	384	384	406	391	66
Agriculture and forestry	101	97	84	90	92	103	114	154	156	176	179
Consumed for non-energy purposes	**44**	**41**	**63**	**62**	**71**	**63**	**65**	**70**	**109**	**93**	**128**

Source: Energy Balances of the Republic of Moldova for 2010-2020.

If analyzed the structure of gross domestic consumption in the reference year (1990) and in 2020, one can notice an obvious trend of decreasing share of solid fuels (from 23.8% of the total in 1990 to 2.7% of the total in 2020) and liquid fuels (from 41.5% of the total in 1990 to 33.1% of the total in 2020), respectively an increasing trend for the share of electricity (from 8.5% of the total in 1990 to 10.6% of the total in 2020), gaseous fuels (from 25.9% of the total in 1990 to 30.6% of the total in 2020) and biofuels (from 0.4% in 1990 to 23.1% in 2020) (Table 1-33, Fig. 1-5 and 1-6).

Table 1-33: Structure of gross domestic consumption by types of fuels and energy resources in the RoM, kt conventional fuel (in kt conventional coal equivalent), 1990-2020

Years	Coal	Natural gases	Oil products	Biofuels	Electricity	Total products
1990	4,311	4,688	7,518	72	1,542	18,131
1995	227	1,436	1,402	71	650	3,786
2000	108	1,121	753	85	580	2,647
2005	155	1,626	1,022	96	358	3,257
2010	166	1,373	1,109	731	382	3,761
2011	171	1,329	1,162	770	395	3,827
2012	165	1,264	1,096	822	406	3,753
2013	215	1,192	1,124	833	415	3,779
2014	137	1,214	1,149	898	417	3,815
2015	146	1,165	1,182	926	413	3,832
2016	107	1,196	1,276	997	413	3,989
2017	149	1,195	1,336	1,090	425	4,195
2018	115	1,300	1,437	1,121	437	4,410
2019	145	1,222	1,455	927	444	4,193
2020	110	1,246	1,349	941	432	4,078
1990-2020, %	**-97.4**	**-73.4**	**-82.1**	**1206.9**	**-72.0**	**-77.5**

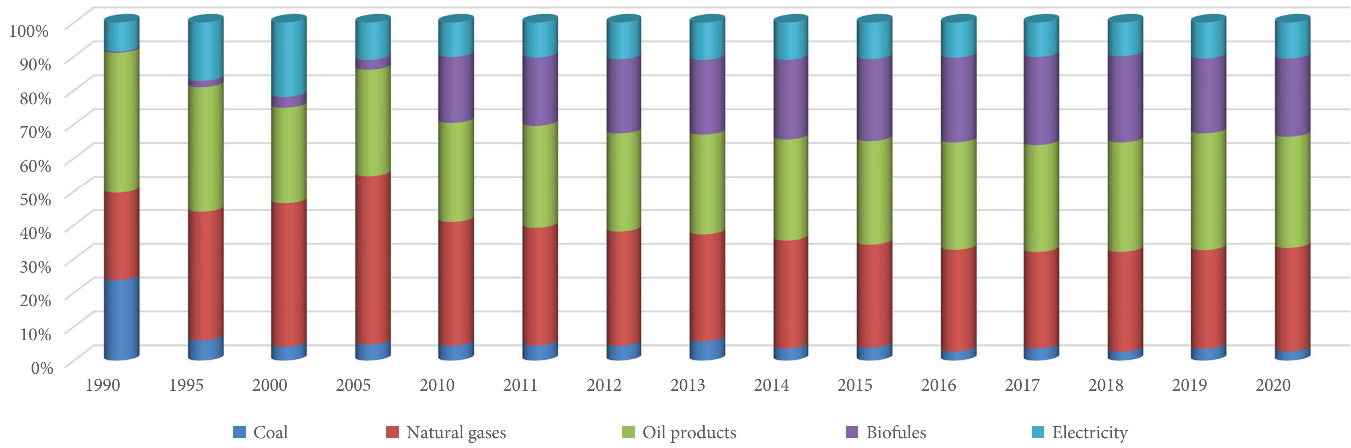


Figure 1-5: The share of different fuels and energy resources in the structure of the gross domestic consumption of the RoM, % of the total,1990-2020.

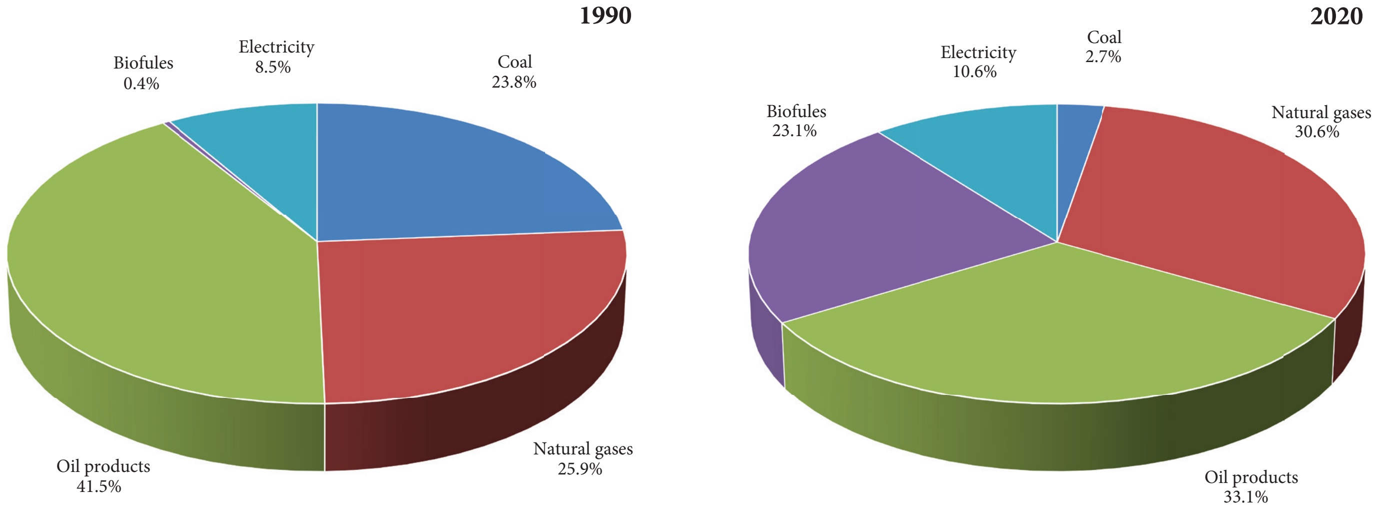


Figure 1-6: The share of different fuels and energy resources in the structure of gross domestic consumption in the RoM in 1990 and 2020, % of the total.

Production of electricity from renewable energy sources in the Republic of Moldova

In accordance with the provisions of the Renewable Energy Law no.160 of 12.07.2007, the National Agency for Energy Regulation (ANRE) approves annually the tariffs for electricity produced from renewable energy sources (RES), calculated by the producers in accordance with the methodology developed and approved by ANRE.

According to the reports submitted by the central supplier "Energocom" JSC and the transmission system operator S.E. "Moldelectrica", the total electricity generated by the installations using renewable sources, the holders of which benefit from the support scheme, except for S.E. "Hydroenergetic Node Costești" and the producers who sell electricity at unregulated prices, in 2020 was 81.4 million kWh, which represents an increase of about 20.6% compared to 2019. Out of its total, for 50.7 million kWh of electricity were issued guarantees of origin by the central supplier.

Table 1-34 presents aggregated data on the installed capacity of power plants, on the quantities of electricity produced from RES and delivered to the power grids for which guarantees of origin were issued to the respective producers, during the period 2013-2020.

Table 1-34: Electricity production from renewable energy sources in 2013-2020, according to the guarantees of origin issued by system operators of the RoM

Renewable energy sources	Installed capacity, MW							
	2013	2014	2015	2016	2017	2018	2019	2020
Photovoltaic energy	0.105	0.466	1.257	1.778	2.061	2.131	2.131	4.300
Biomass energy (biogas)	0.405	0.405	2.805	2.805	5.709	5.709	5.709	6.100
Wind power	1.100	1.100	1.130	2.330	9.190	29.330	33.720	44.100
Hydropower					0.254	0.254	0.254	0.254
Total kW	**1.610**	**1.971**	**5.192**	**6.913**	**17.214**	**37.424**	**41.814**	**54.754**
Renewable energy sources	**Quantity of electricity produced and delivered to electricity grids, million kWh**							
	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Photovoltaic energy	0.101	0.378	1.091	1.311	1.509	1.457	1.437	3.275
Biomass energy (biogas)	0.827	1.276	14.531	14.030	21.576	27.961	28.748	27.793
Wind power	0.980	1.481	1.548	2.477	7.066	21.968	36.915	50.138
Hydropower					0.038	0.279	0.330	0.147
Total, thousand kWh	**1.908**	**3.135**	**17.170**	**17.818**	**30.189**	**51.665**	**67.430**	**81.353**

Of the total amount of electricity generated from renewable sources, the largest share belongs to the energy generated using the wind potential (61.6%), followed by the electricity produced from biogas (34.2%), the electricity produced from solar energy (4.0%), and the smallest share belongs to the energy produced by hydropower installations, less than one percent (0.2%) (the electricity generated by hydropower sources does not include the energy generated by Costești HPP) (Fig. 1-7).

The largest amount of energy delivered by a single installation that produces electricity from RES comes from the power plant belonging to JV "Sudzucker Moldova" JSC with the capacity of 3.6 MW – 17.0 million kWh of electricity generated in 2020.

It should be mentioned that the total installed capacity of the RES power plants in 2020 was 54.75 MW. The structure of RES production capacities in 2020 for which tariffs have been approved by ANRE, by types of renewable energy sources, is presented in Fig. 1-8.

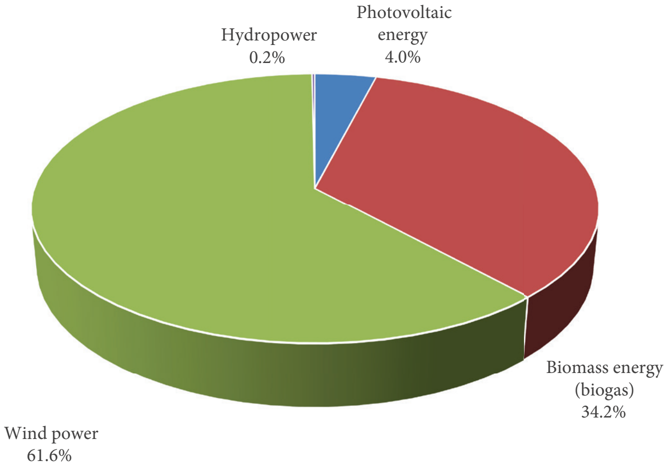


Figure 1-7: The share of each type of RES in the total electricity production of RES in 2020.

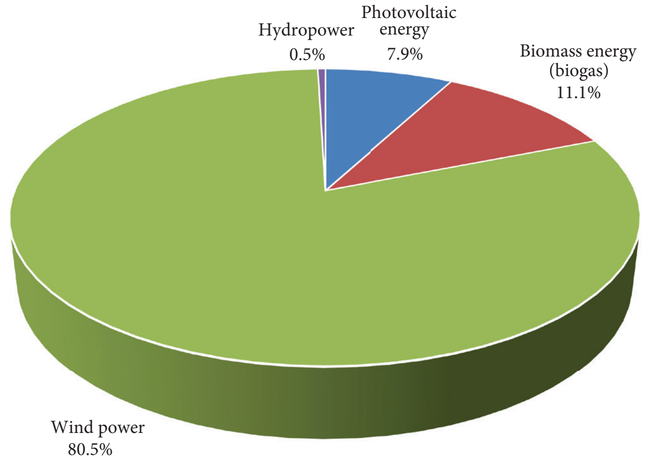


Figure 1-8: Electricity generation installed capacity, the share by types of RES in 2020.

Mining and quarrying. In 2020, companies in the extractive industry accounted for about 1.7% of the total production output produced by large companies with main industrial activities. These enterprises output amounted to about 1,041 billion MDL (in current prices), increasing by 6.6% compared to 2019 (0,976 billion MDL) (in current prices).

The evolution of the main industrial products production within the extractive industry during 1990-2020 is presented in Table 1-35. It should be noted that the statistical indicators monitored and the units of measurement of industrial production output have been modified since 2005.

Table 1-35: Production of the main industrial products in the extractive industry of the RoM in the period 1990-2020

	UM	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Ecaussine and other calcareous stones for carving or building;	thousand tones	...	...	...	474.8	346.0	279.4	188.8	154.4	139.6	144.6	105.0
	thousand m3	468.0	99.0	63.4	...	...	...	...	...	...	...	...
Other stones for carving or building (excluding granite or sandstone)	thousand tones	...	...	...	250.3	203.6	638.4	498.5	448.1	569.0	523.4	685.9
Sand	thousand m3	3 360.0	229.0	246.3	...	...	...	...	...	...	...	...
	thousand tones	...	...	...	1 051.9	1 211.1	1 599.9	1 522.5	1 579.1	1 648.2	1 981.8	2 240.9
Pebbles, gravel, boulders and flint	thousand m3	7 237.0	672.0	536.0	...	...	...	...	...	...	...	
	thousand tones	...	...	...	1 370.2	1 640.3	2 717.1	2 349.0	2 956.9	3 634.1	4 132.7	4 894.4
Mixtures of slag and similar industrial waste materials, whether or not incorporating pebbles, gravel, shingles and flint for construction use (sand and gravel mixtures)	thousand m3	617.0	37.0	22.4	...	...	...	...	...	...	...	...
	thousand tones	...	...	...	151.6	258.3	1 087.8	1 109.7	1 308.0	1 313.2	1 371.1	1 601.1

Source: National Bureau of Statistics, <http://statbank.statistica.md/pxweb/pxweb/ro/40%20Statistica%20economica/40%20Statistica%20economica__14%20IND__IND030/IND030100.px/table/tableViewLayout1/?rxid=b2ff27d7-0b96-43c9-934b-42e1a2a9a774>.

1.5.2. Agricultural Sector

The value of agricultural production output in 2020 was about 30.061 billion MDL (in current prices). The index of agricultural production output in comparison with 2019 decreased by 27.2% (under comparable conditions) (Tab. 1-36, Fig. 1-9).

Table 1-36: Evolution of agricultural production in the RoM, 1990-2020

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Agriculture, billion MDL	6.1	4.2	8.3	12.7	19.9	27.2	30.4	34.1	32.6	34.6	30.1
in % compared to the previous year	2.2	1.9	-3.3	0.8	7.9	-13.4	18.8	9.1	2.9	-1.6	-27.2
in % compared to 1990	100.0	64.5	49.5	57.3	56.2	60.0	71.3	77.7	80.0	78.7	57.3
Agriculture, US $billion		0.94	0.66	1.01	1.61	1.45	1.52	1.85	1.94	1.97	1.74

Source: National Institute of Economic Research of the ASM and Ministry of Economy and Infrastructure (September 2021).

The decrease of global agricultural production was determined by the decrease of vegetal production by 35.9% and animal production by 3.8%. In 2020, the share of plant production in the total agricultural production was 67.8% (in 2018 – 72.6%), animal production was 30.4% (in 2019 – 27.4%).

During 1991-2020, the evolution of agricultural production was fluctuating, the best results were reported in 1993, 1997, 2004, 2008, 2010, 2011, 2013, 2014 and 2017, and the most negative results, namely in 1992, 1994, 1996, 1998, 2003, 2007, 2012, 2015, 2019 and 2020.

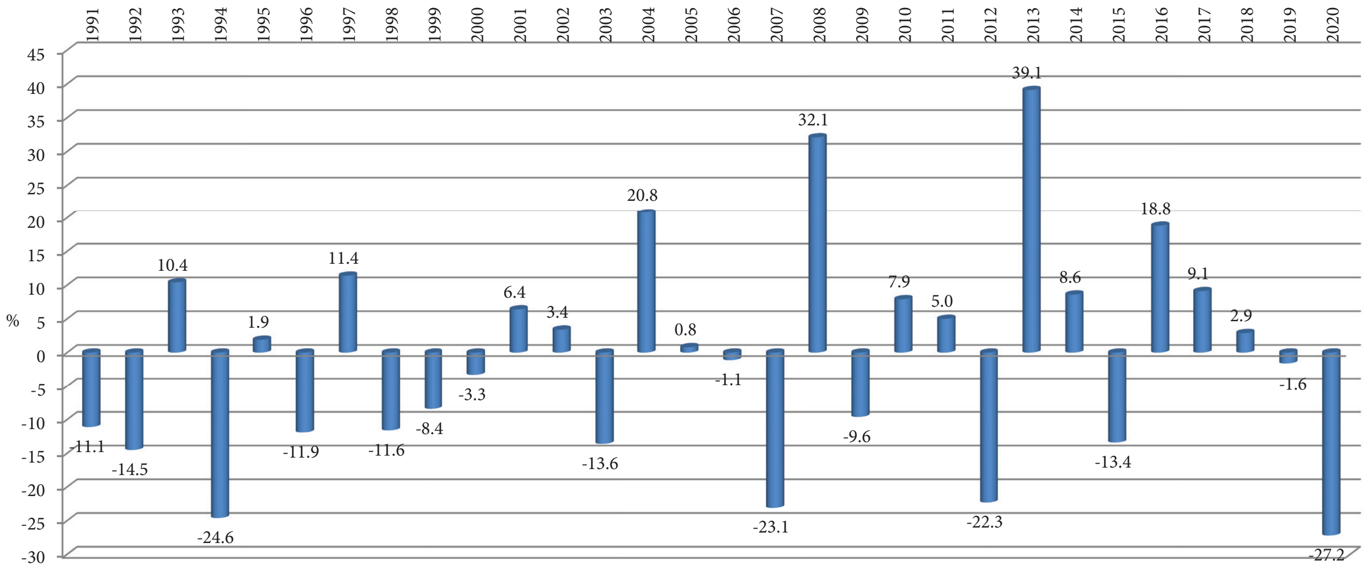


Figure 1-9: Evolution of agricultural production during 1991-2020, in % compared to the previous year.

It should be noted that during 1990-2020 the sown areas of certain agricultural crops were reduced quite significantly in the RoM (for example, the areas sown with oats were reduced by 22.8%, cucurbit crops – by 31.5%, vegetables – by 40.6%, potatoes – by 43.8%, autumn and spring barley – by 47.4%, grain legumes – by 51.9%, perennial herbs for green fodder, silage and fodder – by 81.0%, buckwheat – by 89.4%, sugar beet – by 83.4%, annual herbs for green fodder – by 93.7%, corn for silage and green mass – by 95.9%, roots for fodder – by 97.3%, tobacco – by 98.8%, etc.).

There was also a decrease in the average production per hectare (for example, in the reference period it reduced in root crops for fodder by 88.8%, perennial grasses for green fodder, silage and forage – by 83.8%, vegetables – by 62.9%, annual grasses for green fodder – by 61.5%, corn – by 58.4%, autumn and spring wheat – by 54.2%, tobacco – by 51.5%, autumn and spring barley – by 46.0%, oats – by 41.8%, grain legumes – by 37.3%, corn for silage and green mass – by 36.2%, sunflower – by 34.9%, rape for oil seeds – by 5.8%) (Tab. 1-38).

Table 1-37: Areas sown with agricultural crops during 1990-2020, thousand ha

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Sown area – total	**1,733.1**	**1,725.4**	**1,701.4**	**1,698.1**	**1,628.2**	**1,693.8**	**1,715.1**	**1,735.8**	**1,749.2**	**1,724.0**	**1,709.7**
Cereals and grain legumes – total	**745.7**	**920.5**	**1,077.4**	**1,131.7**	**1,020.3**	**1,065.3**	**1,074.2**	**1,050.7**	**1,095.4**	**1,074.7**	**1,050.9**
...wheat (autumn and spring)	286.7	393.9	423.8	456.1	380.8	416.9	454.8	410.5	455.2	438.4	362.7
... autumn rye	0.9	2.7	3.8	3.2	1.6	0.4	0.6	0.6	0.5	0.6	1.5
...barley (autumn and spring)	120.4	135.0	125.0	147.8	164.9	104.8	101.4	96.9	77.9	63.3	63.2
oats	2.1	5.8	4.2	6.4	3.0	1.7	1.4	1.7	1.3	1.0	1.6
millet	0.1	0.2	0.4	0.2	0.5	0.1	0.9	0.1	0.1	0.1	0.1
buckwheat	3.6	5.5	12.1	3.1	0.2	0.3	0.5	0.4	0.3	0.3	0.4
... bean legumes	72.6	54.0	53.6	43.3	39.5	24.9	26.3	37.1	46.1	42.9	34.9
...corn for the kernels	258.0	321.3	454.1	469.1	425.7	515.1	485.6	500.9	512.0	519.9	575.9
... grain sorghum	1.2	1.1	0.4	0.7	0.2	0.2	1.4	1.3	1.1	7.3	10.1
...other cereal crops	0.1	1.0	0.0	1.8	3.5	0.8	1.3	0.9	0.7	0.7	0.6
Technical crops – total	**295.3**	**284.0**	**364.9**	**392.6**	**440.5**	**499.0**	**510.6**	**558.4**	**538.9**	**530.5**	**531.5**
sugar beet	81.5	90.3	66.6	34.4	26.5	21.9	20.9	23.6	19.8	15.3	13.5
sunflower	134.1	163.2	256.9	309.2	288.1	380.6	416.2	451.0	419.3	410.0	447.0
soy	26.5	3.6	11.6	36.9	61.5	69.7	41.4	35.5	29.4	38.1	29.3
tobacco	32.1	20.1	23.7	4.8	4.4	0.8	0.6	0.5	0.4	0.3	0.4
... rapeseed for oil	0.0	0.0	1.0	2.4	48.9	13.3	22.4	36.1	58.2	53.6	29.9
...other technical crops	21.1	6.6	3.9	4.9	10.4	12.5	9.0	11.8	11.8	12.9	11.1
Potatoes, vegetables and cucurbit crops – total	**131.8**	**142.0**	**132.3**	**84.0**	**80.5**	**59.6**	**61.5**	**59.9**	**55.6**	**66.2**	**72.4**
potatoes	41.2	57.1	65.4	36.7	28.0	22.5	20.9	19.9	19.2	18.7	23.2
vegetable	71.1	74.0	56.8	39.8	40.6	29.4	30.5	31.0	30.4	39.4	42.2
...cucurbit crops	9.2	7.6	7.9	5.2	10.6	6.7	7.9	7.8	5.5	7.4	6.3
– other	10.3	3.3	2.2	2.2	1.4	1.1	2.2	1.1	0.5	0.7	0.7
Fodder plants – total	**560.3**	**379.0**	**126.8**	**89.9**	**86.8**	**69.9**	**68.6**	**66.7**	**59.3**	**52.5**	**54.8**
root crops for fodder	26.4	24.5	11.5	2.5	1.7	1.3	1.5	1.2	1.0	0.6	0.7
...corn for silo and green mass	292.3	179.0	49.7	18.2	10.1	11.2	8.0	6.8	6.3	5.7	11.8
... perennial herbs for green fodder, silage and forage	206.3	144.7	53.1	60.2	66.9	51.6	55.0	54.4	47.9	42.5	39.2
... annual herbs for green fodder	31.4	29.3	11.3	8.1	6.5	4.4	2.2	2.6	2.6	2.1	2.0
– other	3.9	1.3	1.1	0.9	1.6	1.4	1.8	1.7	1.6	1.6	1.0

Source: NBS, Data Bank, field "Sown area, production and average yield by agricultural crops, 1980-2020: <http://statbank.statistica.md/pxweb/Database/RO/16%20AGR/AGR02/AGR02.asp>; Statistical Yearbooks of the TMR 1998 (p. 218), 2002 (p. 113), 2005 (p. 101), 2009 (p. 97), 2011 (p. 100), 2014 (p. 94), 2019 (p. 109), 2020 (p. 112), 2021 (p. 112).

Table 1-38: Average yield per hectare by main crops in 1990-2020, tones/ha

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Cereals and grain legumes	**3.4**	**2.9**	**1.9**	**2.7**	**2.6**	**2.4**	**3.3**	**3.6**	**3.6**	**3.7**	**1.6**
...wheat (autumn and spring)	3.9	2.9	1.7	2.3	2.0	2.8	3.7	3.8	3.2	3.3	1.8
... autumn rye	2.1	2.2	1.3	1.9	1.5	2.3	2.9	3.6	3.3	3.1	1.9
...barley (autumn and spring)	3.5	2.3	1.2	1.6	1.5	2.3	3.2	3.1	2.7	3.1	1.9
Oats	1.8	1.7	0.8	1.2	1.0	1.0	2.3	2.2	1.2	1.7	1.1
Millet	1.0	1.4	0.2	0.9	0.5	1.3	1.2	1.0	1.5	2.0	0.4
Buckwheat	0.5	0.4	0.7	0.4	3.2	0.9	1.9	1.6	1.0	1.3	1.6
... bean legumes	1.3	1.0	0.6	1.6	1.0	1.0	1.7	2.0	1.1	1.3	0.8
...corn for kernels	3.4	3.0	2.3	3.2	3.4	2.2	3.1	3.7	4.3	4.4	1.4
... grain sorghum	1.9	0.7	1.2	0.4	0.9	0.9	3.7	3.8	4.0	4.0	4.0
...other cereal crops	1.7	1.7	1.2	1.4	1.6	1.5	2.0	2.7	3.3	3.3	3.3
Technical crops											
Sugar beet	29.1	20.8	14.8	29.0	31.6	24.5	31.8	37.1	35.7	39.7	31.3
Sunflower	1.9	1.3	1.2	1.2	1.5	1.5	1.9	2.1	2.1	2.2	1.2
Soy	0.9	0.9	1.0	1.8	1.8	0.7	1.1	1.4	2.0	1.7	1.1
Tobacco	2.1	1.3	1.1	1.4	1.7	1.5	1.5	2.0	1.8	1.7	1.0
... rapeseed for oil	2.0	0.8	1.0	1.4	1.0	1.9	2.3	2.5	2.1	2.1	1.9
Potatoes, vegetables and cucurbit crops											
Potatoes	7.2	6.8	5.1	10.6	10.2	7.3	10.5	10.1	9.3	9.7	7.8
Vegetable	16.6	7.7	7.0	10.3	9.0	9.1	10.5	11.0	9.9	8.6	6.2
... cucurbit crops	3.7	3.1	4.0	9.4	9.9	8.5	8.8	7.6	8.9	6.3	4.8
Fodder plants											
... root crops for fodder	44.4	24.4	10.9	16.4	18.5	11.2	14.0	17.8	19.8	30.2	5.0
...corn for silo and green mass	15.4	11.9	7.1	11.0	14.2	8.2	17.4	16.4	21.3	20.3	9.8
... perennial herbs for green fodder, silage and forage	21.6	11.8	6.0	3.1	4.8	2.6	3.8	3.7	4.3	4.2	3.5
... annual herbs for green fodder	9.2	9.0	5.0	6.5	5.4	4.9	4.7	4.3	3.3	5.3	3.5

Source: NBS, Data Bank, field "Sown area, production and average yield by agricultural crops, 1980-2020": <http://statbank.statistica.md/pxweb/Database/RO/16%20AGR/AGR02/AGR02.asp>; Statistical Yearbooks of the TMR 1998 (p. 218), 2002 (p. 113), 2005 (p. 101), 2009 (p. 99), 2011 (p. 102), 2014 (p. 96), 2019 (p. 112), 2020 (p. 115), 2021 (p. 115).

Table 1-39: Average yield of main crops in 1990-2020, kt

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Cereals and grain legumes	**2,538.6**	**2,638.6**	**2,070.2**	**3,059.9**	**2,674.3**	**2,587.0**	**3,531.7**	**3,813.4**	**3,946.8**	**4,020.6**	**1,638.9**
...wheat (autumn and spring)	1,129.0	1,154.3	725.0	1,048.6	749.5	927.4	1,302.4	1,258.6	1,169.1	1,152.3	655.3
... autumn rye	1.9	5.9	5.0	6.1	2.4	1.0	1.8	2.3	1.7	1.9	3.0
...barley (autumn and spring)	417.9	311.2	152.3	240.9	240.7	199.1	273.9	265.0	188.2	178.2	118.4
... oats	3.8	9.8	3.5	7.6	3.1	1.6	2.8	3.6	1.5	1.6	1.7
... millet	0.1	0.3	0.1	0.2	0.3	0.2	1.1	0.1	0.1	0.2	0.0
... buckwheat	1.8	2.2	8.0	1.1	0.5	0.2	0.9	0.7	0.3	0.4	0.6
... bean legumes	97.1	55.4	30.8	67.1	40.1	25.1	45.1	75.2	51.5	56.6	29.3
...corn for the beans	885.5	948.6	1,050.4	1,523.4	1,462.1	1,133.6	1,485.5	1,871.0	2,208.0	2,263.7	821.2
... grain sorghum	1.2	0.8	0.5	0.3	0.2	0.2	5.1	4.5	4.6	48.9	12.5
...other cereal crops	0.3	0.3	3.2	12.3	7.7	2.8	4.4	4.5	2.2	1.7	0.7
Technical crops											
... sugar beet	2,374.5	1,877.9	982.5	996.2	837.6	537.5	664.8	876.3	707.2	607.0	423.2
... sunflower	252.2	208.1	305.1	368.7	440.2	562.3	789.4	925.1	898.7	915.3	547.3
... soybeans	23.8	3.3	11.6	66.4	113.0	49.2	43.8	48.5	59.7	64.8	33.4
... tobacco	66.2	27.1	26.3	6.7	7.6	1.2	0.9	1.0	0.7	0.5	0.4
... rape for oilseed	0.0	0.0	1.1	3.4	51.0	25.6	52.4	89.9	120.8	110.2	56.3
Potatoes, vegetables and cucurbit crops											
... potatoes	295.3	385.3	330.4	391.1	286.7	163.8	220.3	201.7	177.7	181.8	179.5
...vegetable	1,177.3	568.8	396.1	410.3	365.8	266.9	320.6	340.9	301.2	339.4	259.8
... cucurbit crops	34.4	23.3	31.7	49.3	104.9	56.7	69.3	59.6	49.1	47.0	30.3
Fodder plants											
... root crops for fodder	1,171.8	597.0	125.0	41.6	31.7	14.6	21.0	21.4	19.8	18.2	3.5
...corn for silo and green mass	4,509.0	2,136.2	350.7	199.6	143.8	91.7	139.6	111.7	133.8	116.2	116.6
... perennial herbs for green fodder, silage and forage	4,456.1	1,704.7	317.4	183.8	323.9	136.0	209.6	199.2	203.8	177.3	137.1
... annual herbs for green fodder	288.9	222.3	28.8	16.3	10.9	12.4	13.3	13.2	12.0	16.8	21.7

Source: NBS, Data Bank, field "Sown area, production and average yield by agricultural crops, 1980-2020": <http://statbank.statistica.md/pxweb/Database/RO/16%20AGR/AGR02/AGR02.asp>; Statistical yearbooks of the TMR 1998 (p. 218), 2002 (p. 113), 2005 (p. 101), 2009 (p. 98), 2011 (p. 101), 2014 (p. 95), 2019 (p. 110), 2020 (p. 113), 2021 (p. 113).

At the same time, the same period showed a substantial increase in areas sown with sunflower (by 233.3%), corn for grain (by 123.2%), rye (by 69.9%), winter and spring wheat (by 26.5%) and soybean (by 10.5%). There was also an increase in the average production per hectare for such crops as: cucurbit crops (by 28.6%), soya (by 27.1%), potatoes (by 8.1%) and sugar beet (by 7.6%).

Plant growing. The harvest of 2020 compared to 2019 is characterized by a considerable decrease in the output of cereals and grain legumes – by 57.9% less (including corn for grain – by 63.5%, wheat – by 50.5%, barley – by 36.6% and grain legumes – by 47.0%), soybeans – by 52.4%, sunflower – by 40.0%, rape – by 39.2%, cucurbit crops – by 35.1%, sugar beet by 30.2%, grapes – by 27.9%, vegetables – by 26.8% and fruits, nuts and berries – by 23.3%[23]. In 2020, agricultural enterprises produced the bigger part of: sugar beet – 91.8%, rape – 89.0%, tobacco – 88.9%, cereals and grain legumes (excluding maize) – 70.8%, sunflower – 69.4%. At the same time, 96.5% of the total amount of cucurbit crops, 86.6% of potatoes, 80.2% of vegetables, 73.5% of grapes, 73.2% of maize for kernels, 67.1% of fruits, nuts and berries and 50.1% of soybeans were produced by population and peasant (farmer) households.

In 2020 chemical fertilizers used per hectare (recalculated to 100% nutrients) amounted to 67 kg, compared to 66 kg in 2019. Natural fertilizers per 1 hectare was 62 kg, compared to 49 kg in 2019. In the period 1990-2020, the application of chemical (in thousands tones of active substance) and natural (in thousands of tons) fertilizers in the RoM decreased by about 50.7% and 98.9%, respectively (Table 1-40).

[23] National Bureau of Statistics, Press release of 29.01.2021 "Agricultural activity in 2020" <https://statistica.gov.md/newsview.php?l=en&idc=168&id=6897>.

Table 1-40: Application of chemical fertilizers in the RoM, kt, 1990-2020

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Chemical fertilizers – total, thousands of tons, etc.	**232.4**	**12.5**	**10.3**	**18.0**	**25.5**	**52.4**	**58.8**	**81.4**	**94.2**	**113.8**	**114.7**
nitrates	92.1	10.5	10.2	16.1	20.6	38.7	43.4	55.7	64.3	77.2	75.2
phosphates	85.7	1.4	0.1	1.5	3.3	10.8	11.6	19.2	22.2	25.6	27.7
potassic	54.6	0.6	0.0	0.5	1.6	2.9	3.8	6.4	7.8	10.3	12.0
Average per 1 hectare of crops, kg	134.1	7.2	6.1	10.6	15.6	30.9	34.3	46.9	53.9	66.0	67.1
Natural fertilizers, thousand tones	**9,740.0**	**1,779.2**	**83.3**	**44.2**	**17.7**	**61.2**	**74.6**	**45.5**	**103.4**	**84.0**	**105.5**
Average per hectare of crops, tones	5.62	1.03	0.05	0.03	0.01	0.04	0.04	0.03	0.06	0.05	0.06

Source: Statistical Yearbooks of the RM for 1988 (p. 280), 1994 (p. 239), 1999 (p. 330), 2003 (p. 442), 2006 (p. 352), 2011 (p. 345), 2014 (p. 345) and 2020 (p. 296). Statistical Yearbooks of the ATULBD 1998 (p. 230), 2000 (p. 107), 2002 (p. 111), 2006 (p. 108), 2009 (p. 107), 2012 (p. 114), 2017 (p. 110), 2019 (p. 108), 2020 (p. 111), 2021 (p. 111).

Animal husbandry. The production (growth) of cattle and poultry (in live weight) in 2020 compared to the previous year in households of all categories decreased by 0.8%, due to the decrease in animal production by 10.7% in households. At the same time, in agricultural enterprises cattle and poultry breeding increased by 10.9%. The production of milk and eggs in households of all categories decreased, respectively, by 12.4% and by 6.6% as a result of decrease of production both in agricultural enterprises and in households.

During 1990-2020, production of the main animal products significantly decreased: the sale for slaughter of animals and birds (in live weight) – by 67.4%, milk – by 80.7%, eggs – by 44.4% and wool – by 51.9% (Table 1-41).

Table 1-41: Production of the main animal products in the RoM, 1990-2020

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Cattle and poultry sold for slaughter (in live weight), kt	**530.0**	**174.0**	**123.0**	**121.0**	**150.0**	**174.5**	**184.3**	**157.8**	**163.3**	**158.6**	**172.6**
cattle	181.0	70.0	30.0	26.0	16.9	14.0	15.8	12.7	13.4	12.7	13.1
swine	238.0	67.0	63.0	51.0	72.5	91.6	92.9	79.2	84.0	82.7	93.8
sheep and goats	15.0	11.0	7.0	5.0	4.7	4.4	4.2	5.1	4.1	4.2	4.1
poultry	92.0	24.0	21.0	37.0	54.7	62.7	69.9	59.3	60.3	57.6	60.6
other species	4.0	2.0	1.0	2.0	1.5	1.7	1.7	1.7	1.5	1.4	1.0
Milk yield, kt	**1,503.0**	**751.0**	**555.0**	**627.0**	**591.2**	**479.5**	**462.1**	**442.6**	**373.1**	**331.7**	**290.5**
Eggs, million pieces	1,129.0	477.0	575.0	762.0	718.5	628.8	673.5	707.2	688.7	686.6	627.5
Wool, tones	3,043.0	2,895.0	2,066.0	2,079.0	2,067.0	1,899.0	1,709.5	1,850.2	1,917.5	1,755.1	1,464.1

Source: National Bureau of Statistics, Data bank: <https://statbank.statistica.md/PxWeb/pxweb/ro/40%20Statistica%20economica/40%20Statistica%20economica__16%20AGR__AGR030/AGR030200.px/?rxid=b2ff27d7-0b96-43c9-934b-42e1a2a9a774>.

During the period 1990-2020, the number of domestic animal species significantly decreased: cattle – by 88.1% (dairy cows – by 79.7%, other cattle – by 93.2%), pigs – by 80.2%, poultry of all species – by 61.5%, sheep – by 61.5%, horses – by 51.3%, donkeys – by 28.9%. At the same time, the number of goats and rabbits increased – by 303.6%, and 12.8%, respectively (Table 1-42).

Table 1-42: Livestock and poultry population in the RoM, thousands of heads, 1990-2020

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Bovines, total, including:	1,060.7	729.5	445.4	339.8	236.4	204.5	199.9	185.6	162.7	141.2	125.8
...Dairy cows	395.2	380.8	298.5	233.1	165.8	137.7	132.3	122.1	106.4	90.2	80.3
...Other cattle	665.5	348.7	146.9	106.7	70.5	66.9	67.7	63.5	56.3	51.0	45.5
Sheep and goats, in total, including:	1,281.9	1,423.0	962.1	954.3	920.6	880.8	882.0	853.8	781.2	688.8	629.1
...Sheep	1,244.8	1,326.6	846.3	827.0	793.1	722.2	714.9	683.6	618.3	535.9	479.3
...Goats	37.1	96.4	115.8	127.3	127.5	158.6	167.0	170.3	162.9	152.9	149.7
Horses	47.2	61.6	76.0	72.0	53.6	40.2	37.4	34.1	30.4	26.4	23.0
Asses	1.7	3.2	3.8	3.7	2.8	2.0	3.1	5.0	3.8	1.4	1.2
Swine	1,850.1	1,016.4	492.7	493.0	511.7	484.5	469.8	439.8	431.6	428.5	366.9
Poultry of all species, total, including:	24,625.0	13,746.4	13,624.9	22,773.6	23,782.5	12,590.6	13,172.6	13,616.4	11,456.5	11,115.7	9,492.0
...Chicken	20,234.4	10,200.6	9,952.9	17,195.3	19,456.4	10,633.3	11,155.0	11,542.6	9,666.9	9,494.4	8,176.6
...Geese	1,335.5	1,487.4	1,550.6	2,120.3	1,597.3	746.1	770.6	790.7	683.8	621.3	492.7
...Duck	2,165.7	1,293.3	1,325.3	2,394.1	2,010.8	904.1	929.1	956.9	823.6	742.8	599.2
...Turkeys	889.3	765.2	796.2	1,063.9	718.1	307.1	317.8	326.1	282.2	257.1	223.5
Rabbits	283.0	209.3	161.3	278.9	277.0	350.2	366.7	376.5	351.5	329.7	319.2

Sources: Statistical report (annual) No. 24-Agr "Status of the animal husbandry sector". Livestock and poultry population in all categories of farms on 1 January (annual for the period 1990-2020). Statistical Yearbooks of the ATULBD 1998 (p. 224), 2002 (p. 118), 2006 (p. 109), 2010 (p.110), 2014 (p.104), 2017 (p.117), 2019 (p.115), 2021 (p.118).

1.5.3. Transport Sector

The structure of the transport sector of the RoM comprises: road transport, railway transport, air transport and naval transport.

Road transport. The public road network with a total length of 9,465 thousand km (of which with hard top – 9,098 thousand km) (Table 1-43 and 1-44) has Chisinau municipality as the main hub, the intersection center of the national and international main routes crossing the RoM.

Table 1-43: Length of roads, by categories of roads and type of cover, 2000-2020, km

	2000	2005	2010	2015	2016	2017	2018	2019	2020
Total public roads	**9,378**	**9,467**	**9,344**	**9,373**	**9,386**	**9,378**	**9,446**	**9,432**	**9,465**
.. with rigid cover	8,780	8,883	8,811	8,879	8,894	9,042	9,079	9,146	9,098
Total national roads	**2,812**	**3,329**	**3,336**	**3,339**	**3,346**	**5,815**	**5,822**	**5,842**	**5,882**
.. with rigid cover	2,810	3,324	3,336	3,339	3,346	5,765	5,772	5,798	5,835
Total local roads	**6,566**	**6,138**	**6,008**	**6,034**	**6,040**	**3,563**	**3,624**	**3,589**	**3,582**
.. with rigid cover	5,970	5,559	5,475	5,539	5,547	3,277	3,307	3,348	3,263

Source: National Bureau of Statistics, Data bank: <https://statbank.statistica.md/pxweb/pxweb/ro/40%20Statistica%20economica/40%20Statistica%20economica__19%20TRA__TRA010/?rxid=9a62a0d7-86c4-45da-b7e4-fecc26003802>

Table 1-44: Length of communication paths, end of year, 2000-2020, km

	2000	2005	2010	2015	2016	2017	2018	2019	2020
Railway lines in operation for general use	1,139	1,139	1,157	1,151	1,151	1,151	1,150	1,150	1,150
Public roads	9,378	9,467	9,344	9,373	9,386	9,378	9,446	9,432	9,465
Trolleybus lines in operation	264	290	306	306	306	306	306	306	306
Inland waterways for general use	558	558	558	558	561	410	410	410	410

Source: National Bureau of Statistics, Data bank: <https://statbank.statistica.md/pxweb/pxweb/ro/40%20Statistica%20economica/40%20Statistica%20economica__19%20TRA__TRA010/?rxid=9a62a0d7-86c4-45da-b7e4-fecc26003802>.

Automotive transport in the RoM is represented by a wide spectrum of means of transport: cars, buses and minibuses, trucks, special purpose cars (ambulances, fire trucks, mobile cranes and others) (Tab. 1-45). The main types of fuels consumed are gasoline, diesel fuel, liquefied petroleum gases and compressed natural gas.

Table 1-45: Vehicles existing at the end of the year in the RoM, 2005-2020, units

	2005	2010	2015	2016	2017	2018	2019	2020
Passenger cars (including taxis)	292,994	404,290	529,813	546,781	588,119	616,800	648,780	677,670
Trucks	81,798	131,243	164,533	168,618	173,384	179,392	185,669	185,878
Buses and minibuses	19,825	21,395	21,134	20,968	20,944	21,050	21,087	21,014
Trailers and semi-trailers	40,379	54,127	64,953	66,832	69,326	71,454	74,115	76,541

Source: National Bureau of Statistics, Data bank: <https://statbank.statistica.md/PxWeb/pxweb/ro/40%20Statistica%20economica/40%20Statistica%20economica__19%20TRA__TRA020/TRA020100.px/table/tableViewLayout1/?rxid=9a62a0d7-86c4-45da-b7e4-fecc26003802>.

In 2020, the volume of goods transported by means of road transport was 42.2 million tons of goods, a 2.9% increase compared to 1995 (Table 1-46).

Table 1-46: Transportation of goods by means of transport, 1995-2020

	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Goods transported, thousand tones										
Transport – total, including:	**54,203**	**28,918**	**36,410**	**27,806**	**36,712**	**36,992**	**42,928**	**48,357**	**48,955**	**45,337**
railway, thousand tones	13,146	8,214	11,704	3,852	4,158	3,493	4,794	4,928	4,271	2,887
road transport, thousand tones	41,036	20,672	24,593	23,825	32,401	33,363	37,998	43,301	44,553	42,221
naval, thousand tones	19.7	30.8	111.8	127.2	152.0	135.6	134.8	127.0	129.6	227.6
air, thousand tones	1.6	1.4	0.8	1.3	0.6	0.5	1.1	1.3	1.6	1.3
Turnover of goods, million tone-km										
Transport – total, including:	**4,296**	**2,605**	**5,460**	**4,193**	**5,182**	**5,484**	**5,997**	**6,303**	**6,508**	**6,151**
railway	3,134	1,513	3,053	959	964	790	987	1,012	940	599
road transport	1,160	1,088	2,405	3,232	4,217	4,693	5,008	5,290	5,567	5,551
naval	0.2	0.1	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.5
air	2.8	4.1	1.0	1.7	0.8	0.7	0.8	1.0	1.3	1.0

Source: National Bureau of Statistics, Data bank: <https://statbank.statistica.md/PxWeb/pxweb/ro/40%20Statistica%20economica/40%20Statistica%20economica__19%20TRA__TRA030/TRA030200.px/table/tableViewLayout1/?rxid=9a62a0d7-86c4-45da-b7e4-fecc26003802>.

Buses and minibuses transported 54,240 million passengers, by 35.5% less than in 1995 (Tab. 1-47).

Table 1-47: Passenger transport by public transport,1995-2020

	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Passengers transported, thousands of passengers										
Transport – total, including:	**410,913**	**326,657**	**316,439**	**232,455**	**248,727**	**248,315**	**252,302**	**261,261**	**276,542**	**178,363**
rail	11,721	4,798	5,024	4,964	3,268	2,258	1,814	1,710	1,161	720
buses	84,040	72,440	105,656	105,985	102,642	102,122	100,400	98,687	100,108	54,240
naval	-	32	135	119	139	139	130	136	136	212
air	240.1	220.9	361.7	649.2	1,085.4	1,128.5	1,640.4	1,628.2	1,575.5	385.1
taxies	725.0	722.9	1,007.4	4,262.4	4,950.8	4,960.3	6,897.9	9,604.7	9,395.3	6,558.8
trolleybuses	314,187	248,442	204,255	116,477	136,642	137,708	141,420	149,495	164,166	116,247
Passenger mileage, million passenger-km										
Transport – total, including:	**3,605**	**2,415**	**3,549**	**3,993**	**5,072**	**5,302**	**6,232**	**6,597**	**6,693**	**2,941**
rail	1,019	315	355	399	181	122	99	95	74	29
buses	1,163	1,021	2,059	2,417	2,834	3,006	3,132	3,375	3,512	1,755
naval	-	0.1	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.4
air	305	253	440	751	1,543	1,651	2,424	2,455	2,388	650
taxies	15	12	19	80	101	108	149	220	221	154
trolleybuses	1,103	815	676	347	413	416	427	453	498	353

Source: National Bureau of Statistics, Data bank: <https://statbank.statistica.md/PxWeb/pxweb/ro/40%20Statistica%20economica/40%20Statistica%20economica__19%20TRA__TRA030/TRA030500.px/table/tableViewLayout1/?rxid=9a62a0d7-86c4-45da-b7e4-fecc26003802>.

Railroad transport. Rail transport has been present in the Republic of Moldova for over 140 years. The length of the railway is about 1150 km, and the density of communication paths per 1000 km^2 is about 34 km. Rail transport is provided through line diesel locomotives (power 400-4000 kW), shunting locomotives (power 200-2000 kW), diesel trains, freight and passenger wagons. During the reference period, the number of inventory rolling stock tended to decrease (Table 1-48).

Table 1-48: Railroad transport existing by the end of the year, units, 2000-2020

	2000	2005	2010	2015	2016	2017	2018	2019	2020
Diesel locomotives	162	156	152	138	138	134	134	134	146
Railway wagons	11,037	8,758	8,246	7,247	7,087	5,850	4,953	4,848	4,850
Freight wagons	10,577	8,318	7,835	6,866	6,741	5,582	4,690	4,586	4,586
Passenger coaches	460	440	411	381	346	268	263	262	264

Source: National Bureau of Statistics, Data bank: <https://statbank.statistica.md/PxWeb/pxweb/ro/40%20Statistica%20economica/40%20Statistica%20economica__19%20TRA__TRA020/TRA020300.px/table/tableViewLayout1/?rxid=9a62a0d7-86c4-45da-b7e4-fecc26003802>.

The main type of fuel used in railroad transport is diesel fuel. In 2020, the volume of goods transported by rail was 2.9 million tones, decreasing by 78.0% compared to 1995 (Table 1-46). Railroad transport transported 0.720 million passengers, by 93.9% less than in 1995 (Table 1-47).

Naval transport. The naval transport in the Republic of Moldova is developing now after a long stagnation period (in 2000, transportation of goods on the Dniester River was resumed, which had been stopped for more than ten years). Currently, the following ports operate in the RoM: Bender (Tighina), Dnestrovsk, Molovata and Ribnița on the Dniester River, the port of Ungheni on the Prut River and the port of Giurgiulești on the Danube River, which also has an exit to the Black Sea. The length of the navigable waterways of general use is about 476 km (including 410 km to the right bank of the Dniester River and 66 km to the left bank of the Dniester River). There is a relatively small number of naval transport means (Table 1-49), which are used in the RoM for transportation of goods and passengers on the Danube River and the Dniester and Prut Rivers, especially during the warm period of the year.

In 2020, the volume of goods transported by river transport was 227.6 thousand tones, an increase by about 11.6 times compared to 1995 (Table 1-46). Naval transportation means transported 212 thousand passengers, or about 6.6 times more than in 2000 (32 thousand passengers) (Table 1-47).

Table 1-49: Means of naval transport existing by the end of the year on the right bank of the Dniester River, units, 2000-2020

	2000	2005	2010	2015	2016	2017	2018	2019	2020
Non-propelled cargo ships	15	15	9	9	9	7	7	7	8
Tugs and pusher crafts	12	12	8	8	8	7	7	6	7
Self-propelled passenger ships	3	3	1	1	2	2	2	2	2

Source: National Bureau of Statistics, Data bank: <https://statbank.statistica.md/PxWeb/pxweb/ro/40%20Statistica%20economica/40%20Statistica%20economica__19%20TRA__TRA020/TRA020400.px/table/tableViewLayout1/?rxid=9a62a0d7-86c4-45da-b7e4-fecc26003802>.

Air transport. There are four airports in the RoM: in Chisinau, Balti, Cahul and Marculesti. Out of these, only the Chisinau airport carries out regular passenger routes. Cahul and Marculesti airports are certified. Balti Airport is certified, but it serves only irregular routes. The aircraft fleet in the RoM has changed significantly in recent years. Most of the aircraft in use are modern low greenhouse gas emitting aircraft, produced mainly in industrial developed countries in the West. Table 1-50 provides information on the number of aircraft in use by the end of each calendar year during 2000-2020.

Table 1-50: Means of air transport existing at the end of the year, units, 2000-2020

	2000	2005	2010	2015	2016	2017	2018	2019	2020
Civil aircraft	**32**	**39**	**25**	**7**	**14**	**5**	**6**	**7**	**6**
Civil passenger aircraft	26	32	22	7	9	3	4	4	4
Civil cargo aircraft	6	7	3	-	5	2	2	3	2

Source: National Bureau of Statistics, Data bank: <https://statbank.statistica.md/PxWeb/pxweb/ro/40%20Statistica%20economica/40%20Statistica%20economica__19%20TRA__TRA020/TRA020500.px/table/tableViewLayout1/?rxid=9a62a0d7-86c4-45da-b7e4-fecc26003802>.

In 2020, the volume of goods transported by air was 1.3 thousand tons (Table 1-46). Air transport transported 0.385 million passengers, about 1.6 times more than in 1995 (Table 1-47).

1.5.4. Housing Sector

As of December 31, 2020, the total area of the housing stock in the RoM accounted for 89.2 million m2 (with 0.8% more than in the previous year, respectively with about 14.5% more than in 1990) (Table 1-51).

Table 1-51: Housing stock in the RoM (right bank of the Dniester River) during 1990-2020 (by the end of the year), million m^2 total area

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Total housing stock, mil m^2	77.9	71.8	75.6	77.1	79.3	81.5	86.8	87.3	87.8	88.5	89.2
Urban housing stock, mil m^2	29.5	26.0	28.1	28.6	30.4	32.5	37.9	38.3	38.7	39.4	39.9
Rural housing, mil m^2	48.4	45.8	47.5	48.5	48.9	49.0	48.9	49.0	49.1	49.1	49.3

Sources: Statistical Yearbooks of the Republic of Moldova for the years 1993 (p. 318-320), 1994 (p. 312-315), 1999 (p. 214-218), 2003 (p. 183-189), 2006 (p. 149-154), 2007 (p. 141-146), 2008 (p. 143-148), 2009 (p. 137-142), 2010 (p. 137-142), 2014 (p. 137-141), 2015 (p. 135-139), 2016 (p. 180-187), 2017 (p. 134-137), 2020 (p. 130).

By number of rooms, in 2020 only 10.4% of the total number of registered dwellings were dwellings with one room (for comparison – 21.7% in 1990), 32.3% – with two rooms (47.6% in 1990), 36.3% – with three rooms (30.7% in 1990), respectively 21.0% – with four and more rooms[24] (Fig. 1-10).

The following is the information on the indicative energy consumption per m^2 total area in the residential sector of the RoM in the period 1990-2020 (Table 1-52).

The presented information is relevant only for general trends identification, as the time series associated with energy consumption in the residential sector are not stable (with reference to the periods 1990-2009 and 2010-2020), due to the fact that consumption of biofuels and waste in residential sector for the period during 2010-2020 was revised with the support of the Energy Community experts, based on the results achieved in the framework of "Research on Energy Consumption in Households", carried out by the NBS in 2015. The significant reduction (by about 69.4%) of the indicative energy consumption per m^2 total area in the residential sector during 1990-2000 correlates with the evolution of some socio-economic indicators (for example, the GDP per capita) in the same time span and is explained, in part, not so much by the improvement of energy efficiency in the residential sector, but rather by the austere living conditions of the population during the transition to the market economy, with the independence of the RoM and the breakup of the USSR, resulting from the low incomes per capita, but also by the significant increase of the cost of energy resources and the reduced capacity of the population to purchase energy resources, adequate maintenance of the housing fund and ensuring decent living conditions in that period of time. During 2001-2020 a gradual increase in the indicative energy consumption per m^2 total area in the residential sector becomes a trend, with relatively constant values in the years 2010-2020. The reported values are below the reference year level, including as a result of the implementation of energy efficiency measures envisaged by sectoral policies, in particular from 2011 onwards.

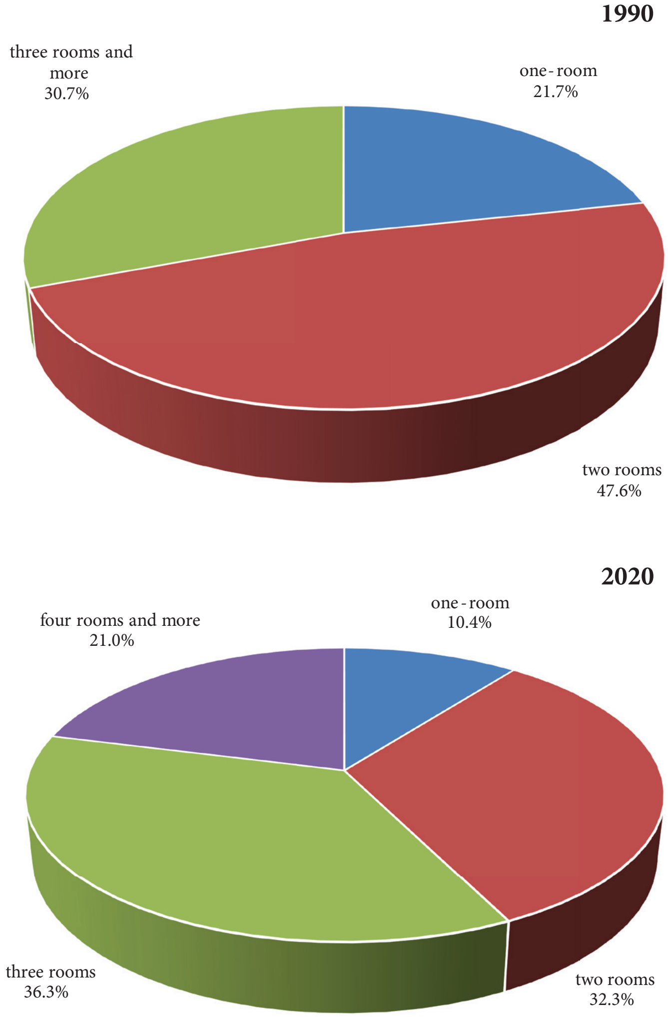


Figure 1-10: Structure of dwellings by number of rooms in 1990 and 2020 in the RoM.

[24] National Bureau of Statistics, Press release of 30.06.2021 "Dwelling stock on 1 January 2021", <https://statistica.gov.md/newsview.php?l=ro&idc=168&id=7040>.

Table 1-52: Indicative energy consumption per m^2 total area in the residential sector, 1990-2020

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Housing stock, mil m^2 total area	77.9	71.8	75.6	77.1	79.3	81.5	86.8	87.3	87.8	88.5	89.2
Energy consumption in the residential sector, thousand t.c.c.	2025	613	602	1004	1631	1722	1797	1916	1979	1817	1848
Indicative energy consumption per m^2 total area in the residential sector, kg c.c./m^2	26.0	8.5	8.0	13.0	20.6	21.1	20.7	22.0	22.5	20.5	20.7

Sources: Annual Statistical Reports of the RoM for the years 1993, 1999, 2003, 2006, 2009, 2014, 2017, 2020 and 2021. Energy Balance of the RoM for years 1990 and 1993-2020.

The information presented below demonstrates that recently the living conditions of the population gradually improve. A growing share of the country's population has access to running water, sewerage, central heating, bathroom, gas supply systems and hot water supply systems (Table 1-53).

Table 1-53: Availability of running water, sewerage, central heating, bathroom and hot water supply systems the housing stock of RoM by total area during 1997-2020, %

	1997	2000	2005	2010	2015	2016	2017	2018	2019	2020
Share of the total area equipped with:	**Total per country**									
running water	32.4	33.4	34.6	44.2	53.5	58.2	58.7	59.6	60.4	61.2
sewerage	28.3	29.4	30.8	43.8	53.2	55.8	56.3	57.5	58.3	59.0
central heating,	27.1	26.7	27.5	35.1	41.5	46.0	46.1	46.4	46.9	47.3
bathroom (shower)	26.4	25.7	26.0	35.6	42.6	37.3	37.5	38.1	38.7	39.2
gas	81.3	82.6	85.4	87.8	90.2	90.4	90.1	90.2	90.3	90.5
hot water supply system	20.5	19.4	19.5	29.5	36.3	34.4	35.1	35.6	36.1	36.2
Share of the total area provided with:	**Urban settlements**									
running water	77.9	77.0	79.0	82.8	86.3	90.1	89.3	89.4	89.6	89.9
sewerage	76.2	75.9	77.9	82.7	85.8	84.9	84.2	85.0	85.4	85.7
central heating,	77.3	74.8	73.8	77.6	80.5	83.9	83.6	83.5	83.8	84.0
bathroom (shower)	70.3	66.0	67.3	75.0	79.2	60.0	59.2	59.5	59.9	60.3
gas	89.0	91.0	92.1	92.6	94.4	93.9	93.0	93.0	93.2	93.6
hot water supply system	59.9	55.2	55.0	66.6	72.5	61.8	62.2	62.2	62.6	62.0
Share of the total area equipped with:	**Rural settlements**									
running water	9.4	10.3	11.3	20.2	31.7	33.6	34.7	36.1	37.1	37.9
sewerage	4.1	4.7	6.1	19.6	31.6	33.3	34.5	35.7	36.6	37.3
central heating,	1.5	1.3	3.3	8.6	15.7	16.6	16.8	17.1	17.3	17.6
bathroom (shower)	4.1	4.4	4.2	11.2	18.4	19.7	20.5	21.3	21.7	22.2
gas	77.3	78.2	81.8	84.9	87.4	87.6	87.8	88.0	88.0	87.9
hot water supply system	0.6	0.4	0.8	6.4	12.2	13.1	14.0	14.5	14.8	15.3

Sources: Statistical Yearbooks of the RoM for the years 1993 (p. 318-320), 1994 (p. 312-315), 1999 (p. 214-218), 2003 (p. 183-189), 2006 (p. 149-154), 2007 (p. 141-146), 2008 (p. 143-148), 2009 (p. 137-142), 2010 (p. 137-142), 2014 (p. 137-141), 2015 (p. 135-139), 2016 (p. 180-187), 2017 (p. 134-137), 2021 (p. 131).

During 1990-2020, gasification of the country was successfully carried out. This has considerably reduced the consumption of solid and liquid fuels in favor of natural gas and, after 2010, in favor of renewable energy sources (especially biomass).

According to the information presented in Table 1-54, the length of natural gas networks in RoM during 1990-2020 increased about 13.2 times, including about 6.9 times in urban settlements and 21.6 times in rural settlements.

Table 1-54: Availability of natural gas for the population of the RoM, 1990-2020

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Length of gas pipelines– total, km	**1,873.4**	**4,305.8**	**7,470.9**	**12,465.0**	**20,203.5**	**22,860.0**	**22,981.0**	**23,226.0**	**23,757.0**	**24,208.0**	**24,695.0**
out of which:											
in urban settlements	1,072.0	2,262.5	3,675.0	4,983.7	6,272.8	6,907.0	6,990.0	7,074.0	7,172.0	7,284.0	7,422.0
in rural settlements	801.4	2,043.3	3,795.9	7,481.3	13,930.7	15,353.0	15,991.0	16,152.0	16,585.0	16,924.0	17,273.0
Number of flats (houses) gasified with piped gas, thousand	1,286.5	1,115.5	1,085.5	1,141.4	610.5	665.5	675.2	693.8	707.7	725.3	744.9
Of the total number of flats (houses) gasified with piped gas – flats supplied:											
in urban settlements	281.8	263.0	309.3	357.8	414.7	449.5	456.4	471.9	480.2	489.6	501.2
in rural settlements	21.5	38.9	71.5	123.7	195.8	216.0	218.8	221.9	227.5	235.7	243.7

Sources: Statistical Yearbooks of the RoM for the years 1993 (p. 318-320), 1994 (p. 312-315), 1999 (p. 214-218), 2003 (p. 183-189), 2006 (p. 149-154), 2007 (p. 141-146), 2008 (p. 143-148), 2009 (p. 137-142), 2010 (p. 137-142), 2014 (p. 137-141), 2015 (p. 135-139), 2016 (p. 180-187), 2017 (p. 134-137), 2021 (p. 133).

In the same context, during the period under review, the total number of apartments (houses) supplied with piped gas increased by about 1.8 times in urban settlements and about 11.3 times in rural settlements in the RoM.

1.5.5. Waste Sector

Current situation with the management of "Municipal Solid Waste" (MSW) in the RoM is similar to the situation in other developing countries; it is in the budding stage and includes two basic elements: municipal solid waste generating sources and the landfills.

The generating process of municipal solid waste is influenced by multiple factors, the most relevant being the population income, consumer behavior, the use of new packed products, as well as the demographic evolution. The recent increase in the wellbeing of the population and the evolution of the urbanization process resulted in an increased waste generation rate per capita, varying, according to the World Bank's studies, between 0.3 and 0.4 kg/per capita/day in rural areas and around 0.9 kg/per capita/per day in urban areas. These data were taking into consideration during the development of the Waste Management Strategy for 2013-2027.

Food consumption currently generates more and more waste. The introduction of new packages, plastic in particular, produces a significant negative impact on the environment. The polyethylene terephthalate (PET) packaging has replaced in the last years the glass packaging; while the polyethylene (PE) sacks, bags or boxes have replaced paper packaging, thus influencing the amount and composition of generated waste.

The increasing number of markets, shops and supermarkets, along with an increase in welfare, respectively in purchasing power of packed products led to a greater capacity to generate waste, in particular in urban areas.

Waste generation indicators were revised in the RoM during the completing process of the feasibility studies for the development of integrated waste management systems at regional level, and the following values were proposed for rural areas: 0.5-0.7 kg/ per capita/day, respectively 0.9 kg/per capita/day for small urban settlements and district centers, and between 1.3-1.5 kg/ per capita/day for Balti and Chisinau municipalities. It should be mentioned that these calculations use AD on waste disposed provided by waste collection services.

Currently, the most used method of treating waste is waste disposal on sites, which often is a major source of soil pollution and groundwater contamination. In this context, sanitation and waste management services represent an important goal for local and governmental structures.

According to the "State Ecological Inspectorate Yearbook for 2020 – Environment Protection in the RoM", there are 1,136 SWDS with an area of 1,220.55 ha. Local public authorities organized SWDSs in virtually every settlement and currently the area of the SWDS that are exploited according to the decisions of the local councils covers 1,052.60 ha. Most often about ¾ do not comply with sanitary and environment protection requirements and, the total amount of solid wastes accumulated on these sites cannot be estimated. Currently, in most municipalities, the sanitation and separate collection of waste activities are organized at a satisfactory level. Thus, waste collection and disposal specialized services exist in municipalities, in all district centers, which work on a contract basis with individual waste generators. Thus, there are 187 waste collection and disposal specialized services (53 services in the urban sector and 134 services in the rural sector). Waste collection services are available for 296 rural settlements. In some district centers, such as Anenii Noi (5), Chisinau (3), Cimislia (13), Floresti (14), Otaci (3), Orhei (3), Rezina (3), Sangerei (3), Soldanesti (11), Telenesti (5), Ungheni (9), Nisporeni (2), the urban sanitation services provide waste collection services to the neighboring rural settlements.

About 90% of the municipal solid waste collected by the sanitation services was disposed of by landfilling, the selective collection being partially organized in Chisinau municipality and in some district centers.

Waste recycling and recovery rates are still very low. Many recyclable and useful materials are disposed together with non-recyclable ones, thus losing much of their useful potential (paper, glass, metals, plastics). Being mixed and chemically and biologically contaminated, their recovery is difficult.

Statistical records of the amount of waste historically accumulated in landfills are not kept, there are only visual estimates of environmental inspectors, who estimate the total amount of MSW accumulated in landfills at about 30-35 million tons.

In most district towns the dump sites are overfilled, the disposed waste layer being 10-15 m deep (ex., in Ungheni, Cahul, Ocnita, etc.), at some landfills the layer is circa 10-20 m deep (ex., in Briceni, Balti, Ialoveni, etc.) and even up to 25- 30 m deep (Cretoaia and Orhei). About 3/4 of district town's landfills are being used for circa 25-35 years at over 80 % of their capacity.

In recent years, there have been changes in waste management in Chisinau municipality. The landfill situated in Tintareni village, Anenii Noi district that served until recently Chisinau municipality became operational by the end of 1990 (de facto exploitation began in 1991); this landfill has an area of about 24.95 ha, of which net area represents 20.89 ha. According to the execution project, it was designed to store about 44 mil. m^3 of solid waste until the end of 2010. By 2011, when it's use stopped, only 19 mil. m^3 of solid waste were stored, which is less than half the capacity of the landfill.

Starting 2011 and until 2017, Chisinau municipality has deposited its waste near the waste transshipment station, located in Bubuieci village as a temporary solution. It became a serious environmental problem since waste was disposed on an undeveloped land, lacking environment protection measures such as sealing the foundation, collecting and treating leachate, deviation of rainwater etc. Since summer 2017, Chisinau municipality restarted using the Tintareni SWDS with prior negotiation of conditions for the recommissioning of the SWDS, including the solution of environmental protection problems with the local public authorities. In 2018-2019, measures were taken to recultivate and remedy the environmental pollution caused by the landfill situated near the waste transshipment station in Bubuieci commune. Also, in November 2020 the treatment plant for the leachate from the Țantareni landfill was put into operation, and the landfill protection dam was also built.

Between 1986 and 2016, several waste morphologic composition studies have been carried out in the RoM. Figure 1-11 illustrates the shares of biodegradable fractions in the waste stream in the RoM, indicating a decrease from circa 77.0 % in 1986, to circa 54.0 % in 2001 with a further increase to 72.4 per cent% in 2005 and a subsequent decrease to circa 59.0 per cent in 2016.

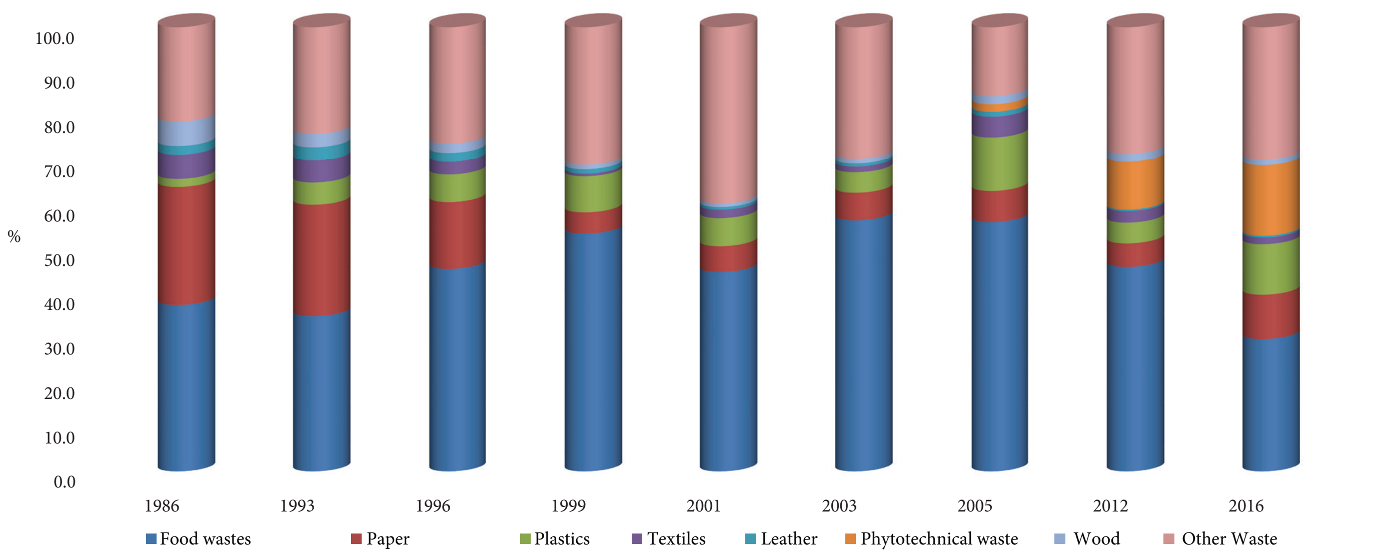


Figure 1-11: Dynamics of biodegradable waste in the MSW stream in the RoM.

The last study on the morphology of solid household waste generated in Chisinau, respectively Causeni and Straseni municipalities was conducted in 2016 by a technical team within the State Centre for Ecological Investigations, previously trained in similar waste management analysis, in fully cooperation with project experts from Climate Change Office and Prevention of Environment Pollution of the Ministry of Agriculture, Regional Development and Environment (Tab. 1-55).

Table 1-55: Annual average of the MSW morphological composition per country in 2016

Waste category and type		Morphological composition of municipal waste, %			
		Chisinau	Causeni	Straseni	Average
Recyclable waste	Paper, cardboard	6.5	8.0	15.8	10.1
	Glass	5.5	6.0	5.7	5.7
	Plastic products	7.0	14.2	12.8	11.3
	Metals and non-metals	1.5	1.8	1.5	1.6
Organic Waste	Food scraps	26.4	33.6	29.2	29.7
	Vegetation waste	19.5	11.8	16.3	15.9
	Textile	2.9	0.3	1.3	1.5
	Footwear	0.1	0.8	0.3	0.4
Bulky waste	Furniture	2.0	0.0	0.0	0.7
	Electrical and electronic equipment	0.3	0.5	0.0	0.3
Other waste	Wood	1.7	0.2	0.0	0.6
	Construction and demolition waste	26.6	22.8	17.0	22.1

In 2013, with the support of the GIZ Project "Modernization of local public services" and based on the Waste Management Strategy of the RoM for the years 2013-2027, approved by Government Decision no. 248 of 10.04.2013, waste management planning activities were initiated at the level of development regions. Thus, for example, in February 2014, the regional sectoral programs in the field of waste management for the Central and Northern Development Regions were approved.

With reference to the statistical sources on waste management, statistical forms F-1 "Toxic waste" and F-2 "Waste" and statistical form "Special Road vehicles" are noteworthy, while starting in 2003, the statistical form no. 2-gc "Sanitation of urban communities", approved by order of the Department of Statistics and Sociology of the RoM no. 83 of 01.08.2003, are used which show the volumes of stored municipal solid waste.

The analysis revealed that only municipal solid waste is transported through sanitation services, while waste from food industry, livestock husbandry and plant protection waste disposed of by storage are not included in the statistical form no. 2 – GC "Sanitation of urban communities", because such waste is discharged with own transport of the beneficiary. Under these conditions, activity data on the amount of waste from food industry, livestock and plant protection waste disposed of by storage were collected using the statistical form F-2 "Waste". Taking into account the trends in activity data collected through the statistical form F-2 "Waste" during the years 2007-2012, the decision was taken to calculate a coefficient for conversion of municipal waste into industrial waste, for the 1990-2019 years. The downward trend of the coefficient from 0.8 to 0.4 is justified by the economic decline of the country during the 1990-1999 period, as well as increase in the amount of municipal waste. In the current inventory cycle, the same approach was taken in collection of activity data. For municipal and industrial waste, the data on disposal of municipal solid waste were reported using the statistical form no. 2 – GC "Sanitation of urban communities".

Table 1-56 refers only to the urban landfills where sanitation services exist and provide activity data to the NBS of the RoM.

Table 1-56: Activity data on the amount of municipal solid waste and industrial waste disposed at MSW landfills in the RoM, 1960-2020

	Total	MSW			D_{ind}, kt	Share of MSWD,%			MCF Average
	MSW + D_{IND}, kt	Total kt	Inert material, kt	No inert material, kt		admin., MCF=1.0	neadmin, >5 m, MCF=0.8	neadmin, <5 m, MCF=0.4	
1960	626.59	375.96	109.01	266.95	250.64	0.0	10.0	90.0	23.6
1965	809.78	485.87	140.88	344.99	323.91	0.0	15.0	85.0	24.8
1970	1046.53	627.92	182.09	445.82	418.61	0.0	20.0	80.0	26.4
1975	1427.62	856.57	248.44	608.13	571.05	0.0	25.0	75.0	28.9
1980	1844.99	1014.75	294.26	720.48	830.25	0.0	35.0	65.0	31.2
1985	2093.98	1163.32	337.36	825.96	930.66	0.0	40.0	60.0	32.9
1990	2311.52	1359.72	394.31	965.41	951.80	0.0	45.0	55.0	34.6
1995	1070.97	632.19	183.34	448.85	438.78	31.1	30.0	38.9	26.8
2000	924.55	523.80	199.04	324.76	400.74	31.8	30.0	38.2	25.8
2005	1109.58	602.50	162.68	439.83	507.08	28.3	30.0	41.7	26.9
2010	1531.58	1075.06	290.27	784.80	456.52	39.0	35.0	26.0	30.5
2015	1826.90	1270.69	393.92	876.78	556.21	39.1	35.0	25.9	32.5
2016	1818.37	1263.09	517.87	884.16	555.28	39.5	35.0	25.5	32.5
2017	2090.53	1445.83	592.79	1012.08	644.71	35.8	35.0	29.2	34.3
2018	1895.71	1303.63	534.49	912.54	592.08	40.1	35.0	24.9	33.0
2019	1913.57	1304.11	534.69	977.53	609.46	39.6	35.0	25.4	33.8
2020	2075.53	1417.93	581.35	836,58	657.60	36.5	35.0	28.5	33.3

Historical activity data for the period 1960-1984 were deduced based on population number, the social-economic development conditions as well as waste generation trends. At the same time, the average value of the MCF was estimated considering the SWDS characteristics, such as managed or unmanaged SWDS and the deep of the disposed waste layer.

Regarding the trends of per capita waste generation data, since 2001, these trends show a steady growth, and in Chisinau municipality this level even exceeded the level reported in the early 90's of the twentieth century. So, if in 1990 year only 20% of the waste was generated in Chisinau municipality, in the last four or five years the share of Chisinau municipality accounted for about 30% of the total amount of waste disposed in landfills.

However, it should be recognized that the statistical information does not reflect the actual situation on municipal solid waste management. Thus, for example, the amounts of MSW generated in rural areas are not subject to statistical recording, as there are usually no sanitation services. Also, although waste processing enterprises operate in the RoM, the information on the amounts of recycled waste is not subject to mandatory statistical recording. Taking into account the trend of alignment of the Republic of Moldova to EU standards, the sector has to be substantially restructured. In this context, most landfills have to be recultivated, and their number drastically reduced until the commissioning of regional SWDS, planned in the Waste Management Strategy of the RoM for the years 2013-2027, approved by the Government Decision no. 248 of 10.04.2013.

In order to implement the Waste Management Strategy of the RoM for the years 2013-2027, according to Law no. 89/2020 of 11.06.2020, the Parliament of the RoM ratified the Financing Contract between the RoM and the European Investment Bank regarding the implementation of the Project Municipal Solid Waste in the Republic of Moldova with the first tranche amounting to 25 million euro for the Waste Management Region (WMR) 1 (Cahul, Cantemir, Taraclia and Vulcanesti districts and Ceadir-Lunga in ATU Gagauzia); WMR 5 (pilot project, Ungheni, Nisporeni, Calarasi districts); WMR 8 (Briceni, Ocnita, Edinet, Donduseni districts). The total value of the Municipal Solid Waste Project in the RoM is estimated at about 200 million euro, of which 100 million euro is to be lent by the European Investment Bank based on several financing contracts.

1.5.6. Water Supply and Sewerage Sector

Water supply systems. Works are carried out annually for the rehabilitation, modernization and extension of public water supply systems. In 2020, the total length of water supply pipelines and public water distribution networks expanded by about 500 km of newly built networks or 3.4% and reached 15.4 thousand km (Table 1-57). Compared to 2016, the total length of water supply pipelines and public water distribution networks increased by 15.8% and 49.9 km of water supply pipelines and public water distribution networks were also rebuilt. The largest share of water supply pipelines and newly built public networks was recorded in the settlements of the Central region – 209.7 km (41.9%) and the South region – 181.7 km (36.3%)[25].

[25] National Bureau of Statistics, Press release of 25.05.2021 "Activity of public water supply and sewerage systems in 2020" <https://statistica.gov.md/newsview.php?l=en&idc=168&id=6997>.

Table 1-57: Water supply systems in the RoM, 1996-2020

	1996	2000	2005	2010	2015	2016	2017	2018	2019	2020
Length of water supply pipelines and networks – total, thousand km	**7.1**	**6.6**	**6.8**	**8.5**	**12.8**	**13.4**	**14.0**	**14.4**	**14.9**	**15.4**
in urban settlements	3.9	3.9	4.0	4.5	4.7	4.7	4.6	4.7	4.8	4.8
in rural settlements	3.2	2.7	2.7	4.0	8.1	8.6	9.1	9.7	10.1	10.6
Water delivered to all consumers – total, mil. m^3	**203.9**	**98.7**	**67.1**	**75.0**	**79.5**	**84.8**	**86.4**	**89.0**	**91.3**	**93.9**
in urban settlements	182.5	93.3	62.3	67.9	63.4	67.1	68.6	70.4	71.6	71.5
in rural settlements	21.4	5.4	4.8	7.1	16.1	16.9	17.5	18.7	20.1	22.4
Of which, water delivered to the population, mil. m^3	**134.7**	**70.9**	**47.9**	**51.3**	**57.3**	**59.5**	**59.9**	**61.8**	**63.4**	**67.7**
in urban settlements	122.5	67.2	44.5	45.5	43.1	44.2	44.0	44.9	45.2	47.2
in rural settlements	12.2	3.7	3.4	5.8	14.2	15.3	15.9	16.9	18.2	20.5

Sources: Statistical Yearbooks of the RoM for the years 1993 (p. 318-320), 1994 (p. 312-315), 1999 (p. 214-218), 2003 (p. 183-189), 2006 (p. 149-154), 2007 (p. 141-146), 2008 (p. 143-148), 2009 (p. 137-142), 2010 (p. 137-142), 2014 (p. 137-141), 2015 (p. 135-139), 2016 (p. 180-187), 2017 (p. 134-137), 2021 (p. 132).

Captured and distributed water. In 2020, the amount of water collected was 134.6 mil. m^3, including water collected from surface sources – 85.1 mil. m^3 (63.2%), from underground sources – 35.9 mil. m^3 (26.7%) and water collected or received from other sources – 13.6 mil. m^3 (10.1%). At the same time, the amount of water distributed to consumers in 2020 was 93.9 million m^3, by 2.3 million m^3 more than in 2019. The difference of 40.6 thousand m^3, between the amount of water collected and the amount of water distributed to consumers, is explained by own consumption by the water collecting enterprises, but also losses of water during transportation. On average, 26.0 m^3 of water distributed per inhabitant per year. Of the total amount of distributed water, 67.7 million m^3 (or 72.0%) was provided to the population, 3.8% – to budgetary institutions, and 24.2% to other consumers, such as businesses. The amount of water distributed to population compared to the previous year increased by 6.8%.

Public sewerage systems[26]. In 2020, the total length of public sewerage networks was 3.0 thousand km or by 38.9 km more than in 2019. De facto, 98.8% of the total length of the public sewerage networks were operational. The level of functionality of the public sewerage networks is the highest in Chisinau municipality (100%), North region (98.4%), Center and South region (99.1% each), with a lower level in ATU Gagauzia (91.6%). In 2020, 31.7 km of public sewerage networks were built and 14.6 km were rebuilt. Most of the new public sewerage networks, 23.5 km (or 74.1% of the total length) were built in the Central region: in Calarasi district – 15.1 km, Dubasari district – 4.0 km, Hincesti district – 3.1 km, etc.

[26] Centralized sewerage system – set of technological installations, functional equipment and specific equipment through which the public sewerage service is performed. The public sewerage system comprises, in particular, the following components: public sewerage networks, pumping stations, sewage treatment plants, evacuation collectors to the emissary.

In 2020, disposal of wastewater from households and economic and social units was available in 52 municipalities and towns, but also in 72 villages. Public sewerage service was available to 8.1% of all settlements in the country, 94.5% of municipalities and towns and 4.9% of rural settlements. The largest share of settlements with access to the public sewerage system was in Chisinau municipality (71.4%), ATU Gagauzia (21.9%) and the Central region (8.2%), while the settlements in the Southern and Northern regions have the lowest access rates (5.8% and 4.5%, respectively). Thus, there is a considerable discrepancy between villages and cities, rural areas in the of Briceni, Drochia, Falesti, Glodeni, Ocnita, Soroca, Rezina, Soldanesti, Basarabeasca, Cantemir and Leova districts had no access at all to centralized sewerage.

Table 1-58: Sewerage systems in the RoM, 1996-2020

	1996	2000	2005	2010	2015	2016	2017	2018	2019	2020
Length of sewerage networks – total, thousand km	**2.7**	**2.6**	**2.6**	**2.6**	**2.8**	**2.8**	**2.8**	**2.9**	**2.9**	**3.0**
in urban settlements	1.9	2.0	2.1	2.2	2.2	2.3	2.3	2.4	2.4	2.4
in rural settlements	0.8	0.6	0.5	0.4	0.5	0.5	0.5	0.5	0.5	0.6
Wastewater treated at wastewater treatment plants – total, mil. m³	**174.7**	**114.2**	**76.4**	**70.1**	**67.6**	**66.9**	**69.7**	**69.5**	**70.4**	**66.9**
in urban settlements	169.3	113.1	75.4	69.6	65.4	65.6	68.0	67.4	68.1	64.3
in rural settlements	5.4	1.1	1.0	0.5	2.2	1.4	1.7	2.1	2.3	2.6

Sources: Statistical Yearbooks of the RoM for the years 1993 (p. 318-320), 1994 (p. 312-315), 1999 (p. 214-218), 2003 (p. 183-189), 2006 (p. 149-154), 2007 (p. 141-146), 2008 (p. 143-148), 2009 (p. 137-142), 2010 (p. 137-142), 2014 (p. 137-141), 2015 (p. 135-139), 2016 (p. 180-187), 2017 (p. 134-137), 2021 (p. 132).

Wastewater discharged and treated. In 2020, the total amount of discharged wastewater was 66.9 million m^3, by 3.5 million m^3 less than in 2019. About 71% of the total public sewerage systems were equipped with sewage treatment plants. Settlements in Glodeni and Rezina districts are not equipped with treatment plants. Of the 92 treatment plants, 81 were functional. The best situation in terms of the treatment plants functionality was in the North (95.5%), Chisinau and South (88.9%) regions. 64.9 million m^3 of wastewater was treated at the waste water treatment plants (97.0%). 96.1% of the total amount of treated wastewater was treated mechanically, 95.5% biologically, and 2.9% was discharged without treatment.

1.5.7. Forestry Sector

According to the national notion, the forest is an element of the geographical landscape, a functional unit of the biosphere, composed of the community of forest vegetation (in which trees and shrubs dominate), a living cover, animals and microorganisms, which in their biological development are interdependent and have impact on their own habitat. Lands covered with forest vegetation with an area of over 0.25 ha are considered to be forests. The minimum consistency of trees and shrubs for forest vegetation to be considered forest is an operational level of 30%. Such stability is attributed only to trees and shrubs that have the natural potential to reach a height of at least five meters at maturity.

The area covered by forests varied considerably over time, from 366.2 kha in 1848 to 222.0 kha in 1945, reaching 370.7 kha in 2020 or about 11.2% of the country's territory (Fig. 1-12).

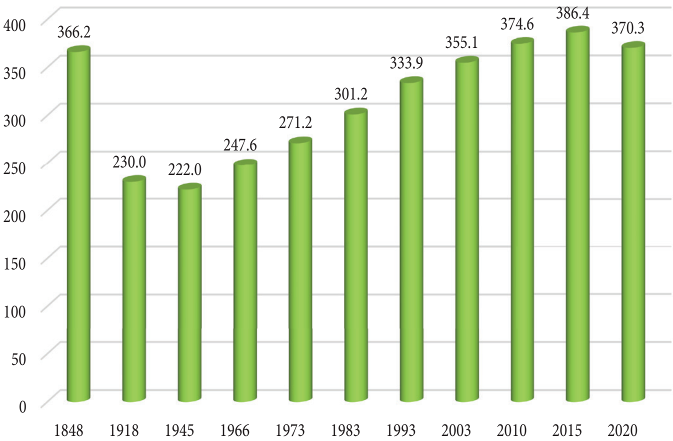


Figure 1-12: Evolution of areas covered with forests over the period 1848-2020, kha.

This indicator is well below the European average (around 30%). According to scientific research, the current forest area is obviously insufficient to meet the ecological and socio-economic needs of the RoM. In order to ensure a stable ecological balance and a more pronounced influence on the climatic and hydrological regime of the territory and to increase productivity of agricultural land, it is necessary that forests occupy at least 15% of the territory. Dispersion and fragmentation of forest resources, their uneven distribution in the country is a negative factor in exerting beneficial eco-protective influences on the environment, creating comfortable living conditions for the population and providing wood and non-wood products. The total volume of standing timber in the forests of the Republic of Moldova is about 45.4 million m^3, with an average of 118 m^3 per hectare. The current average growth of forests is 3.8 m^3/year/hectare, and the total average growth is about 1408.7 thousand m^3/year. The average production class is 3.9. The age structure of all forest species[27] is unbalanced, especially for those of low productivity.

In accordance with art. 14 of the Forest Code, the forests of the RoM are classified in functional group I, having exclusively environmental protection functions. In relation to their functions, the following five functional subgroups are distinguished: forests with water protection functions – 1.6%; forests for lands and soils protection – 6.7%; forests for protection against harmful climatic and industrial factors – 48.6%; forests with leisure functions – 29.5%; forests of scientific interest and for protection of genetic fund and eco-funds – 13.6%.

In spring-summer 2007, a catastrophic drought occurred affecting more than 80% of the country's territory. This phenomenon has also significantly damaged national forests on an area of about 19 thousand ha or 5.5% of the forested areas, especially in the south and central part of the country. The drought affected about 20 forest species, both native and allogeneic, including: pedunculate oak (Quercus robur L.), sessile oak (Quercus petraea (Matt) Liebl.), downy oak (Quercus pubescens Willd), ash (Fraxinus exelsior L.), field maple (Acer platanoides L.), mountain maple (Acer pseudoplatanus L.), acacia (Robinia pseudoacacia L.), birch

[27] Abbreviations of forestry species used in Table 1-59: Pedunculate oak – ST; Sessile oak – GO; Downy oak – STP; white poplar – PLA; White willow – SA; Field maple – PA; Common ash – FR; Linden (silver linden, large leaf linden and small leaved linden) – TE; Hornbeam – CA; Common walnut – NU; Field elm – ULC; Acacia – SC; Miscellaneous conifers – DR, Miscellaneous softwood species – DM; Miscellaneous hardwood species – DT; Miscellaneous exotic species – EX.

(Betula verrucosa Ehrh.), pine (Pinus sylvestris L.), black pine of Crimea (Pinus pallasiana (Lamb) Holmboe). The most heavily affected were acacias, which make up 71.3% (13 kha) of the total area of damaged forests. The 2007 drought had long-term consequences, with visible effects for over several years. In 2009, according to research data on damage to forests, the total area of degraded and dry stands with different severity of damage was 17.9 kha, in 2010 - 13.1 kha, in 2011 - 8.9 kha, and in 2012 - 9.0 kha.

The diversity of forest species growing in the forests of the RoM is represented in Table 1-59, distributed in 11 large categories (groups of species).

Table 1-59: Categories or groups of species and their structure in the RM

No.	Groups of species		Species included in categories	Abbreviation in Romanian	Abbreviation in English
	Scientific name	Name in English			
	Quercus spp.	Oaks	Pedunculate oak, sessile oak, fluffy oak, red oak	ST	QU
	Carpinus ssp.	Hornbeam	Hornbeam	CA	CA
	Fraxinus spp.	Ash	Ash, manna ash etc.	FR	FR
	Acer spp.	Sycamore	Field maple, jugastra, mountain maple	PA	AC
	Ulmus spp.	Elm	Field elm, European white elm, Turkistan elm, etc.	UL	UL
	Tilia spp.	Linden	Small leaved linden, silver linden, large leaf linden, etc.	TE	TI
	Salix spp.	Willow	White willow, osier, etc.	SA	SA
	Pinus spp.	Pine	Wild pine, black pine, spruce, fir, etc.	PI	PI
	Populus spp.	Poplar	White poplar, black poplar, Euro-American poplar	PL	PO
	Robinia spp.	Acacia	Acacia, maple, sophora	SC	RB
	Other species	Other species	Apple, pear, cherry, sour cherry, apricot, Tartar maple, willow, American maple, etc.	AS	OS

The estimation of biomass increases in forests was made by using the data on the evolution of the forest area in the RoM in the period 1990-2020 from a series of national/sectorial reports (Table 1-60). At the same time, starting with 2013, the data on distribution by forest species were taken from the forest management database owned by the Forest Research and Management Institute.

Table 1-60: Evolution of the land area covered by forests in the RoM, thousand ha, 1990-2020

Year	Total	Distribution of the land area covered by forests by group of species										
		QU	CA	FR	AC	UL	TI	SA	PI	PO	RB	OS
1990	325.4	140.6	9.4	16.6	2.9	3.1	2.9	1.9	6.9	5.7	124.0	11.4
1995	336.9	143.5	10.2	17.6	3.0	3.1	2.9	2.3	6.9	6.2	130.9	10.4
2000	344.4	145.3	12.1	19.2	3.0	3.1	2.9	2.5	6.9	6.5	135.3	7.6
2005	362.7	153.6	12.1	20.3	3.7	3.8	3.4	2.4	7.0	6.9	139.7	9.8
2010	374.5	155.4	12.1	21.0	4.1	3.9	3.5	2.4	6.9	7.1	148.0	10.1
2015	386.4	170.3	16.7	22.2	5.8	4.2	5.8	4.0	6.4	7.7	128.0	15.4
2016	386.5	170.3	16.7	22.2	5.8	4.2	5.8	4.0	6.4	7.7	128.1	15.4
2017	374.3	164.9	16.1	21.5	5.6	4.1	5.6	3.9	6.2	7.4	124.1	14.9
2018	378.7	166.8	16.3	21.7	5.7	4.1	5.7	3.9	6.3	7.5	125.5	15.1
2019	373.2	164.4	16.1	21.4	5.6	4.1	5.6	3.8	6.2	7.4	123.7	14.9
2020	370.7	163.3	16.0	21.3	5.6	4.1	5.6	3.8	6.2	7.4	122.9	14.8

Source: Galupa, D., Platon, I. et al. (2011), National Report on the State of the Forestry Fund of the Republic of Moldova (2011); Land Cadaster of the RoM for the period 1990-2020; Report of the CSOs on the update of the basic indicators of forests and other types of forest vegetation in the Republic of Moldova (2016), Land Cadaster of the RoM for the period 1990-2020; Matrix of land use and change in the RoM for the period 1970-2020.

Collection of final data for the entire record keeping period on distribution by species from the above listed sources was done by modelling the primary data from the reports / records of the Agency "Moldsilva". According to such data, of the total area of forest crops, planted over the reporting period, acacia covered about 80%, walnut (common, black) - 8%, oaks (pedunculated oak, sessile oak, etc.) - 3%, poplar and willow - 3%, other species - 6% (Tab. 1-61).

Table 1-61: Evolution of forest land area remaining as forest land in the RoM, kha, 1990-2020

Groups of species	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Quercus spp.	97.76	113.35	126.75	131.76	132.60	128.69	125.80	118.55	117.16	111.24	107.16
Carpinus spp.	6.54	8.08	10.52	10.38	10.32	12.59	12.31	11.60	11.46	10.88	10.49
Fraxinus spp.	11.54	13.88	16.77	17.41	17.92	16.75	16.37	15.43	15.25	14.48	13.94
Acer spp.	2.02	2.37	2.62	3.17	3.50	4.41	4.31	4.06	4.01	3.81	3.67
Ulmus spp.	2.16	2.45	2.70	3.26	3.33	3.19	3.12	2.94	2.90	2.76	2.66
Tilia spp.	2.02	2.29	2.53	2.92	2.99	4.39	4.29	4.04	4.00	3.79	3.66
Salix spp.	1.32	1.81	2.19	2.06	2.05	3.01	2.94	2.77	2.74	2.60	2.51
Pinus spp.	4.80	5.45	6.02	6.00	5.89	4.86	4.75	4.48	4.42	4.20	4.05
Populus spp.	3.96	4.91	5.69	5.92	6.06	5.79	5.66	5.33	5.27	5.01	4.82
Robinia spp.	86.22	103.40	117.97	119.81	126.29	96.73	94.65	89.19	88.15	83.69	80.63
Other species	7.93	8.22	6.63	8.41	8.62	11.65	11.39	10.73	10.61	10.07	9.69
Groves[28]	31.99	25.98	24.32	25.84	33.39	20.94	20.03	29.08	26.44	29.42	30.39
Total	**258.25**	**292.20**	**324.71**	**336.94**	**352.95**	**312.99**	**305.62**	**298.19**	**292.40**	**281.95**	**273.66**

Source: Land Cadaster of the RoM for the period 1990-2020; Matrix of land use and land use change in the RoM for the period 1970-2020.

[28] Includes forest lands with consistency below the average index of 0.3, which are part of forest management (parcels undergoing regeneration, forest crops up to the state of massif, forest nurseries, different types of forest plantations, etc.).

The volume of wood harvested in the forest cutting process includes working wood (without bark) and firewood (round wood for fire, branches and tips, bark, illegally harvested wood) traditionally used in the Republic of Moldova. Commercial wood is identified as "working wood" in national statistical reports. The biomass extension coefficient for firewood crops (BEF_R) applies only to the commercial volume of wood and it is represented only by bark. The data are provided by the Moldsilva Agency and the environmental protection authorities (Inspectorate for Environmental Protection; Environmental Agency) on authorized logging and illegal logging in forests and other wooded areas managed by the state forestry authorities and by the Inspectorate for Environmental Protection (Environmental Agency) for land managed by local public authorities. Data also come from data available in the Annual Statistical Reports on timber harvests in the forests of the Administrative-Territorial Units of the Left Bank of the Dniester (ATULBD) (Tab. 1-62)

Table 1-62: Evolution of timber harvests in forests, 1990-2020, thousand m^3

Assortment Categories	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Working wood	39.42	68.49	39.68	39.01	40.63	28.00	50.16	46.20	47.30	44.40	44.58
Firewood	184.80	531.42	393.34	394.79	429.89	607.32	567.42	589.71	596.71	561.29	546.79
Total	**224.22**	**599.91**	**433.02**	**433.80**	**470.52**	**635.32**	**617.57**	**635.91**	**644.01**	**605.69**	**591.36**

Source: Statistical records, reports of the Moldsilva Agency, the Inspectorate for Environmental Protection and the Environment Agency for 1990-2020; Galupa, D., Talmaci, I., Spitoc, L. (2005), Study for the Republic of Moldova "Ensuring the sustainability of forests and livelihoods by improving governance and control over illicit logging". Chisinau, Editorial Center of UASM,116 p.; Statistical Yearbooks of UATSN (2000-2020); Galupa, D., Ciobanu, A., Scobioală, M. et al. (2011), Illegal logging in the Republic of Moldova. Analytical study, Ch., "Moldsilva" Agency, 38 pp.

Since the statistical annual reports provide a national aggregate value of timber harvest, the breakdown by species is made on the basis of the Moldsilva Agency records, which are kept by categories (excluding working wood varieties): (i) "hardwoods": pedunculate oak, sessile oak, hornbeam, ash, maple, elm, acacia, honey locust, etc.; (ii) "softwoods": poplar, willow, linden, etc. The ratio between the estimated volume by species and the total volume harvested per year provides data of acceptable quality (the difference between estimated volume and harvested volume is 5-10% on the average). Further, distribution by species of commercial felling and firewood harvested over the period 1990-2020 is shown in Table 1-63 and Table 1-64.

Table 1-63: Evolution of commercial felling yield in forests, 1990-2020, thousand m^3

Groups of species	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Quercus spp.	7.16	9.59	7.77	7.63	7.16	6.62	12.15	8.56	8.76	8.22	10.39
Carpinus spp.	1.05	1.79	1.07	1.05	0.87	0.36	0.40	1.10	1.12	1.05	0.34
Fraxinus spp.	3.65	8.56	3.17	3.12	5.83	4.66	7.49	5.16	5.29	4.96	9.57
Acer spp.	0.31	0.58	0.28	0.28	0.20	0.06	0.14	0.30	0.31	0.29	0.12
Ulmus spp.	0.17	0.26	0.18	0.18	0.19	0.06	0.07	0.20	0.20	0.19	0.11
Tilia spp.	3.78	6.31	3.97	3.90	3.42	2.19	5.46	4.27	4.37	4.10	3.57
Salix spp.	0.26	0.48	0.24	0.24	0.14	0.08	0.37	0.31	0.32	0.30	0.83
Pinus spp.	0.28	0.44	0.30	0.30	1.19	0.68	0.49	0.67	0.68	0.64	0.61
Populus spp.	4.87	8.14	5.11	5.02	6.32	5.13	9.52	6.39	6.54	6.14	9.96
Robinia spp.	16.74	30.83	16.13	15.85	14.41	7.76	13.50	18.07	18.50	17.37	8.92
Other species	1.15	1.51	1.46	1.44	0.89	0.40	0.56	1.18	1.21	1.13	0.16
Total	**39.42**	**68.49**	**39.68**	**39.01**	**40.63**	**28.00**	**50.16**	**46.20**	**47.30**	**44.40**	**44.58**

Source: Statistical records, reports of the Moldsilva Agency, the Inspectorate for Environmental Protection and the Environmental Agency for the period 1990-2020.

Table 1-64: Evolution of forest firewood yields in the RoM, thousand m^3, 1990-2020

Groups of species	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Quercus spp.	30.10	63.60	53.71	56.64	65.69	100.82	103.58	84.55	85.56	80.48	104.37
Carpinus spp.	12.50	11.30	23.40	24.68	30.17	44.15	44.61	33.76	34.16	32.13	42.44
Fraxinus spp.	15.80	71.97	29.22	30.81	62.33	74.44	73.67	64.42	65.19	61.32	91.65
Acer spp.	8.70	5.30	16.16	17.04	23.79	31.63	30.81	21.72	21.97	20.67	26.41
Ulmus spp.	3.50	8.76	6.19	6.53	12.74	15.12	17.29	13.15	13.31	12.52	12.81
Tilia spp.	10.60	20.10	19.02	20.06	22.98	31.28	38.27	30.36	30.72	28.90	36.52
Salix spp.	3.40	10.64	6.13	6.47	5.42	12.82	11.92	10.33	10.45	9.83	9.64
Pinus spp.	0.40	5.63	0.72	0.76	4.78	5.59	4.91	5.33	5.39	5.07	3.85
Populus spp.	11.80	74.35	19.73	20.80	26.00	40.88	41.78	45.14	45.67	42.96	40.67
Robinia spp.	76.80	246.00	199.28	190.14	156.80	222.77	164.35	252.34	255.34	240.18	138.82
Other species	11.20	13.77	19.78	20.86	19.20	27.82	36.23	28.61	28.95	27.23	25.81
Total	**184.80**	**531.42**	**393.34**	**394.79**	**429.89**	**607.32**	**567.42**	**589.71**	**596.71**	**561.29**	**532.99**

Source: Statistical records, reports of Moldsilva Agency, IPM and AM for 1990-2020; Arcadie Capcelea, Aurel Lozan, Ion Lupu et al. (2011), The analytical study on wood consumption in the Republic of Moldova. "Moldsilva" Agency, Chisinau, 48 pp. Statistical Yearbooks of the TMR 2000-2021 r.

Data on the volume of firewood also include the volume of twigs, branches, etc., which are also intended as a priority for domestic heating and food preparation. Considering that most illicit logging is done in the nearby forests managed by the town halls, composed primarily of acacia, the respective volumes were attributed to the category "SC" (*Robinia spp.*).

The activity for conversion of land to forest land over the reporting period also included afforestation carried out within

Moldova Soil Conservation Project (MSCP) and Moldova Community Forestry Development Project (MCFDP). Both projects were implemented under the Clean Development Mechanism (CDM) of the Kyoto Protocol, have gone through all national and international validation and registration procedures. Within the MSCP and MCFDP project, several objectives were achieved: restoring degraded land, improving forest products supply to local population and enhancing GHG absorption. The total area planted within the MSCP and MCFDP projects was about 28.8 thousand ha (Tab. 1-65). In addition to harvested forest products, the net reduction of CO_2 emissions into the atmosphere will be about 4.8 million tons (MSCP - 3.6 million tons; MCFD - 1.2 million tons). The main participants in implementation of these projects are the Moldsilva Agency, the World Bank (WB), the Institute for Forest Research and Management, territorial forestry entities, municipalities that have allocated land for afforestation (over 500 municipalities).

Table 1-65: Annual afforestation implemented within the CDM projects in the RoM, ha

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
MSCP	4894.7	4736.6	4219.6	4029.6	891.2	71.9	475.8	152.8	211.3	276.7	98.8	116.5	45.7	68.8	20289.9
MCFDP	0.0	0.0	0.0	0.0	2009.6	2959.3	2190.4	1224.4	10.0	12.0	8.0	52.6.	2.5	0.0	8468.8
Total	**4894.7**	**4736.6**	**4219.6**	**4029.6**	**2900.8**	**3031.2**	**2666.2**	**1377.2**	**221.3**	**288.7**	**106.8**	**169.1**	**48.2**	**68.8**	**28758.7**

Source: 'Moldsilva' Agency (2009), PDD for PCSM, available at: https://cdm.unfccc.int/Projects/DB/SGS-UKL1216031019.22/view. 'Moldsilva' Agency (2012), PDD for PDSFCM, available at: https://cdm.unfccc.int/Projects/DB/TUEV-SUED1352989843.61. Moldsilva Agency (2004-2020), Annual Reports to the World Bank for the period 2004-2020 on emission reductions under SCMFM and SCMFDP. 'Moldsilva' Agency (2012-2013 and 2017-2020) Monitoring reports for PCSM and PDSFCM, available at: https://cdm.unfccc.int/Projects/DB/SGS-UKL1216031019.22/view and https://cdm.unfccc.int/Projects/DB/TUEV-SUED1352989843.61.

With reference to the forest areas affected by fires, the information is available in the Statistical Yearbooks of the RoM and ATULBD (Table 1-66). Most fires occurred in forest crops or young stands, especially in the vicinity of agricultural cropland.

Table 1-66: Forest areas affected by fires in the RoM, ha, 1990-2020

Categories	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
Right bank of the Dniester	120.10	1.40	0.00	5.50	20.00	338.20	119.00	173.00	79.00	169.68	402.00
Left bank of the Dniester	IE	0.53	0.90	2.90	26.90	18.00	59.8	73.80	5.90	37.40	17.20
Total	**120.10**	**1.93**	**0.90**	**8.40**	**46.90**	**356.20**	**178.8**	**246.80**	**84.90**	**204.08**	**419.20**

Source: Statistical Yearbooks of the RoM for 1994 (p. 38), 1999 (p. 20), 2007 (p. 22), 2011 (p. 22), 2014 (p. 22), 2015 (p. 22); National Bureau of Statistics, Statistics on Geography and Environment (Forest fires, on 1 November 2010-2021); Statistical Yearbooks of the TMR for 2000 (p. 88), 2002 r. (p. 91), 2007 (p. 81), 2009 r. (p. 80), 2011 r. (p. 82), 2014 r. (p. 78), 2015 r. (p. 88), 2016 r. (p. 88), 2017 r. (p. 91), 2020 r. (p. 92), 2021 r. (p. 90).

CHAPTER 2. NATIONAL GREENHOUSE GAS INVENTORY

CHAPTER 2. NATIONAL GREENHOUSE GAS INVENTORY

2.1. Introduction

2.1.1. Convention, Kyoto Protocol, Paris Agreement and Party's Commitments

The ultimate objective of the United Nations Framework Convention on Climate Change (UNFCCC) is aimed *"to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system"*. To-date 196 countries are Parties to the Convention. The Republic of Moldova signed the UNFCCC on June 12, 1992 and it was ratified by the Parliament on March 16, 1995.

Article 4, paragraph 1(a) and Article 12, paragraph 1(a) of the UNFCCC stipulate that each Party has to make available to the Conference of the Parties (COP) *"a national inventory of anthropogenic emissions by sources and removals by sinks, of all greenhouse gases uncontrolled by the Montreal Protocol, to the extent its capacities permit, using comparable methodologies to be agreed upon by the Conference of the Parties; also a general description of steps taken or envisaged by the Party to implement the Convention; and any other information that the Party considers relevant to the achievement of the objective of the Convention and suitable for inclusion in its communication, including, if feasible, relevant data for calculations of global emission trends"*.

The main mechanism for making this information available is national communications. COP 2 (Geneva, 1996) adopted the Guidelines on national communications for non-Annex I Parties (Decision 10/CP 2).

According to these Guidelines, over the 1998-2000 period the Republic of Moldova developed the First National Communication to the UNFCCC within the UNDP-GEF Project *"Enabling Moldova to prepare its First National Communication in response to its Commitments to UNFCCC"*, presented at COP 6, 2000.

The COP 8 (New Delhi, 2002) adopted a new Guideline on national communications for Non-Annex I Parties (Decision 17/CP 8). In conformity with these Guidelines, during 2005-2009, under the UNEP-GEF Project "Enabling Activities for the preparation of the Second National Communication under the UNFCCC", the RoM developed its NC2 under the UNFCCC, during 2010-2013 period – the Third National Communication (NC3), from 2014 to 2017, the Fourth National Communication (NC4), and in during 2019-2022, the Fifth National Communication of the Republic of Moldova to UNFCCC (NC5).

With reference to UNFCCC implementation instruments it should be noted that the COP 3 (Kyoto, 1997) adopted the Kyoto Protocol[29], which is an instrument setting binding targets for the Convention Parties, by committing industrialized countries and economies in transition (in total, 37 industrialized countries and the European Union) included in Annex I to Convention, to reduce total emissions of direct GHG by at least 5%, against levels of the reference year (1990). The RoM ratified the Kyoto Protocol on February 13, 2003. As a Non-Annex I Party, the RoM had no commitments to reduce GHG emissions under this Protocol.

The Bali Action Plan was adopted at COP 13 (Bali, 2007). At this Conference of the Parties, developing countries agreed for the first time to develop and implement National Appropriate Mitigation Actions (NAMAs) in the context of sustainable development, supported by technology transfer, adequate funding and capacity building actions.

At COP 15 (Copenhagen, 2009) a policy statement was adopted and proposed for implementation in support of limiting global warming by less than 2°C compared to the pre-industrial level, in the context of equity and sustainable development. This statement was named *the Copenhagen Accord* and it reaffirmed development issues in the context of climate change, including through implementation of Low Emissions Development Strategies (LEDS).

At COP 17 (Durban, 2011), the *Guidelines on preparation and reporting to the UNFCCC of Biennial Update Reports of countries not included in Annex I* were adopted (Decision 2/CP.17 and Annex III to this decision). In line with existing capacities at national level and the level of international support obtained for reporting, the countries not included in Annex I were to submit to the UNFCCC Secretariat by the end of December 2014, the first Biennial Update Report. The report was to be prepared every two years and reported to the UNFCCC Secretariat as a stand-alone document, or as a summary of parts of National Communications, if their reporting year coincided.

The Republic of Moldova had initiated the process of developing its First Biennial Update Report (BUR1) in July 2014, and the country managed to submit the report to the UNFCCC Secretariat on 5 April 2016. BUR1 was submitted to the UNFCCC Secretariat together with two technical annexes: National Inventory Report for 1990-2013, Sources of Greenhouse Gas Sources and Sinks in the Republic of Moldova (2015) and Report on the National GHG Inventory System in the Republic of Moldova (2015).

Regarding the non-Annex I Parties, the COP 17 in Durban approved (Decision 2/CP.17 and Annex IV) the Modalities and Guidelines for International Consultation and Analysis (ICA) consisting of two steps: (i) the technical analysis of BURs and (ii) a facilitative sharing of views among Parties on BURs content and the results of technical analysis. The process aims to enhance the transparency and accountability of information reported in BURs by non-Annex I Parties. The technical analysis is conducted by a team of technical experts (TTE) and is initiated within six months of BUR submission to the Secretariat.

[29] The Kyoto Protocol entered into force on February 16, 2005, 90 days after its ratification by the Russian Federation in November 2004, thus covering at least 55 Parties to the Convention, including Annex I countries, which encompass 55 % of total carbon dioxide emissions recorded in 1990.

As for the First Biennial Update Report of the RM under the UNFCCC, its technical analysis by the technical expert team took place between 19 and 23 of September 2016, with the summary report being published by the Secretariat on the UNFCCC web page on February 20, 2017[30]. The Facilitative Sharing of Views (FSV) among Parties on the BUR1 content and the results of technical analysis was carried out during the 3rd FSV workshop, organized by the UNFCCC Secretariat on 15th of May 2017 in Bonn, Germany[31].

At COP 18 (Doha, 2012), *the Doha Amendment to the Kyoto Protocol* was approved. The amendment includes new commitments for countries included in Annex I to the Kyoto Protocol during the second commitment period (1 January 2013-31 December 2020); a revised list of greenhouse gases to be reported by Annex I countries during the second commitment period; and a series of amendments to several articles of the Kyoto Protocol that specifically address certain issues related to the first commitment period and which were to be revised to remain valid during the second commitment period as well. By 21 December 2012, the Doha Amendment to the Kyoto Protocol was forwarded to all signatory parties to the UNFCCC by the Secretary-General of the United Nations, acting as depositary, in accordance with Articles 20 and 21 of the Protocol. According to the Doha Amendment to the Kyoto Protocol, industrially developed countries are to reduce their greenhouse gas emissions by at least 18% in the second commitment period compared to the base year (1990). As of 28 October 2020[32], a number of 147 countries have ratified the Doha Amendment to the Kyoto Protocol, the vast majority of which are, however, non-Annex I countries to the UNFCCC and the Kyoto Protocol. The Doha Amendment entered into force on 31 December 2020.

At COP 19 (Warsaw, 2013), the Parties agreed to communicate their intended nationally determined contributions (INDC) (Decision 1/CP.19), in order to include them in the new Climate Agreement to be considered and adopted by the COP 21 in 2015, in Paris. The new climate agreement establishes a new commitment period (1st of January 2021 – 31st of December 2030) for reducing the GHG emissions. Also, COP 19 adopted *General guidelines for domestic measurement, reporting and verification of domestically supported nationally appropriate mitigation actions by developing country Parties* (Decision 21/CP.19). This document provides a solid foundation for the new 2015 Paris Climate Agreement.

The COP 20 took place in Lima (2014). The Parties agreed over *Lima Call for Climate Action* and were repeatedly invited to communicate to the Secretariat their intended nationally determined contributions, in order to facilitate clarity, transparency and understanding. The INDC may include, as appropriate, inter alia: (i) quantifiable information on the reference point; (ii) time frames and/or periods for implementation; (iii) scope and coverage; (iv) planning processes; (v) assumptions and methodological approaches including those for estimating and accounting for anthropogenic greenhouse gas emissions and, as appropriate, removals; and (vi) how the Party considers that its national circumstances, and how it contributes towards achieving the objective of the Convention as set out in its Article 2. According to *Lima Call for Climate Action*, countries were invited to communicate their intended nationally determined contributions by March 31, 2015, the deadline for the presentation being September 30, 2015. The request to the Secretariat was to prepare by 1st of November 2015 a synthesis report on the aggregate effect of the INDC communicated by Parties.

The Republic of Moldova was fully committed to the UNFCCC negotiation process towards adopting at COP 21 the Paris Agreement – a document with legal force under the Convention, applicable to all Parties, in line with keeping global warming below 2°C by 2100 compared to the preindustrial era. The Paris Agreement was signed by the Prime Minister of the Republic of Moldova in New York on September 21, 2016, and was subsequently ratified by the Parliament through Law No. 78 from 04.05.2017 for the ratification of the Paris Agreement (Official Monitor No. 162-170 from 26.05.2017)[33].

At 25th of September 2015, the Republic of Moldova communicated its Intended Nationally Determined Contribution (INDC)[34] and the accompanying information to facilitate clarity, transparency, and understanding, with reference to decisions 1/CP.19 and 1/CP.20.

Accordingly, the Republic of Moldova has committed to reach by 2030 the unconditional target of reducing GHG emissions by 64-67% as compared to the level recorded in the reference year (1990), and to make every effort to reduce GHG emissions by 67% as compared to 1990 levels. The reduction commitment could be conditionally increased to around 78%, in line with this global agreement, which addresses important issues such as provision of low-cost financial resources, technology transfer and technical cooperation, access to all of these to an extent appropriate to the challenges of global climate change. GHG emission reduction targets have been set in an emissions budget, covering the period from 1 January 2021 to 31 December 2030. GHG emission reduction targets, set in the intended nationally determined contribution of the Republic of Moldova were subsequently officially approved at national level by Government Decision no. 1470 of 30.12.2016 on approval of the Low Emission Development Strategy of the Republic of Moldova until 2030 and of the Action Plan for its implementation (Official Gazette no. 85-91 of 24.03.2017)[35].

30 <http://unfccc.int/files/national_reports/non-annex_i_parties/biennial_update_reports/submitted_burs/application/pdf/mda.pdf>.

31 The conclusions of the 3rd FSV workshop regarding the BUR1 of the RM under the UNFCCC and the results of the technical analysis are available on the web page: <http://unfccc.int/files/national_reports/non-annex_i_parties/ica/facilitative_sharing_of_views/application/pdf/20170529_mda_v04.pdf>; RM's presentation at the 3rd FSV workshop is available on: <http://unfccc.int/files/national_reports/non-annex_i_parties/ica/facilitative_sharing_of_views/application/pdf/moldova_fsv_workshop_presentation_15.05.2017.pdf>, while the video recording of the presentation and the interventions from the Parties are available on: <https://www.youtube.com/playlist?list=PL-m2oy1bnLzpmdRpG2pTBzUeOH3qrXlZt>

32 <https://unfccc.int/process/the-kyoto-protocol/the-doha-amendment>

33 <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=370323>

34 <http://www4.unfccc.int/submissions/INDC/Published%20Documents/Republic%20of%20Moldova/1/INDC_Republic_of_Moldova_25.09.2015.pdf>.

35 <https://www.legis.md/cautare/getResults?doc_id=114408&lang=ro>

On 4 March 2020, the Republic of Moldova had submitted to the UNFCCC Secretariat the updated version of the nationally determined contribution[36]. Accordingly, the Republic of Moldova is committed to achieving more ambitious GHG reduction targets by 2030. Thus, the unconditional target is to increase GHG reduction from 64-67% to 70% as compared to the level recorded in the reference year (1990), while the conditional target is to increase accordingly from 78% to about 88% as compared to the level recorded in 1990. The new GHG emission reduction targets are to be introduced in the Low Emission Development Programme of the Republic of Moldova by 2030 and the Action Plan for its implementation; to be considered and approved by the Government during 2023 year.

In respect to the BUR2 of the Republic of Moldova to the UNFCCC (2019), its technical analysis by the technical expert team took place between 27 and 31 May 2019, with the summary report being published by the Secretariat on the UNFCCC web page on 28 October 2019[37]. The FSV among Parties on the content of the BUR2 of the Republic of Moldova and the results of the technical analysis was carried out during the during the 9th FSV workshop, organized online by the UNFCCC Secretariat from 24 to 27 November 2020[38].

The Third Biennial Update Report of the RoM to the UNFCCC was presented to the UNFCCC Secretariat on December 21, 2021, together with 2 technical annexes: the National Inventory Report: 1990-2019, Greenhouse Gas Emissions by Sources and Sinks in the RoM and the Report on the National Greenhouse Gas Inventory System of the Republic of Moldova – 2021[39]. The technical evaluation of the Third Biennial Update Report of the RoM to the UNFCCC by the technical team of experts took place between 20 and 24 June 2022, with the summary report being published by the Secretariat on the UNFCCC web page on 8 November 2022[40].

[36] <https://www4.unfccc.int/sites/NDCStaging/Pages/All.aspx>
[37] <https://unfccc.int/sites/default/files/resource/tasr2_2019_MDA.pdf>, <https://unfccc.int/ICA-cycle2>
[38] Conclusions of the 9th Seminar for FSV on Second Biennial Update Report of the Republic of Moldova to UNFCCC and outcomes of the technical review are available on the website: <https://unfccc.int/ICA-cycle2>, including the presentation of the Republic of Moldova to the 9th FSV seminar and the video record and interventions from Parties.
[39] <https://unfccc.int/BURs>.
[40] <https://unfccc.int/sites/default/files/resource/tasr2022_MDA.pdf>, <https://unfccc.int/ICA-cycle3>.

2.1.2. Greenhouse Gases

The most important greenhouse gas in the atmosphere is water vapors (H_2O), responsible for about 2/3 of the total greenhouse effect. The water content in the atmosphere is not directly influenced by anthropogenic activities; it is rather determined by the natural water cycle, expressed more simply as the difference between evaporation and precipitation.

Carbon dioxide (CO_2) leads to the greenhouse effect in proportion of 30%, and methane (CH_4), nitrogen oxide (N_2O) and ozone (O_3), taken together - in proportion of 3%. The group of artificial (man-made) substances: chlorofluorocarbons (CFCs) and their substitutes, hydrofluorocarbons (HCFCs, HFCs) and other substances such as perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) are also attributed to direct greenhouse gases. There are other photochemically active gases, such as carbon monoxide (CO), nitrogen oxides (NO_x) and non-methane volatile organic compounds (NMVOCs) (including substances such as propane, butane and ethane), which are not attributed to direct greenhouse gases, but indirectly contribute to the greenhouse effect. These gases are considered to be precursors of ozone in the troposphere, thus influencing the formation and disintegration of ozone in the atmosphere in the presence of sunlight (ultraviolet radiation).

Although GHGs are considered natural components of air, their presence in the atmosphere is strongly affected by anthropogenic activities. Increase of the concentration of GHGs in the atmosphere (caused by anthropogenic emissions) leads to strengthening of the greenhouse effect, thus leading to additional warming of the atmosphere. The concentration of GHGs in the atmosphere is determined by the difference between GHG emissions and removals. It has been established with certainty that atmospheric concentrations of GHGs have increased significantly as compared to the pre-industrial period. Thus, from 1750 until the end of 2021, the concentration of CO_2 increased by about 148.4%, the concentration of CH_4 – by 264.2%, and the concentration of N_2O by about[41] 123.9% (Table 2-1). These trends are largely attributable to human activities – in particular fossil fuels combustion and continuous deforestation of forest lands.

[41] <https://www.esrl.noaa.gov/gmd/ccgg/trends/>.

Table 2-1: Tropospheric concentration (northern hemisphere), rate of change in concentration and lifespan of direct greenhouse gases in the atmosphere

Fluorinated greenhouse gases	Pre-industrial tropospheric concentration (1850-1900)	Tropospheric concentration at the end of 2021	Global warming potential over 100 years horizon (IPCC, 2014)	Tropospheric lifetime (years)
Carbon dioxide (CO_2)	280 ppm	415.7 ppm	1	50-200
Methane (CH_4)	722 ppb	1907.2 ppb	28	12.4
Nitrous oxide (N_2O)	270 ppb	334.6 ppb	265	121

Notes: ppm – parts per million concentration by volume; ppb – parts per billion concentration by volume.

In 2020, globally, the amount of annual carbon dioxide emissions from fossil fuels combustion was about 31.5 Gigatons (Gt)[42], 1.9 Gt less than in 2019. The most important sources of carbon dioxide emissions are fossil fuel combustion, deforestation and industrial processes (e.g. cement production). The carbon dioxide lifetime in atmosphere varies between 100 and 300 years. It can be removed from atmosphere through a complex set of natural sinks mechanisms. Also, it is considered that circa 40 per cent of the emitted carbon dioxide can be absorbed by oceans. Photosynthesis, in particular in sea vegetation and plankton is

[42] <https://library.wmo.int/index.php?lvl=notice_display&id=21975#.Yh0M85b8uUk>.

an important, though transitory, mechanism of CO_2 emissions removal, because after the perishing of plants, carbon dioxide is again emitted into the atmosphere.

Concentration of methane in atmosphere is affected in proportion of circa 60 per cent by anthropogenic activities such as rice cultivation, animal breeding (enteric fermentation and manure management), coal, oil and natural gas extraction, transportation and distribution of natural gases, solid waste disposal on lands, biomass combustion, etc. The breakdown of methane in the atmosphere takes place through chemical reactions (by means of OH radicals). The lifetime of CH_4 in atmosphere is circa 12.4 years. The annual accumulation rate of CH_4 in atmosphere is about 29-30 Mt[43].

It has been established that circa 40 per cent of the atmospheric N_2O is of anthropogenic origin[44], coming from use of synthetic nitrogen fertilizer, soil cultivation, animal breeding (manure management), wastewater handling, adipic acid and nitric acid production, fossil fuels combustion, waste incineration and biomass burning. The other 60 per cent of the atmospheric N_2O comes from the soil and denitrification of water in anaerobic conditions. N_2O breaks down photochemically in atmosphere. The annual global emissions of N_2O from anthropogenic activities are about 7.3 Mt[45].

HFCs (hydrofluorocarbons), PFCs (perfluorocarbons) and SF_6 (sulphur hexafluoride) are anthropogenic greenhouse gases. HFCs are mainly used to replace ozone-depleting chemicals, but are also emitted in the production of HCFC-22. PFCs and SF_6 are emitted in various industrial processes, including production of aluminium and magnesium, production of semiconductors, transmission and distribution of electricity, etc. All these gases have a long lifespan in the atmosphere and have a considerable capacity to absorb infrared radiation, so that in the future they could have a significant impact on global warming.

2.1.3. Global Warming Potential

The effect of the radiant force of a gas in the atmosphere is a reflection of its ability to cause the atmosphere to heat up. We refer to the direct radiant force when the gas is a GHG and to the indirect radiant force when the chemical transformation of the original gas produces a gas or gases that are GHGs, or when a gas influences the atmospheric lifespan of other gases.

The concept of "Global Warming Potential" (GWP) was developed to allow scientists and politicians to compare the capacity of each GHG to capture heat in the atmosphere. By definition, GWP is the change in radiant force overtime due to the emission of one kg of gas expressed as radiant force from the emission of one kg of CO_2. In other words, GWP is a relative measure of the heating effect that a radiant gas (GHG) can have on the surface of the troposphere. The GWP takes into account both the instantaneous radiant force due to the cumulative increase in the concentration of greenhouse gases in the atmosphere and the lifespan of such gases in the atmosphere. In this report the term "GWP for a period of 100 years" is used, as recommended by the IPCC in the Fourth Assessment Report (IPCC, 2007) for use in the inventory of GHG emissions within the UNFCCC (Tab. 2-2).

[43] <https://library.wmo.int/index.php?lvl=notice_display&id=21795#.YIKYFaFDOUk>.
[44] <https://www.wmo.int/pages/mediacentre/press_releases/pr_1002_en.html>, <https://library.wmo.int/index.php?lvl=notice_display&id=21795#.YIKYFaFDOUk>.
[45] <https://library.wmo.int/index.php?lvl=notice_display&id=21795#.YIKYFaFDOUk>.

Table 2-2: GWP for a period of 100 years and atmospheric lifespan of direct greenhouse gases[46]

GHG	Chemical formula	Lifetime according to AR5	SAR	TAR	AR4	AR5	AR6
Carbon dioxide	CO_2	50-200	1	1	1	1	1
Methane	CH_4	12.4	21	23	25	28	27.9
Nitrous oxide	N_2O	121	310	296	298	265	273
Nitrogen trifluoride	NF_3	500	NA	10800	17200	21000	17400
Sulphur hexafluoride	SF_6	3200	23900	22200	3940	23500	25200
Hydrofluorocarbons (HFCs)							
HFC-23	CHF_3	222	11700	12000	14800	12980	14600
HFC-32	CH_2F_3	5.2	650	550	675	677	771
HFC-125	C_2HF_5	28.2	2800	3400	3500	3170	3740
HFC-134a	$C_2H_2F_2$ (CH_2FCF_3)	13.40	1300	1300	1430	1300	1530
HFC-143a	$C_2H_3F_3$ (CF_3CH_3)	47.1	3800	4300	4173	4800	5810
HFC-152a	C_2H4F_2 (CH_3CHF_2)	1.5	140	120	124	138	164
HFC-227ea	CF_3CHFCF_3	38.9	2900	3500	3220	3350	3600
HFC-236fa	$CF_3CH_2CF_3$	242	6300	9360	9810	8060	8690
HFC-245fa	$CHF_2CH_2CF_3$	7.7	NA	950	1030	858	962
HFC-365mfc	$CH_3CF_2CH_2CF_3$	8.7	NA	890	794	804	914
HFC-43-10mee	$CF_3CHFCHFCF_2CF_3$	16.1	1300	1500	1640	1650	1600
Perfluorocarbons (PFCs)							
Perfluoromethane	CF_4	50000	6500	5700	8690	6630	7380
Perfluoroethane	C_2F_6	10000	9200	11900	12200	11100	12400
Perfluoropropane	C_3F_8	2600	7000	8600	9050	8900	9290
Perfluorobutane	C_4F_{10}	2600	7000	8600	8860	9200	1000
Perfluoropentane	C_5F_{12}	4100	7500	8900	9160	8550	9220
Perfluorohexane	C_6F_{14}	3100	7,400	9000	9300	7910	8620

Sources: SAR – IPCC Evaluation Report 2 (1996), TAR – IPCC Evaluation Report 3 (2001), AR4 – IPCC Evaluation Report 4 (2007), AR5 – IPCC Evaluation Report 5 (2014) and AR6 – IPCC Evaluation Report 6 (2021).

[46] <http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2014-Annex-6-Additional-Information.pdf>.

2.1.4. Republic of Moldova's Relative Contribution to Global Warming

The historic contribution of the RoM to greenhouse gas emissions is low. In 2020, the RoM emissions amounted to 13.66 Mt CO_2 equivalent (Table 2-3), which is less than 0.03% of total global emissions. Total and net emissions per capita were practically two times lower than the overall average (4.4 t CO_2 equivalent per capita compared to 6.4 t CO_2 equivalent per capita). Also, the RoM has a low level of historical emissions since 1990, below 0.05% of global emissions (without LULUCF). For example, during 1990-2019, the total national GHG emissions (without the contribution of the LULUCF sector) decreased in the RoM by about 69.6%, which is much more than in most industrialized countries and economies in transition included in Annex I to Convention (Fig. 2-1).

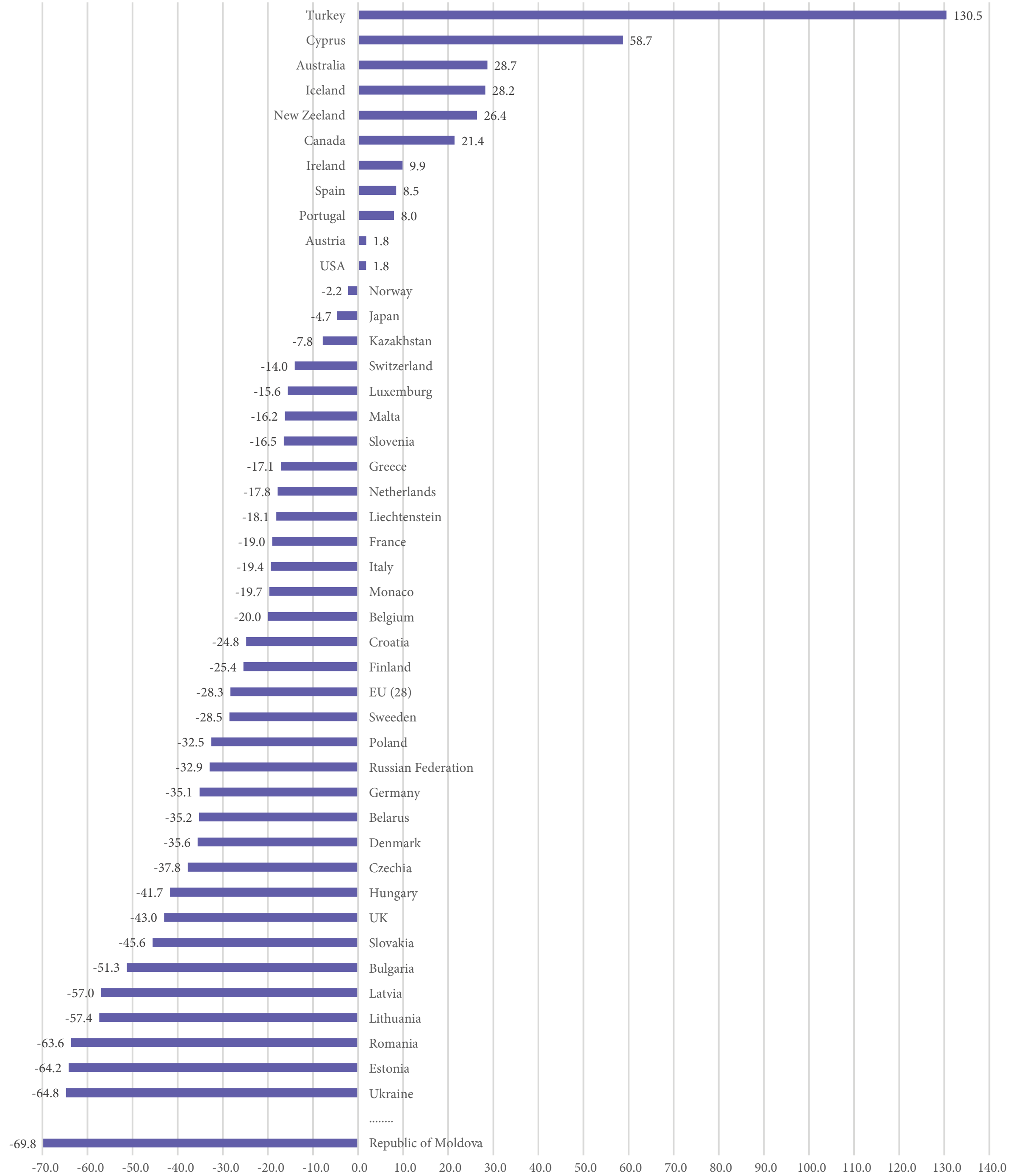


Figure 2-1: Total GHG Emissions (without LULUCF) of the RoM and in Annex I Parties to the Convention in 2019[47] (% compared to 1990).

[47] <https://di.unfccc.int/time_series>

Table 2-3: Republic of Moldova's Total Direct GHG Emissions during the 1990-2020 period

SOURCES OF GREENHOUSE GAS EMISSIONS	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
	CO_2 equivalent (kt)										
1. Energy	**36,992.9272**	**12,391.3486**	**6,940.8801**	**8,836.4882**	**9,496.4226**	**9,119.6469**	**9,256.6167**	**8,924.9057**	**9,406.8597**	**9,401.4161**	**9,549.8909**
A. Fuel Combustion	36,081.5198	11,652.5180	6,276.3671	7,987.6700	8,833.9136	8,476.3861	8,568.0854	8,204.5753	8,727.4133	8,929.7241	9,308.0809
1. Energy Industries	21,364.2413	7,192.4074	3,159.3286	3,233.2579	4,052.9708	3,688.0902	3,648.5771	2,999.4997	3,258.6362	3,127.5077	3,637.9713
2. Manufacturing Industries and Construction	1,921.7642	386.9966	521.6280	577.3845	517.2615	518.3827	489.6135	502.7968	595.6181	720.0202	803.6492
3. Transport	4,838.6388	1,660.3423	1,005.6576	1,866.9919	2,188.7989	2,307.8259	2,481.6061	2,463.4491	2,581.8939	2,665.4305	2,511.9066
4. Other Sectors	7,841.3054	2,286.2222	1,552.9485	2,283.7523	2,047.3623	1,939.2152	1,925.2983	2,175.9589	2,267.8044	2,393.7886	2,332.0606
5. Other	115.5701	126.5495	36.8044	26.2833	27.5201	22.8721	22.9905	22.7351	23.4607	22.9770	22.4933
B. Fugitive Emissions from Fuels	911.4074	738.8306	664.5129	848.8182	662.5090	643.2608	688.5313	720.3305	679.4463	471.6920	241.8100
1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Oil and Natural Gas	911.4074	738.8306	664.5129	848.8182	662.5090	643.2608	688.5313	720.3305	679.4463	471.6920	241.8100
C. CO_2 Transport and Storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2. Industrial Processes and Product Use	**1,605.2421**	**456.6563**	**315.7771**	**573.0521**	**561.2070**	**765.1264**	**746.9409**	**779.7366**	**964.6613**	**991.2229**	**998.8320**
A. Mineral Industry	1,338.9600	351.6610	240.7803	439.1892	405.3915	504.2041	488.0182	475.6060	591.9454	593.6612	536.8930
B. Chemical Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal Industry	28.5023	26.2369	36.2689	41.9358	9.6985	17.2792	5.2203	18.8842	20.2133	15.7926	18.6972
D. Non-energy Products From Fuels and Solvent Use	234.3591	76.5607	32.6395	68.1910	66.2398	84.5691	84.8044	97.0212	151.1809	143.6217	195.3645
E. Electronic Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Product Use as Substitutes for ODS	NO	1.0298	5.1199	22.5106	78.1507	157.0394	166.7099	185.8945	198.8877	235.5397	245.3168
G. Other Product Manufacture and Use	3.4207	1.1679	0.9685	1.2255	1.7265	2.0346	2.1882	2.3306	2.4340	2.6076	2.5605
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Agriculture	**5,076.7326**	**3,173.3679**	**2,136.1941**	**2,063.2167**	**1,803.7474**	**1,701.2089**	**1,826.6518**	**1,881.7490**	**1,837.3116**	**1,798.7248**	**1,546.4355**
A. Enteric Fermentation	2,189.4276	1,618.0865	1,085.7826	924.0273	708.1752	629.2090	622.0031	578.3838	516.4851	440.9463	389.0391
B. Manure Management	1,394.8097	743.9702	418.9254	420.8418	379.5922	318.7613	321.2590	306.5829	269.6956	246.2774	210.7848
C. Rice Cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural Soils	1,491.9134	811.2505	631.0464	718.1737	714.2357	741.9984	871.1149	970.5743	1,007.7685	1,071.8704	903.9960
E. Prescribed Burning of Savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field Burning of Agricultural Residues	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
G. Liming	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
H. Urea Application	0.5820	0.0607	0.4397	0.1739	1.7443	11.2402	12.2747	26.2081	43.3624	39.6306	42.6156
I. Other Carbon-containing Fertilizers	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. LULUCF	**-1,657.4590**	**-2,031.1108**	**-2,123.3389**	**-1,667.5188**	**-1,228.1669**	**-1,181.9309**	**-937.4818**	**-993.3179**	**-841.0512**	**13.3072**	**-3.5354**
A. Forest Land	-2,563.0889	-2,045.0615	-2,307.4358	-2,409.4945	-2,484.0285	-2,158.4241	-2,115.2503	-2,015.7307	-1,969.1152	-1,950.0547	-1,886.1227
B. Cropland	2,382.2907	1,319.6504	1,223.9203	1,271.9854	1,271.8515	1,112.6784	1,112.0573	1,089.6553	1,206.4257	1,507.4508	1,630.0069
C. Grassland	-1,205.6938	-1,601.1004	-1,291.9495	-1,058.1239	-691.9874	-418.4569	-402.3693	-384.0392	-440.1513	-293.2923	-223.1528
D. Wetlands	-555.3798	-469.4389	-328.4245	-187.4101	-46.3958	-82.7917	-82.7917	-82.8162	-82.8253	-82.8099	-82.8099
E. Settlements	254.2294	357.7389	396.2187	340.1329	303.7123	229.0089	198.3556	248.8550	186.9048	277.7857	194.7102
F. Other Land	152.3638	401.1281	178.5246	416.5012	441.4824	86.8192	351.6349	218.2055	321.2138	611.7881	329.1445
G. Harvested Wood Products	-122.1804	5.9727	5.8073	-41.1098	-22.8014	49.2353	0.8816	-67.4476	-63.5037	-57.5604	34.6883
H. Other	NE	NO	NE	NE	NE	NE	NE	NE	NE	NE	NE
5. Waste	**1,573.5058**	**1,637.3163**	**1,573.8873**	**1,478.4941**	**1,501.4555**	**1,423.2385**	**1,449.8546**	**1,539.4310**	**1,555.2113**	**1,560.4663**	**1,566.5908**

SOURCES OF GREENHOUSE GAS EMISSIONS	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
	CO_2 equivalent (kt)										
A. Solid Waste Disposal	1,105.9965	1,256.0725	1,207.0370	1,093.6111	1,160.6703	1,104.4973	1,131.9612	1,220.9072	1,232.4760	1,239.2098	1,246.1821
B. Biological Treatment of Solid Waste	2.3322	1.0843	0.8984	1.0334	1.8439	2.1795	2.1665	2.4799	2.2360	2.2366	2.4322
C. Incineration and Open Burning of Waste	24.2621	24.4574	24.2867	23.4100	20.8019	21.5422	21.0986	23.7193	23.1496	22.5896	22.2913
D. Wastewater Treatment and Discharge	440.9149	355.7021	341.6652	360.4395	318.1393	295.0195	294.6284	292.3246	297.3497	296.4302	295.6853
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo Items											
International Bunkers	**195.7347**	**42.5212**	**63.7967**	**38.3980**	**41.5312**	**57.4930**	**102.1063**	**149.8553**	**172.2996**	**153.1717**	**35.5495**
Aviation	195.7347	42.5212	63.7967	38.3980	41.5312	57.4930	102.1063	149.8553	172.2996	153.1717	35.5495
Navigation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Multilateral Operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 Emissions from Biomass	**232.8093**	**230.0480**	**272.3720**	**307.3920**	**341.0480**	**1,428.4386**	**1,603.1890**	**2,122.7228**	**3,583.0567**	**2,976.2234**	**2,985.9162**
CO_2 Captured and Stored	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Long-term Storage of C in waste disposal sites	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Indirect N_2O	763.2533	404.8742	265.5133	288.0244	277.4232	264.8025	294.1106	310.2353	307.0403	314.8264	269.7462
Indirect CO_2	207.5471	65.4471	28.5957	61.0627	59.3041	77.8743	77.9170	90.1477	143.8546	136.1237	187.7661
Total (without LULUCF)	**45,248.4076**	**17,658.6891**	**10,966.7387**	**12,951.2511**	**13,362.8324**	**13,009.2207**	**13,280.0640**	**13,125.8224**	**13,764.0439**	**13,751.8300**	**13,661.7492**
Total (with LULUCF)	**43,590.9487**	**15,627.5783**	**8,843.3998**	**11,283.7323**	**12,134.6655**	**11,827.2898**	**12,342.5822**	**12,132.5045**	**12,922.9927**	**13,765.1372**	**13,658.2138**

Abbreviations: IE – included elsewhere; NE – not estimated; NO –Not Occurring.

2.2. Institutional Arrangements, Inventory Process

2.2.1. National Inventory System

The Ministry of Environment (MoE) of the RoM is the state authority responsible for development and promotion of policies and strategies addressing agriculture, food production and food safety, regional and rural development, use of territory, environment protection, climate change and natural resources.

On behalf of the Government of RoM, MoE is in charge for implementing international environment treaties to which the Republic of Moldova is a Part (including Rio Conventions). The representative of the MoE is also the UNFCCC National Focal Point.

In accordance with the Government Decision No. 549 of 13.06.2018 on establishment, organization and functioning of the Environmental Agency[48], it has been assigned the following authorities *in the field of air protection and climate change*: implementation of the policy documents provisions and international environmental treaties to which the RoM is a party in the field of quality and protection of the atmospheric air and of the ozone layer, *in the field of greenhouse gas emissions reduction and adaptation to climate change*, development and submitting implementation related information to the MoE; participation in the *National Commission for Climate Change*; ensuring the implementation *of the greenhouse gas emissions monitoring, reporting and verification system*; carrying out the *process of collection, aggregation, validation and processing of data and information needed for developing atmospheric and greenhouse gas emissions and pollutants inventories and reports; providing technical support to MoE in national communications and biennial update reports development*, according to the provisions of UNFCCC.

At the same time, in accordance with the GD No. 1277 of 26.12.2018 on the establishment and functioning of the National Monitoring and Reporting System (NMRS) of greenhouse gas emissions and other climate change relevant information, the Environmental Agency was designated as the *competent authority* responsible for ensuring operation of the NMRS of for greenhouse gas emissions and other climate change relevant information, given that NMRS is operated on the account and within the limits of the means approved for the budget of the institutions which are part of the system, as well as from other sources provided by the legislation, including external financing (*activities carried out based on technical assistance and capacity building projects*).

In the above context, it is important to note that, in accordance with GD No. 1249 of 19.12.2018 on organization and functioning of the Public Institution "Environmental Projects National Implementation Office" (PI "EPNIO")[49], the latter has the mission to support MoE and relevant organizational structures, to effectively implement external and internal financial and technical assistance projects in the field of environmental protection and use of natural resources (protection of atmospheric air, ozone layer and

[48] <https://www.legis.md/cautare/getResults?doc_id=119162&lang=ro>.
[49] <https://www.legis.md/cautare/getResults?doc_id=113696&lang=ro>.

climate change; waste and chemical management; prevention of environmental pollution; water resource management; biosecurity; biodiversity conservation and management of natural areas protected by the state), in accordance with the provisions of the normative acts related to implementation of the requirements of the international conventions to which the Republic of Moldova is a party and the alignment with the international standards in the field of environmental protection, given that the basic functions of the PI "EPNIO" consist of: efficient implementation of the projects in the fields of competence in accordance with the established objectives; supervision and verification of the quality of the services, works and goods provided within the established deadlines; management of the financial means allocated to the relevant projects, in accordance with the assistance agreements and the approved budget; founder support in project proposals development; drafting and presentation of projects implementation progress reports and use of financial means intended for the projects.

The management of the PI "EPNIO" is ensured by the director of the institution (executive body), respectively by a Supervisory Committee – a higher collegial body, which manages and supervises the activity of the institution. The Committee consists of five members and is appointed for a period of four years. The nominal composition of the Committee is established by the Order of the MoE, with the mandatory inclusion of at least one representative of the State Chancellery, the Ministry of Finance, the MoE and civil society in the areas of competence of the PI "EPNIO". The Minister of Environment is the Chairman of the Committee who chairs the meetings of the Committee and fulfils any other assigned duties. In absence of the Chairman, the meetings shall be chaired by one of the members, elected by the members of the Committee who attend the meeting.

The NMRS of greenhouse gas emissions and other climate change relevant information to UNFCCC, approved by GD no. 1277 of 26.12.2018, includes two subsystems as integral parts:

1. The National Inventory System (NIS), which provides institutional, legal and procedural framework for the estimation of anthropogenic emissions by sources and removals by sinks of all greenhouse gases compiled in the national inventory of GHG emissions, as well as for the reporting and archiving of inventory information, in accordance with decisions made under the UNFCCC and the Paris Agreement;
2. The national system for policies, measures and projections, which provides the institutional, legal and procedural framework for assessing progress in implementing climate change mitigation policies, for developing projections of anthropogenic greenhouse gas emissions by sources or removals by sinks.

Implementation of NMRS ensures collection, proper processing of data and information necessary for: (1) developing and reporting of the national inventory and of the forecasts of anthropogenic greenhouse gases emissions from sources or removals by sinks and (2) evaluation and reporting of: the progress in mitigation policies implementation; vulnerability to climate change, the impact of climate change and progress in implementation of adaptation actions; and the aggregated financial and technological support, provided by the developed industrial countries, listed in Annex I to UNFCCC, for the implementation of climate change mitigation and adaptation actions, of technical assistance and capacity building projects in the field of climate change.

In the context of GD no. 1277 of 26.12.2018, the NMRS has the objective to ensure the transparent, accurate, coherent and full monitoring and reporting of greenhouse gases to the UNFCCC Secretariat, through the provided reporting instruments, including the actions undertaken to adapt to the consequences of climate change, respectively to ensure evaluation, reporting and verification of information on the progress achieved at national level in terms of compliance with the commitments assumed made under the UNFCCC, Paris Agreement and decisions adopted on the basis thereof.

With reference to the National Inventory System (NIS), it is designed and managed so as to ensure the principles of transparency, consistency, comparability, completeness in the development of the national greenhouse gas emissions inventory, in accordance with the provisions of the 2006 IPCC Guidelines on the development of greenhouse gas inventories.

The Environmental Agency, as the competent authority, in direct collaboration with the responsible authorities and institutions that are part of the NMRS and with the support of the central authority for natural resources and the environment (MoE), ensures the organization and operation of the NIS, by periodically improving the institutional, legal and procedural framework, in accordance with the national and international legal framework.

Within the NIS, the competent authority shall draw up a national greenhouse gas inventory every two years. The national inventory data are displayed according to the format set out in Table 1 of Annex no. 1 to GD no. 1277 of 26.12.2018.

For direct GHG emissions, the National Inventory is developed in accordance with the 2006 IPCC Guidelines, by means of reporting software recommended by UNFCCC, and in the case of indirect greenhouse gas emissions, the National Inventory is developed in accordance with the updated editions of the Air Pollutant Emission Inventory Guidebook, the Technical Guidance for National Emissions Inventory, published and regularly updated by the European Environment Agency in the framework of the European Monitoring and Evaluation Program.

Based on the National GHG Inventory, the competent authority shall be responsible for compiling, every two years, of the National Inventory Report (NIR), in the state language and in English, using the contents structure set out in the relevant COP decisions, namely: (1) introduction; (2) trends in greenhouse gas emissions; (3) Energy Sector; (4) Industrial Processes and Product Use Sector; (5) Agriculture Sector; (6) Land Use, Land Use Change and Forestry Sector; (7) Waste Sector; (8) Recalculations and Planned Improvements; (9) References; and (10) Annexes.

Every two years the competent authority (the Environmental Agency) publishes the National Inventory Report (NIR), as well as the National Inventory of Greenhouse Gas Emissions in tabular format on its official website (<http://am.gov.md/>). Summary tables show the trends in greenhouse gas emissions by gas and by sector.

The competent authority shall ensure the quality of national inventories by implementing the planning, preparation and management stages, which include collection of activity data, appropriate selection of estimation methods and emission factors, estimation of anthropogenic greenhouse gas emissions, implementation of uncertainty analysis, activities for quality assurance and quality control, as well as data verification procedures included in the national inventory.

At the *planning* stage for the national inventory, the following activities are performed:

1) make available financial resources necessary for the development of the national inventory, as well as for collecting activity data, selection of emission factors and estimation methods, implementation of quality assurance and quality control measures, estimation of key categories, uncertainties, envisioned recalculations and improvements, for each source category or sink included in the national inventory;
2) elaborate, approve and periodically update the QA/QC plan which describes specific QC procedures to be implemented during the inventory development process, facilitate the overall QA procedures to be conducted, to the extent possible, on the entire inventory and establish quality objectives;
3) make available on the official website of the competent authority the postal and electronic addresses of the national competent authority responsible for the inventory;
4) establish processes for the official consideration and approval of the inventory, prior to its submission to the UNFCCC Secretariat.

At the stage of *preparation* of the national inventory, the following activities are to be performed:

1) identify key categories by following the methods described in the 2006 IPCC Guidelines;
2) collect sufficient activity data, process information and emission factors as are necessary to support the methods selected for estimating anthropogenic GHG emissions by sources and removals by sinks;
3) prepare estimates in accordance with the methods described in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories, and ensure that appropriate methods are used to estimate emissions from key categories;
4) make a quantitative estimate of inventory uncertainty for each source category and for the inventory in total, following the 2006 IPCC Guidelines;
5) ensure that any recalculations of previously submitted estimates of anthropogenic GHG emissions by sources and removals by sink are prepared in accordance with the 2006 IPCC Guidelines;
6) compile the national inventory in accordance with relevant decisions of the COP;
7) implement general inventory QC procedures (tier 1) in accordance with the approved QA/QC plan following the 2006 IPCC Guidelines;
8) apply category specific QC procedures (tier 2) for key categories and for those individual source categories in which significant methodological and/or data revisions have occurred, in accordance with the 2006 IPCC Guidelines;
9) provide for a basic review of the inventory by personnel that have not been involved in the inventory development, preferably an independent third party, before the submission of the inventory;
10) provide for a more extensive review of the inventory for key categories, as well as for categories in which significant changes in methods or data have been made;
11) re-evaluate the inventory planning process in order to meet the established quality objectives established in the QA/QC plan, taking into account recommendations from the actions laid down above in pt. 9) and 10), and of the results of periodic internal evaluations of the inventory preparation process.

At the *management* stage of the national inventory, the following activities are to be performed

1) periodically archive and store the inventory information for each inventory year, including:
   a) all disaggregated emission factors, activity data, and documentation about how these factors and data have been generated and aggregated for the preparation of the inventory;
   b) internal documentation on QA/QC procedures;
   c) documentation on external and internal reviews, documentation on annual key categories identification and planned inventory improvements;
2) provide the technical teams of experts (TTE) in the process of technical analysis of biennial update reports under the international consultation and analysis (ICA) with access to information used to develop the national inventory, as well as to information on the NSMR;
3) respond to requests for clarifying inventory information resulting from the different stages of the process of technical analysis of biennial update reports under the ICA in a timely manner, in accordance with UNFCCC decisions.

The competent authority shall communicate to the central authority for natural resources and the environment, by 15 December of the year in which the report is made (year X), the following data:

1) the level of anthropogenic emissions of direct greenhouse gases – carbon dioxide [CO_2], methane

[CH_4], nitrous oxide [N_2O], hydrofluorocarbons [HFCs], perfluorocarbons [PFCs], sulfur hexafluoride [SF_6], nitrogen trifluoride [NF_3] – recorded two years prior to the year in which the reporting is done (year X-2);

2) the level of anthropogenic emissions of indirect greenhouse gases – carbon monoxide [CO], nitrogen oxides [NO_x], non-methane volatile organic compounds [NMVOCs] and sulfur dioxides [SO_2] – recorded 2 years prior to the year in which the reporting is done (year X-2);
3) accounting of emissions and removals from land use, land-use change and forestry sector, recorded two years prior to the year in which the reporting is done (year X-2);
4) any recalculations and/or modifications of information provided for in pt. 1) - 3), covering the period between the base year (1990) and three years prior to the year in which the reporting is done (X-3);
5) the elements comprised in the NIR, information on QA/QC plan, a general assessment of uncertainty and completeness of the inventory, as well as information on any other recalculations;
6) measures taken to improve GHG emissions estimates, mainly recalculated estimates.

The central authority for natural resources and environment shall submit to the UNFCCC Secretariat, based on data provided by the competent authority, prior to 31 December of the year in which the reporting is done (year X), the complete greenhouse gases national inventory for the period starting with base year (1990) and ending with the year X-2.

The competent authority shall make available to the public the information on greenhouse gas emissions, in accordance with the provisions of GD No. 1277 of 26.12.2018 on establishment and operation of the National Monitoring and Reporting System for greenhouse gas emissions and other information relevant to climate change.

2.2.2. Institutional Arrangements

The list of responsible authorities and institutions that are part of the GHG emissions and other climate change relevant information NMRS, according to Annex 2 to GD no. 1277 of 26.12.2018, includes:

1. Specialized central public administration bodies:
   1) Ministry of Environment;
   2) Ministry of Agriculture and Food Industry;
   3) Ministry of Economy;
   4) Ministry of Infrastructure and Regional Development;
   5) Ministry of Finance;
   6) Ministry of Health;
   7) Ministry of Defense;
   8) Ministry of Foreign Affairs and European Integration;
   9) Ministry of Education and Research.

2. Public authorities subordinated to ministries:
   1) Environmental Agency;
   2) National Agency for the Regulation of Nuclear and Radiological Activities;
   3) Environmental Protection Inspectorate;
   4) Public Institution "Environmental Projects National Implementation Office";
   5) Civil Aviation Authority;
   6) Naval Agency;
   7) Customs Service;
   8) Energy Efficiency Agency;
   9) National Public Health Agency;
   10) Moldsilva Agency;
   11) State Hydrometeorological Service;
   12) "Apele Moldovei" Agency.

3. Central administrative authorities:
   1) National Bureau of Statistics;
   2) Land Relations and Cadaster Agency;
   3) Medicines and Medical Devices Agency;
   4) Public Services Agency;
   5) National Food Safety Agency.

4. State-owned enterprises and joint-stock companies subordinated to specialized central public administration bodies, as well as companies with state participation:
   1) State Enterprise "State Road Administration";
   2) State Enterprise "Ungheni River Port";
   3) State Enterprise "Molovata Ferry";
   4) Forest Research and Management Institute (subordinated to the "Moldsilva" Agency);
   5) State Enterprise "Moldovan Railways";
   6) State Enterprise "Chisinau Glass Factory";
   7) State Enterprise "Moldelectrica", Chisinau;
   8) Joint Stock Company "RED NORTH", Balti;
   9) Joint Stock Company "TERMOELECTRICA", Chisinau;
   10) Joint Stock Company "CHP-North", Balti;
   11) The Joint-Stock Company "Moldovagaz".

As competent authority responsible for operation of the National Monitoring and Reporting System for greenhouse gas emissions and other information relevant to climate change, the Environmental Agency, by Letter no. 3471 of 25.09.2019 to the Office of Climate Change within the PI "EPNIO", requested to examine and identify the possibility of providing the necessary support for carrying out of responsibilities in the field of climate change by organizing the entire process of developing the BUR3 of the RoM to UNFCCC, respectively, the NC5 of the RoM to the UNFCCC, in accordance with the rules, procedures and decisions of the Conference of the Parties to the UNFCCC.

Towards this end, the Climate Change Office of the PI "EPNIO" has been given the authority: to request and receive, directly or through the Environmental Agency, information from central public authorities, local public authorities, organizations and institutions, economic operators working in fields holding primary information needed to complete these two national reports; to collect, process and validate the data and information necessary for preparation of national inventory and reports on greenhouse gas emissions; to train specialists from the Environmental Agency in processes for working with collected data and information in order to develop their capacities in targeted fields.

It should be noted that the Climate Change Office, being within MoE (February 2004 - December 2018), and more recently also under the PI "EPNIO" (starting January 2019), held the responsibility for activities associated with the preparation of NCs, BURs, NIRs and national GHG inventories.

Figure 2-2 schematically defines the institutional arrangements for the NMRS of the RoM.

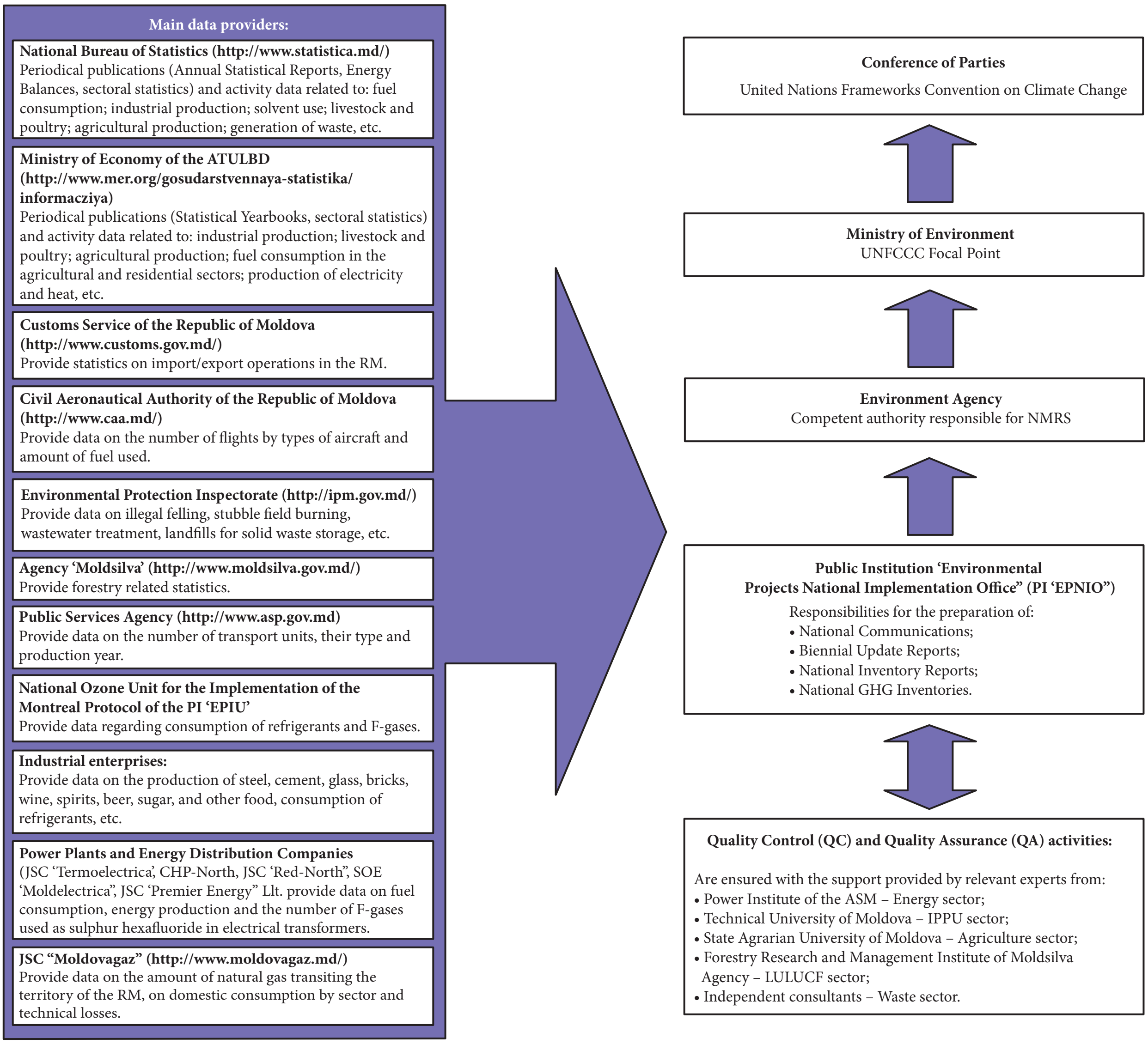


Figure 2-2: Institutional arrangements for the NMRS of the RoM.

Thus, within the PI "EPNIO", the inventory team is responsible for assessing emissions by source category and removals by sink category, analysis of key emission sources, activities for verification and control of the inventory quality, uncertainty analysis, documentation and archiving of information associated with the process of preparing the national inventory of GHG emissions, development of NCs, BURs and NIRs.

The functional responsibilities of the participants in the process are briefly described as follows:

- The Coordinator / Compiler of the National GHG Inventory is responsible for the inventory preparation process coordination, including supervision of estimating emissions by individual categories of sources and removals by individual categories of sinks, KCA, uncertainty analysis interpretation, QA&QC activities coordination, documentation and archiving the data used in the inventory preparation process, synthesis of sectoral reports – serving as basis for the NIR compilation, respectively Chapter 2 "GHG National Inventory" from the BURs and NCs;
- The national experts (hired on a contract basis) are responsible for estimating emissions by individual categories of sources and removals by individual categories of sinks at sectoral level (Sector 1 "Energy", Sector 2 "Industrial Processes and Product Use", Sector 3 "Agriculture", Sector 4 "LULUCF" and Sector 5 "Waste"); national experts are responsible for the activity data (AD) collection, application of decision trees in terms of selecting suitable assessment methods and EFs, estimating emission uncertainties by individual categories of sources, as well as for taking correction measures as a response to QA&QC activities.

The activity data necessary for compilation of the national inventory are available in the Statistical Annual Reports, Energy Balance, sectoral statistical publications, as well as in the online database[50] managed by the National Bureau for Statistics (NBS) of the Republic of Moldova.

For the period until 1992 the information is available for the entire country, and since 1993 only for the territory on the right bank of the Dniester river, excluding the Transnistrian breakaway region (administrative-territorial units on the left side of the Dniester River or ATULBD). For the latter, the information is collected from the Statistical Yearbooks of ATULBD[51] and sectoral statistical publications available on the website of the Ministry of Economic Development of ATULBD[52].

Additional statistical information (unpublished) can be obtained upon request from a number of partner institutions, with the status of information providers, in accordance with the provisions of GD no. 1277 of 26.12.2018 on the establishment and functioning of the National GHG Emissions and other climate change relevant information Monitoring and Reporting System, including:

- the Ministry of Health and Agency for Medicines and Medical Devices: data on use of dose pressurized aerosols made on the basis of HFCs as a propellant;
- the Ministry of Defense: information on the amount of fuels consumed for military transport;
- the Customs Service: information on import-export operations into/from the RoM;
- the Public Services Agency: information on the number of transport units, by category of vehicle and year of production;
- the Naval Agency of the RoM and the State Owned Enterprises "Ungheni River Port" and "Molovata Ferry": information on the amount of fuels consumed for the naval transport;
- the Civil Aviation Authority of the RoM: information on the amount of fuels consumed for air transport (civil and international aviation) and the number of flights by each type of aircraft;
- the Land Relations and Cadaster Agency: information on land use, by categories of use;
- the "Moldsilva" Agency: statistical information associated with the forest management;
- from the Environmental Protection Inspectorate: information on illegal felling of forests and stubble burning;
- the National Unit on the Implementation of the Montreal Protocol the of PI "EPNIO": information on import and use of refrigerants in refrigeration and air-conditioning equipment;
- industrial enterprises ("Lafarge Cement Moldova" SA, "Macon" SA, "Chisinau Glass Factory" SE, "Glass Container Company" SA etc.): information on the amount of fuels used, basic industrial production and mineral resources used;
- the State Owned Enterprise "State Roads Administration": information on the amount of asphalt produced and used in the Republic of Moldova;
- from the State Owned Enterprise "Moldovan Railways": information on the amount of fuels consumed for rail transport, as well as on the rolling stock used in the enterprise;
- the JSC "Moldovagaz": information on the transit of natural gas to third countries through the territory of the RoM, on the consumption of natural gas at sectoral level and on technical losses;
- energy industry enterprises (JSC "TERMOELECTRICA" and JSC CHP-North): information on electricity and heat generation, as well as on fuel consumption;
- enterprises specialized in transmission and distribution of electricity (SOE "Moldelectrica", I.C.S. "Premier Energy" JSC, JSC "RED North"): information on the amount of PFC and SF_6 used as an elegas in electrical transformers.

2.3. Process for Inventory Preparation

The PI "EPNIO" applies a top-down approach for preparing the national inventory, consisting of the National Inventory Report (NIR) and the standard assessment and reporting tables as approved by Decision 24/CP.19 (Annex 1). The process of preparing the national inventory is presented schematically in Fig. 2-3

The Coordinator / Compiler of the National GHG Inventory is responsible for compiling the estimations and ensuring consistency and quality of the inventory by producing the NIR and Chapters 2 "National GHG Inventory" from the Biennial Update Reports and the National Communications.

Estimation of emissions by individual source categories and removals by individual sink categories is the responsibility of national experts who have more competences about individual features of source/sink categories. The national experts, under direct guidance of the Coordinator of the National GHG Inventory, decide, by applying decision trees, on employing the best estimation methodology, and collect AD needed for emissions estimation. For most source and sink categories methodologies used in the previous inventory cycle are applied. It is needed to collect new AD for a more recent period under review or for the entire period under review if historical AD were amended or recalculated. If a new source/sink category was to be assessed, or a higher Tier methodology had to be used, then the Coordinator of the National GHG Inventory with the national experts would decide on which assessment methodology to use, collect most reasonable AD and EFs, calculate GHG emissions, assess uncertainties, ensured implementation of verification, QA/QC procedures acting on behalf of research and academic institutions, ministries and subordinated institutions, central administrative authorities and/or private sector. National experts

[50] National Bureau for Statistics of the RM, on-line database: <http://statbank.statistica.md/pxweb/Database/RO/databasetree.asp>.
[51] PI.. "EPIU" has copies of the Statistical Yearbooks of ATULB for the years 2000-2020, including activity data for 1990 and 1995-2020.
[52] Ministry of Economy of the TMR: <http://mer.gospmr.org/gosudarstvennaya-sluzhba-statistiki/informacziya.html>.

produce explanatory texts for the research on estimation of emissions by individual source categories and removals by individual sink categories, as well as provided the bibliography used.

The Coordinator / Compiler of the National GHG Inventory is responsible for collecting and reviewing these materials, used in drafting the NIR sectoral chapters (Chapter 3 "Energy", Chapter 4 "Industrial Processes and Product Use", Chapter 5 "Agriculture", Chapter 6 "LULUCF", Chapter 7 "Waste"). The Coordinator / Compiler is also responsible for drafting other chapters (Executive Summary, Chapter 1 "Introduction", Chapter 2 "Trends in National GHG Emissions", Chapter 8 "Recalculations", "Bibliography" and "Annexes"), as well as for checking the correctness of the key category analysis, compatible with the 2006 IPCC Guidelines.

The NIR is produced in compliance with the general structure of the National Inventory Reports, as was established in the Decision 24/CP.19. In addition to NIR, the Common Reporting Format (CRF) Tables are filled-in (see Annex 1). The Coordinator/ Compiler of the National GHG Inventory has the task to monitor the process of producing the Sectoral and Summary CRF Tables, to ensure the consistency of results. The national experts accomplished the uncertainties analysis, as well as verification and QA/QC activities, in close cooperation with the Coordinator/ Compiler of the National GHG Inventory.

The first *QA/QC Plan* was produced in 2006 within the UNDP-GEF Regional Project "*Capacity Building for Improving the Quality of the National GHG Inventories (Central Europe and CIS region)*", and complied with the 2006 IPCC Guidelines requirements. Subsequently, it was periodically updated during the national GHG inventory processes.

During the peer reviews, the draft version of the NIR is sent to a group of independent experts (who did not previously participate in the national inventory preparation). The purpose of the inventory peer reviews is to receive from relevant experts in the areas of major interest comments on quality of the work done, in particular on relevance of methodological approaches, EFs and AD used. The received comments are reviewed and estimations and explanatory notes to them are corrected.

Following the final review, after the incorporation of comments received in the process of peer reviews, the PI "EPNIO" prepares the MS Word final version of the National Inventory Report, which is then sent for approval to the Environmental Agency. When the Report is approved, the final version is electronically processed, printed and published.

Once published, the National Inventory Report, the Biennial Update Reports and/or the National Communications are submitted by the Environment Agency to the Ministry of Environment for approval, after which it is officially submitted to the UNFCCC Secretariat, in accordance with Moldova's international commitments to UNFCCC.

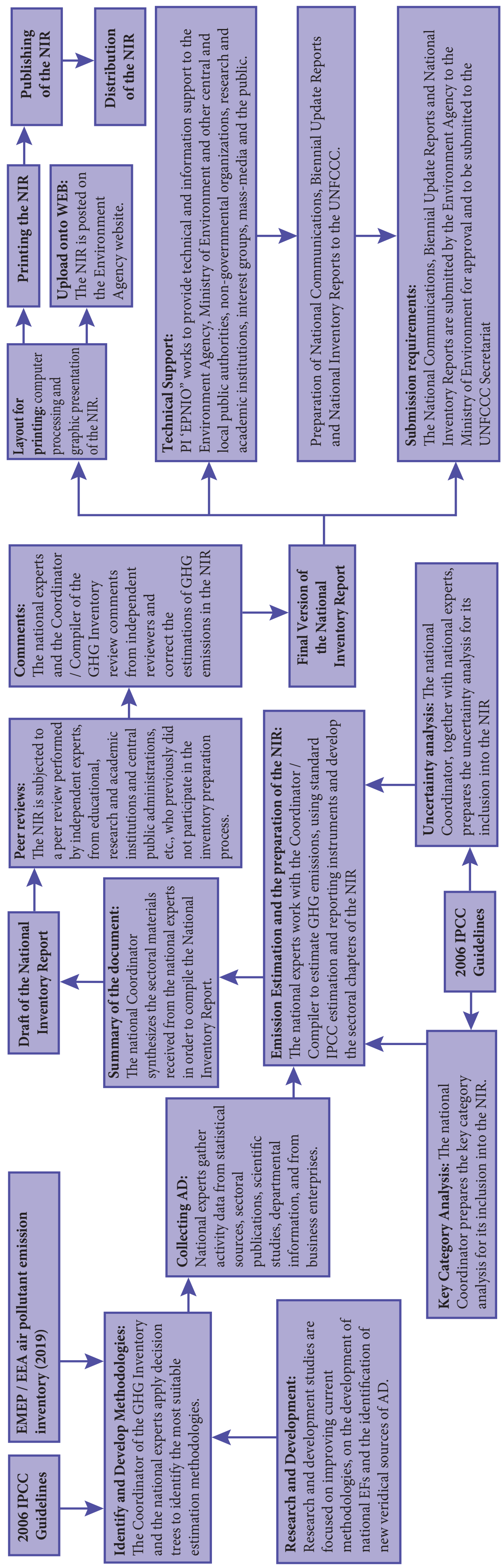


Figure 2-3: Inventory Process in the Republic of Moldova.

2.4. Methodological Issues

2.4.1. Methodologies, Emissions Factors and Data Sources

The national inventory is structured to match the reporting requirement of the UNFCCC and is divided into five main sectors: (1) Energy; (2) Industrial Processes and Product Use; (3) Agriculture; (4) Land Use, Land-Use Change and Forestry and (5) Waste. Each of these sectors is further subdivided, within the inventory, by source categories (Tab. 2-4).

Emissions of direct (CO_2, CH_4, N_2O, HFCs, PFCs and SF_6) (no NF_3 emissions have been registered in the RoM so far) greenhouse gases were estimated based on methodologies contained in the 2006 IPCC Guidelines, while the indirect emissions (NO_x, CO, NMVOC and SO_2) were estimated based on methodologies according to the EEA/EMEP Air Pollutant Emission Inventory Guidebook (2019).

Generally, a GHG inventory can be defined as *a "comprehensive account of anthropogenic sources of emissions and removals by sinks and associated data from source and sink categories within the inventory area over a specified time frame"*.

It can be prepared "top-down", "bottom-up", or using a combination approach. The RoM national inventory is prepared using a "top-down" approach, providing estimates of GHG emissions at a national level. Ideally, a GHG inventory should be developed by using direct measurements of emissions and removals from individual categories of sources or sinks in the country, considering the methodological approach "bottom-up".

The national inventory team is continuously working to improve accuracy, completeness and transparency of its inventory. Comprehensive bottom-up inventory is neither practicable nor possible at the present time, although for some sectors, estimates are derived from individual source specific data.

To the extent possible, AD used in this report are based on officially published data: national (Statistical Yearbooks of the RoM, respectively of the ATULBD, Energy Balances etc.) and international statistical publications (UN FAO on-line database), publications of academic, research and development institutions (Institute of Pedology, Agrochemistry and Soil Protection "Nicolae Dimo", Institute of Ecology and Geography, Institute of Power Engineering, Forest Research and Management Institute, etc.), AD provided by ministries and subordinated institutions (Ministry of Defense, Ministry of Health), activity data provided by the administrative authorities subordinated to the ministries (Environmental Agency, Inspectorate for Environmental Protection, Customs Service; Moldsilva Agency, State Hydrometeorological Service), activity data provided by the central administrative authorities (National Bureau of Statistics, Land Relations and Cadaster Agency, Public Services Agency, Naval Agency, Civil Aviation Authority, Medicines and Medical Devices Agency, National Agency for Food Safety), data obtained from enterprises and businesses associations (State Enterprise "Moldavian Railways", "Moldovagaz" J.S.C., "Lafarge Cement (Moldova)" J.S.C., "Macon" J.S.C., "Glass Plant Chisinau" J.S.C., "Glass Container Company" J.S.C., etc.).

Table 2-4: Summary of emission methods and factors used in the process of preparing the national inventory of the Republic of Moldova

Categories by sources and sinks	CO_2		CH_4		N_2O		HFCs		central facial palsy		SF_6	
	Methods	EF	Methods	EF	Methods	EF	Methods	EF	Methods	EF	Methods	EF
1. Energy												
A. Fuel Combustion	T1	D, CS	T1	D	T1	D						
1. Energy Industries	T1	D, CS	T1	D	T1	D						
2. Manufacturing Industries and Construction	T1	D, CS	T1	D	T1	D						
3. Transport	T1	D, CS	T1	D	T1	D						
4. Other Sectors	T1	D, CS	T1	D	T1	D						
5. Other	T1	D, CS	T1	D	T1	D						
B. Fugitive Emissions from Fuels	T1	D, CS	T1	D	T1	D						
1. Solid Fuels	NO	NO	NO	NO	NO	NO						
2. Oil and Natural Gas	T1	D, CS	T1	D	T1	D						
C. CO_2 Transport and Storage	NO	NO										
2. Industrial Processes and Product Use												
A. Mineral Industry	T2, T1	D, CS	NA	NA	NA	NA						
B. Chemical Industry	NO	NO	NO	NO	NO	NO						
C. Metal Industry	T2	CS, D	NO	NO	NO	NO						
D. Non-energy Products From Fuels and Solvent Use	T2, T1	D	NA	NA	NO	NO						
E. Electronic Industry	NA	NA	NA	NA	NA	NA	NA	NA	NO	NO	NO	NO
F. Product Use as Substitutes for ODS	NA	NA	NA	NA	NA	NA	T2, T1	CS, D	NA	NA	NA	NA

Categories by sources and sinks	CO_2		CH_4		N_2O		HFCs		central facial palsy		SF_6	
	Methods	EF	Methods	EF	Methods	EF	Methods	EF	Methods	EF	Methods	EF
G. Other Product Manufacture and Use	T2, T1	D	NA	NA	T1	D	NA	NA	T1	D	T1	D
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Agriculture												
A. Enteric Fermentation			T2, T1	D, CS	NA	NA						
B. Manure Management			T2, T1	D, CS	T2, T1	D, CS						
C. Rice Cultivation			NO	NO	NA	NA						
D. Agricultural Soils			NA	NA	T1, T3	D, CS						
E. Prescribed Burning of Savannas			NO	NO	NA	NA						
F. Field Burning of Agricultural Residues			IE	IE	IE	IE						
G. Liming	NO	NO	NA	NA	NA	NA						
H. Urea Application	T1	D	NA	NA	NA	NA						
I. Other Carbon-containing Fertilizers	NO	NO	NA	NA	NA	NA						
J. Other	NO	NO	NO	NO	NO	NO						
4. LULUCF												
A. Forest Land	T3, T2, T1	D, CS	T1	D	T1	D						
B. Cropland	T2, T1	D, CS	T1	D	T1	D						
C. Grassland	T2	CS	NE	NE	NE	NE						
D. Wetlands	T2, T1	D, CS	NE	NE	NE	NE						
E. Settlements	T2, T1	D, CS	NE	NE	T1	D						
F. Other Land	T2, T1	D, CS	NE	NE	NE	NE						
G. Harvested Wood Products	T1	D	NA	NA	NA	NA						
H. Other	NO	NO	NO	NO	NO	NO						
5. Waste												
A. Solid Waste Disposal	NA	NA	T3	D, CS	NA	NA						
B. Biological Treatment of Solid Waste	NA	NA	T1	D	T1	D						
C. Incineration and Open Burning of Waste	T1	D	T1	D	T1	D						
D. Wastewater Treatment and Discharge	NA	NA	T1	D, CS	T1	D						
E. Other	NO	NO	NO	NO	NO	NO						
6. Other	NO	NO	NO	NO	NO	NO						
Memo Items												
International Bunkers	T2, T1	D, CS	T1	D	T1	D						
Multilateral Operations	NO	NO	NO	NO	NO	NO						
CO_2 Emissions from Biomass	T1	D, CS	IE	IE	IE	IE						
CO_2 Captured and Stored	NO	NO	NA	NA	NA	NA						

Abbreviations: T1 – Tier 1 method ; T2 – Tier 2 method ; C – EEA/EMEP; CS –Country Specific; D –Default; IE –Included Elsewhere; NA –Not Applicable); NE –Not Estimated; NO –Not Occurring.

2.4.2. Key Categories

According to 2006 IPCC Guidance, it is good practice to identify key categories, as it helps prioritize efforts and improve the overall quality of the national inventory. A "key category" is defined as a "source or sink category, that is prioritized within the national inventory system because its estimate has a significant influence on a country's total inventory of direct greenhouse gases in terms of the absolute level of emissions, the trend in emissions, or both".

Table 2-5, respectively Annex 1, presents the key categories for the National GHG Inventory, 1990-2020, without LULUCF – based on the Tier 1 methodological approach, 18 key categories by level (L) and 20 key categories by trend (T); based on a Tier 2 approach – 17 key categories by level (L) and 16 key categories by trend (T); with LULUCF – based on the Tier 1 methodological approach – 24 key categories by level (L) and 25 key categories by trend (T); based on a Tier 2 approach – 22 key categories by level (L) and by trend (T).

Table 2-5: Summary Overview of the Republic of Moldova's Key Categories for 1990-2020, Based on a Tier 1 and Tier 2 Approaches

IPCC Categories	Key categories	Gas	without LULUCF				with LULUCF			
			T1		T2		T1		T2	
			L	T	L	T	L	T	L	T
1A1	Energy industries - liquid fuels	CO_2	X	X	X	X	X	X	X	X
1A1	Energy industries - gaseous fuels	CO_2	X	X	X	X	X	X	X	X
1A1	Energy industries - solid fuels	CO_2	X	X	X	X	X	X	X	X
1A2	Manufacturing industries and construction	CO_2	X	X	X	X	X	X	X	X
1A3b	Road transportation	CO_2	X	X	X	X	X	X	X	X
1A3c	Railways	CO_2	X	X			X	X		
1A4a	Commercial/institutional	CO_2	X	X	X		X	X	X	
1A4b	Residential	CO_2	X	X	X		X	X	X	
1A4b	Residential	CH_4	X	X	X	X	X	X	X	X
1A4c	Agriculture/forestry/fishing	CO_2	X	X			X	X	X	
1B2	Fugitive emissions from oil and natural gas	CH_4	X	X	X		X		X	
2A1	Cement production	CO_2	X	X			X	X		
2D	Non-energy products from fuels and solvent use	CO_2	X	X	X	X	X	X	X	X
2F1	Product Uses as Substitutes for ODS – Refrigeration and Air Conditioning	HFCs	X	X	X	X	X	X	X	X
2F2	Product Uses as Substitutes for ODS – Foam Blowing	HFCs		X		X				X
3A	Enteric fermentation	CH_4	X	X	X	X	X	X	X	X
3B	Manure management	CH_4	X	X	X	X	X	X	X	
3B1	Direct N_2O emissions from manure management	N_2O	X		X	X	X		X	X
3B5	Indirect N_2O emissions from manure management	N_2O	X		X	X	X		X	X
3Da	Direct N_2O emissions from managed soils	N_2O	X	X	X	X	X	X	X	X
3Db	Indirect N_2O emissions from managed soils	N_2O	X	X	X	X	X		X	X
4A1	Forest lands remaining forest lands	CO_2					X	X	X	X
4A2	Land converted to forest land	CO_2					X	X	X	X
4B1	Cropland remaining cropland	CO_2					X	X	X	X
4C2	Land converted to grassland	CO_2					X	X	X	X
4D2	Land converted to wetlands	CO_2					X	X		X
4E2	Land converted to settlements	N_2O					X	X	X	
4F2	Land converted to other land	CO_2					X	X	X	X
4G	Harvested wood products	CO_2						X		X
5A	Solid waste disposal	CH_4	X	X	X	X	X	X	X	X
5D	Wastewater treatment and disposal	CH_4	X	X	X	X	X	X	X	X

Abbreviations: L – Level Assessment; T –Trend Assessment; T1 –Tier 1 methodological approach; T2 –Tier 2 methodological approach.

Following the recommendations set in the 2006 IPCC Guidelines, the inventory was first disaggregated by source categories which further were used to identify key categories.

Source and sink categories were defined in conformity with the following guidelines: (1) emissions / removals from individual source/sink categories identified according to standard classification, were expressed CO_2 equivalent units, estimated by using the GWP; (2) a category should be identified for each gas emitted by the sources and sinks, since the methods, emission factors, and related uncertainties differ for each gas; (3) source and sink categories that use the same emission factors based on common assumptions were aggregated before analysis.

Key categories were identified from two perspectives: (1) the first analysis the emission contribution that each category makes to the national total; and (2) the second perspective analysis the trend of emission contributions from each category to identify where the greatest absolute changes (either increases or reductions) have taken place over a given time.

The per cent contributions to both levels (L), and trends (T), in emissions are calculated and sorted from greatest to least (see also Annex 1 of the NIR). When a Tier 1 approach was used, a 95 per cumulative contribution threshold has been used in this analysis to define an upper boundary for the key category identification, respectively when a Tier 2 approach was used (considering AD and EFs uncertainties used to estimate GHG emissions for individual source/sink categories), a 90 per cumulative contribution threshold has been used in this analysis to define an upper boundary for the key category identification.

The Key Category Analysis was carried out using the Key Category Calculation Tool developed by the United States Environment Protection Agency (US EPA v2.5)[53].

2.4.3. Quality Assurance and Quality Control

Following the recommendations from the 2006 IPCC Guidelines, national inventories have to be transparent, well documented, consistent, complete, comparable, assessed for uncertainties, subject to verification and QA/QC. The 2006 IPCC Guidelines defines the QA/QC terms as follows:

[53] US EPA's Key Category Calculation Tool v2.5, <https/19january2017snapshot.epa.gov/climatechange/national-ghg-inventory-capacity-building.html>.

- *Quality Control* (QC) is a system of routine technical activities to measure and control the quality of the inventory as it is being developed. A basic QC system should provide routine and consistent checks to ensure data integrity, correctness, and completeness; identify and address errors and omissions; and document and archive inventory material and record all QC activities.
- *Quality Assurance* (QA) comprises a planned system of review procedures conducted by personnel not directly involved in the inventory compilation and development process.

As a part of continuous efforts to develop a transparent and reliable inventory, the Republic of Moldova developed a "*Quality Assurance and Quality Control Plan*". The key attributes of the "*Quality Assurance and Quality Control Plan*" include detailed specific procedures (Fig. 2-4) and standard verification and quality control forms and checklists (see Annex 4 of the NIR), by using Tier 1 (general procedures) and Tier 2 (source-specific procedures), that serve to standardize the process of implementing quality assurance and quality control activities meant to ensure the quality of the national inventory; peer review carried out by experts not directly involved in the national inventory development process; data quality check including by comparing the sets of data obtained from different sources; inventory planning and coordination at an inter-institutional level; as well as the continuous documentation and archiving of all materials used in inventory preparation process.

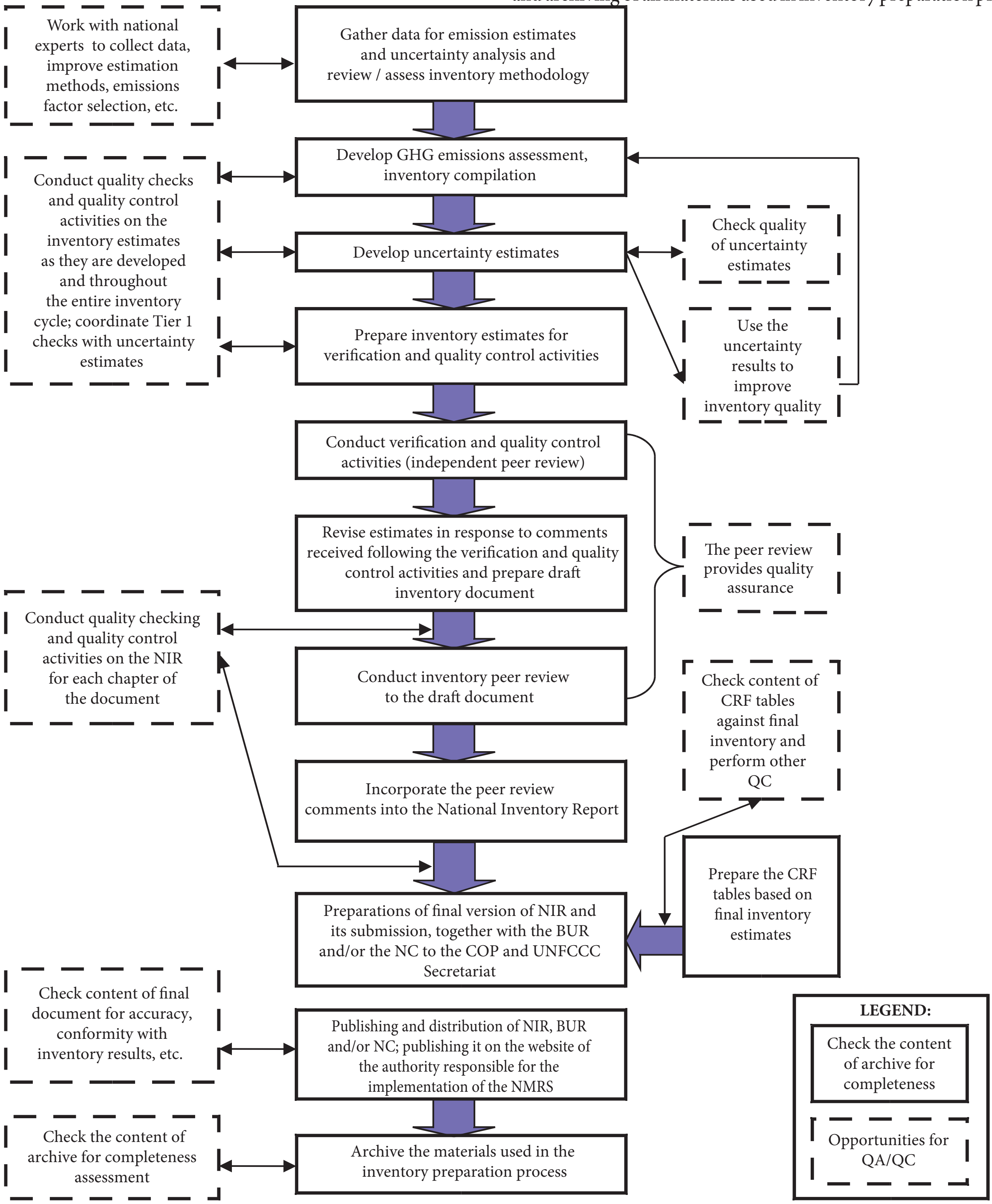


Figure 2-4: The Role of QA/QC Activities in the Inventory Preparing Process.

It is well known that inventory development implies huge amounts of information that has to be gathered, handled and stored. The process sustainability is ensured through a good management and archiving of materials used along the inventory process.

In the Republic of Moldova, the National Inventory Working Group has a sufficiently transparent documentation allowing to fully reproducing the GHG emissions estimates. A standard system for documenting and archiving numeric and qualitative information, in compliance with the 2006 IPCC Guidelines recommendations was used. The activity data sources were documented by inserting references to these into the inventory document text. Estimation methods & emission factors sources and their selection justification are documented in the corresponding chapters of the NIR.

Recalculations made are documented and argued both in sectoral Chapters (3-7), as well as in the Chapter 8 "Recalculations and Improvements" of the NIR.

Individual source and sink categories related documentation include: (1) list of personnel responsible for estimates and individual responsibilities as per Terms of Reference; (2) reference sources for the activity data used; (3); justification of emission factors estimation methods selection; (4) samples of GHG emissions estimation process (in Excel format); (5) uncertainties analysis results by individual source and sink categories; (6) annexes; (7) references.

Materials used in the inventory development process were archived both electronically and on hard copies. As the entity responsible for the national inventory development, the Climate Change Office of the PI "EPIU" holds all documentation used for its compilation.

Summing up, one can assert that transparency and credibility of a national inventory are ensured through: (1) the ability to demonstrate, through appropriate documentation, transparency of inventory development process; (2) further improvements of the inventory process and its basic products; and (3) ensuring that the inventory process employed consistent approaches allowing to obtain comparable results for all source and sink categories.

It is obvious that in comparison with the previous inventory cycles, by continuous integration of QA/QC activities, the Republic of Moldova ensures a better-quality inventory.

2.4.4. Recalculations

The national inventory team revised and recalculated GHG emissions and CO_2 removals for each calendar year covered by the inventory for the period from 1990 through 2019, a component part of the BUR3 of the RoM to UNFCCC (2021).

These activities were carried out during the on-going process of improving the quality of the National GHG Inventory (including, by considering the updated activity data, higher tier methodological approaches available in the 2006 IPCC Guidelines, updating country-specific emission factors used, and errors correcting actions). Under the current inventory cycle, improvements were made in all sectors (move to higher tier methodologies, revision of emission factors, activity data, etc.), entailing the need to make recalculations of national GHG emissions for the time period from 1990 through 2019, reflected in the BUR3 of the RoM under the UNFCCC (Chapter 2 „National GHG Inventory").

In comparison with the results reported under the BUR3 of the RoM to UNFCCC (2021), the changes made during the development of the current inventory, resulted in decreasing trend for total direct GHG emissions in the period 1990-2019, ranging from a minimum of -0.2% in 1990 to a maximum of -1.7% in 2016. Years 2010, 2012 and 2014, showing an insignificant increase in total direct GHG emissions, ranging from a minimum of 0.2% in 2010 to a maximum of 0.4% in 2012 and 2014, were regarded as exceptions (Table 2-6).

Table 2-6: Recalculation of the total GHG emissions (without LULUCF) included in BUR3 of the RoM to UNFCCC (2021), Mt CO_2 equivalent

	1990	1991	1992	1993	1994	1995	1996	1997
BUR3	45.3487	39.1255	31.2699	24.5235	21.1746	17.7666	17.5533	15.8773
NC5	45.2484	38.9698	31.1390	24.4083	21.0598	17.6587	17.4427	15.8305
Difference %	-0.2	-0.4	-0.4	-0.5	-0.5	-0.6	-0.6	-0.3
	1998	1999	2000	2001	2002	2003	2004	2005
BUR3	14.2292	11.9511	11.0391	11.7365	11.6392	12.0733	12.6310	13.0252
CN5	14.1548	11.8882	10.9667	11.6640	11.5573	12.0039	12.5630	12.9513
Difference %	-0.5	-0.5	-0.7	-0.6	-0.7	-0.6	-0.5	-0.6
	2006	2007	2008	2009	2010	2011	2012	2013
BUR3	12.2163	12.2220	12.6964	12.6698	13.3331	13.7595	13.2349	13.0439
CN5	12.1315	12.1686	12.6400	12.6097	13.3628	13.7031	13.2877	12.9792
Difference %	-0.7	-0.4	-0.4	-0.5	0.2	-0.4	0.4	-0.5
	2014	2015	2016	2017	2018	2019	2020	%
BUR3	13.1730	13.1996	13.5035	13.2445	13.9078	13.8100		
NC5	13.2277	13.0092	13.2801	13.1258	13.7640	13.7518	13.6617	-69.8
Difference %	0.4	-1.4	-1.7	-0.9	-1.0	-0.4		

Abbreviations: BUR3 –Third Biennial Update Report of the RoM to the UNFCCC, NC5 – Fifth National Communication of the RoM to the UNFCCC.

With reference to the net direct GHG emissions included in BUR3 of the RoM to UNFCCC (2021), the changes made in the process of compiling this inventory resulted in decreasing trend for the net direct GHG emissions during the years 1990-2019, ranging from a minimum of -0.8% in 1990 to a maximum of -3.9% in 2016 (Table 2-7).

Table 2-7: Results of the recalculation of total net GHG emissions (with LULUCF) included in RoM BUR3 to the UNFCCC (2021), Mt CO_2 equivalent

	1990	1991	1992	1993	1994	1995	1996	1997
BUR3	43.9609	36.6725	29.4236	22.6543	19.3714	16.0050	15.3463	14.0326
NC5	43.5909	36.2482	29.0229	22.2692	18.9867	15.6276	14.9660	13.7147
Difference %	-0.8	-1.2	-1.4	-1.7	-2.0	-2.4	-2.5	-2.3
	1998	1999	2000	2001	2002	2003	2004	2005
BUR3	12.3653	10.3782	9.1852	10.2376	10.0530	10.5567	10.9408	11.6293
NC5	12.0190	10.0440	8.8434	9.8970	9.7030	10.2191	10.6051	11.2837
Difference %	-2.8	-3.2	-3.7	-3.3	-3.5	-3.2	-3.1	-3.0
	2006	2007	2008	2009	2010	2011	2012	2013
BUR3	10.6973	10.5071	11.2869	11.6491	12.3792	12.8635	12.3081	12.2463
NC5	10.3381	10.1794	10.9564	11.3147	12.1347	12.5332	12.0886	11.9082
Difference %	-3.4	-3.1	-2.9	-2.9	-2.0	-2.6	-1.8	-2.8
	2014	2015	2016	2017	2018	2019	2020	%
BUR3	12.7241	12.2961	12.8459	12.5307	13.3477	14.1058		
NC5	12.5029	11.8273	12.3426	12.1325	12.9230	13.7651	13.6582	-68.7
Difference %	-1.7	-3.8	-3.9	-3.2	-3.2	-2.4		

Abbreviations: BUR3 –Third Biennial Update Report of the RoM to the UNFCCC, NC5 – Fifth National Communication of the RoM to the UNFCCC.

2.4.5. Uncertainty Assessment

Uncertainty estimates are an essential element of a complete and transparent emissions inventory. Uncertainty information is not intended to challenge the validity of inventory estimates, but to help prioritize efforts to improve the accuracy of future inventories and guide future decisions on methodological choice. While the National Inventory Team calculates the emission estimates with the highest possible accuracy, uncertainties are associated to a varying degree with the development of emission estimates for any inventory.

Some of current estimates, such as those for CO_2 emissions from fossil fuels combustion or from cement production are considered to have minimal uncertainty associated with them. For some other categories of emissions, however, a lack of data, the use of emission factors used by default or an incomplete understanding of how emissions are generated increases the uncertainty surrounding the estimates presented.

Additional research in the following areas could help reduce uncertainty in the inventory:

- *Incorporating excluded emission sources.* Quantitative estimates for some of the sources and sinks of GHG emissions are not available at this time.
- *Improving the accuracy of emission factors.* Further research is needed in some cases to improve the accuracy of emission factors used to calculate emissions from a variety of sources (for example, the accuracy of current emission factors applied to CH_4 fugitive emissions from oil and natural gas, emissions of CO_2 from solvents and other products, indirect N_2O emissions from manure management and indirect N_2O emissions from agricultural soils etc., is highly uncertain).
- *Collecting more detailed activity data.* Although methodologies for estimating emissions for some sources exist, problems arise in obtaining activity data at a level of detail in which aggregate emission factor can be applied, in particular the ability to estimate emissions of F-gases within Sector 2 "Industrial Processes and Product Use".

The overall inventory uncertainty was estimated using a Tier 1 methodological approach. An estimate of the overall quantitative uncertainty (±6.44 per cent level uncertainty and, respectively ±2.08 per cent trend uncertainty) are shown in Table 2-8, as well as in the Annex 5 of the NIR.

Table 2-8: Estimated Overall National Inventory Quantitative Uncertainty in the RoM

	CO_2	CH_4	N_2O	Total
Level Uncertainty	±4.96	±27.49	±23.11	±6.44
Trend Uncertainty	±1.53	±12.00	±10.21	±2.08

Emissions evaluated under the National GHG Inventory reflect current best estimates; in some cases, however, estimates are based on approximate methodologies, assumptions, and incomplete data. As new information become available in the future, the inventory team will continue to improve, revise and recalculate its GHG emission estimates.

2.4.6. Completeness Assessment

The National GHG Inventory is, mostly, a complete inventory of the following direct GHG – CO_2, CH_4, N_2O, HFC, PFC and SF_6. The national inventory includes also the indirect GHGs such as: CO, NO_x, NMVOC and SO_2.

Despite the effort to cover all existent sources and sinks, the inventory still has some gaps, most being determined by lack of activity data needed to estimate certain emissions and removals, such as: HFC emissions from source categories 2F5 "Solvents" and 2F6 "Other uses".

As part of the inventory improvement plan, during the future inventory activities, the inventory team will continue the efforts to identify new and relevant data for the GHG emissions/ removals assessment from the respective categories.

2.5. Reporting Greenhouse Gas Emissions

2.5.1. Summary of Direct GHG Emissions Trends

During the period 1990-2020, the dynamics of total direct GHG emissions, expressed in CO_2 equivalent, revealed a decreasing trend in the Republic of Moldova, decreasing by about 69.8%: from 45.248 Mt CO_2 equivalent in 1990 to 13.662 Mt CO_2 equivalent in 2020, the net direct greenhouse gas emissions decreased in the same period by about 68.7%:

from 43.591 Mt CO_2 equivalent in 1990 to 13.658 Mt CO_2 equivalent in 2020 (Fig. 2-5).

The most significant reductions in direct GHG emissions by categories were reported in 1990-2020 under the following source categories: 4G "Harvested Wood Products" (-128.4%), 4D "Wetlands" (-85.1%), 3B "Manure Management" (-84.9%), 1A1 "Energy Industries" (-83.0%), 3A "Enteric Fermentation" (-82.2%), 4C "Grassland" (-81.5%), 1A5 "Other" (-80.5%), 1B2 "Fugitive Emissions from Natural Gas" (-73.5%), 1A4 "Other Sectors" (-70.3%), 2A "Mineral Industry" (-59.9%), 1A2 "Manufacturing Industries and Construction" (-58.2%), 1A3 "Transport" (-48.1%), 3D "Agricultural Soils" (-39.4%), 2C "Metal Industry" (-34.4%), 5D "Wastewater Treatment and Discharge" (-32.9%), 4B "Cropland" (-31.6%), 4A "Forest Land" (-26.4%), 2G "Other Products Use" (-25.1%) 4E "Settlements" (-23.4%) and 2D "Non-energy Products from Fuels and Solvent Use" (-16.6%).

Between 2019 and 2020, emissions from the following source categories increased: 2D "Non-energy Products from Fuels and Solvent Use" (+36.0%), 2C "Metal Industry" (+18.4%), 1A1 "Energy Industries" (+16.3%), 1A2 "Manufacturing Industries and Construction" (+11.6%), 5B "Biological Treatment of Solid Waste" (+8.7%), 4B "Cropland" (+8.1%), 3H "Urea Application" (+7.5%), 2F "Product Use as Substitutes for ODS" (+4.2%) and 5A "Solid Waste Disposal" (+0.6%).

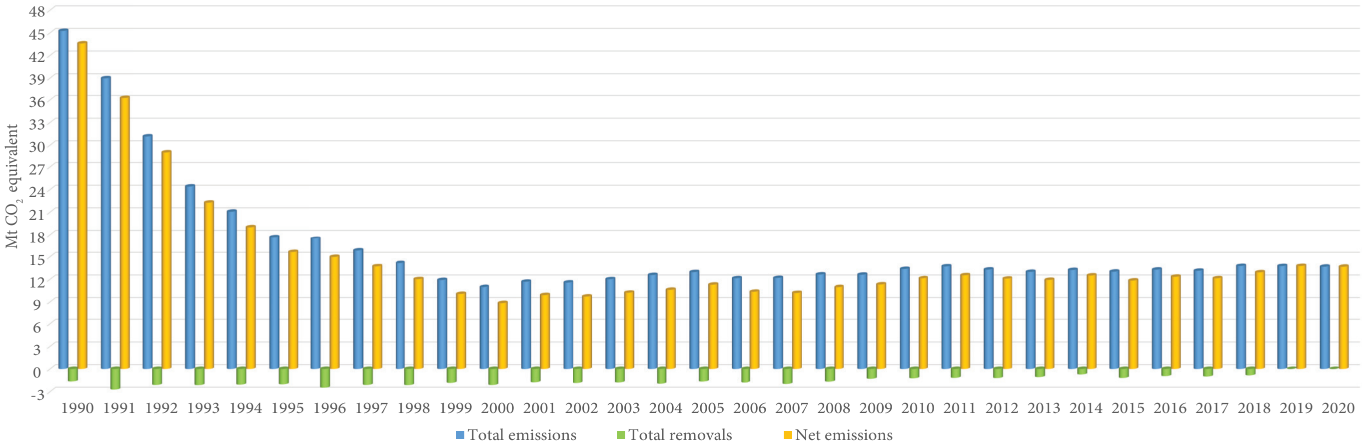


Figure 2-5: Greenhouse Gas Emission and Removals Trends within 1990-2020 time series.

2.5.2. Emission Trends by Gas

Over 1990-2020, total carbon dioxide emissions (without LULUCF) decreased by about 73.6% (from about 37.02 Mt in 1990 to 9.78 Mt in 2020). CH_4 and N_2O emissions decreased by about 55.7% (from about 5.40 Mt CO_2 equivalent in 1990 to 2.39 Mt CO_2 equivalent in 2020), respectively by 56.1% (from about 2.83 Mt CO_2 equivalent in 1990 to 1.24 Mt CO_2 equivalent in 2020) (Table 2-9).

Table 2-9: Direct GHG Emissions within 1990-2020, Mt CO_2 equivalent

	1990	1991	1992	1993	1994	1995	1996	1997
CO_2 (without LULUCF)	37.0219	31.3250	24.1486	18.0938	15.0634	11.9471	11.8103	10.7438
CO_2 (with LULUCF)	35.1914	28.4172	21.8257	15.7291	12.7521	9.6622	9.0698	8.3532
CH_4 (without LULUCF)	5.3988	5.0527	4.8116	4.4870	4.3961	4.1627	4.1152	3.7226
CH_4 (with LULUCF)	5.4014	5.0551	4.8138	4.4900	4.3978	4.1649	4.1168	3.7253
N_2O (without LULUCF)	2.8278	2.5921	2.1787	1.8275	1.6003	1.5479	1.5155	1.3617
N_2O (with LULUCF)	2.9982	2.7759	2.3834	2.0501	1.8368	1.7994	1.7778	1.6339
HFCs	NO	NO	NO	NO	NO	0.0010	0.0017	0.0023
PFCs	NO	NO	NO	NO	NO	NO	NO	NO
SF_6	NO	NO	NO	NO	NO	NO	NO	NO
Total (without LULUCF)	**45.2484**	**38.9698**	**31.1390**	**24.4083**	**21.0598**	**17.6587**	**17.4427**	**15.8305**
Total (with LULUCF)	**43.5909**	**36.2482**	**29.0229**	**22.2692**	**18.9867**	**15.6276**	**14.9660**	**13.7147**
	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
CO_2 (without LULUCF)	9.2819	7.2670	6.5160	7.1474	6.9144	7.5811	8.1018	8.4391
CO_2 (with LULUCF)	6.8593	5.1266	4.0954	5.0826	4.7629	5.5019	5.8536	6.4848
CH_4 (without LULUCF)	3.5847	3.4598	3.3714	3.3590	3.4239	3.3341	3.2988	3.3169
CH_4 (with LULUCF)	3.5872	3.4622	3.3723	3.3603	3.4242	3.3342	3.2990	3.3171
N_2O (without LULUCF)	1.2850	1.1574	1.0743	1.1507	1.2098	1.0765	1.1464	1.1727
N_2O (with LULUCF)	1.5693	1.4513	1.3706	1.4473	1.5068	1.3708	1.4365	1.4593
HFCs	0.0031	0.0040	0.0051	0.0069	0.0091	0.0122	0.0160	0.0225
PFCs	NO	NO	NO	NO	NO	NO	NO	NO
SF_6	NO	NO	NO	NO	NO	0.0000	0.0000	0.0000
Total (without LULUCF)	**14.1548**	**11.8882**	**10.9667**	**11.6640**	**11.5573**	**12.0039**	**12.5630**	**12.9513**
Total (with LULUCF)	**12.0190**	**10.0440**	**8.8434**	**9.8970**	**9.7030**	**10.2191**	**10.6051**	**11.2837**

	2006	2007	2008	2009	2010	2011	2012	2013
CO_2 (without LULUCF)	7.7740	8.1574	8.5307	8.5699	9.2160	9.5168	9.2144	8.8668
CO_2 (with LULUCF)	5.6977	5.8887	6.5743	7.0093	7.7295	8.0948	7.7807	7.5777
CH_4 (without LULUCF)	3.1779	3.0078	2.9903	2.9192	2.9355	2.9806	2.9158	2.8132
CH_4 (with LULUCF)	3.1782	3.0094	2.9910	2.9195	2.9357	2.9808	2.9170	2.8140
N_2O (without LULUCF)	1.1460	0.9582	1.0612	1.0526	1.1324	1.1145	1.0562	1.1891
N_2O (with LULUCF)	1.4286	1.2362	1.3332	1.3179	1.3906	1.3664	1.2896	1.4064
HFCs	0.0332	0.0448	0.0574	0.0675	0.0782	0.0905	0.1005	0.1091
PFCs	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
SF_6	0.0003	0.0004	0.0005	0.0005	0.0007	0.0007	0.0008	0.0010
Total (without LULUCF)	**12.1315**	**12.1686**	**12.6400**	**12.6097**	**13.3628**	**13.7031**	**13.2877**	**12.9792**
Total (with LULUCF)	**10.3381**	**10.1794**	**10.9564**	**11.3147**	**12.1347**	**12.5332**	**12.0886**	**11.9082**
	2014	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**%**
CO_2 (without LULUCF)	8.8728	8.9092	8.9583	8.5679	9.1726	9.3915	9.7804	-73.6
CO_2 (with LULUCF)	7.9454	7.5363	7.8412	7.4022	8.1660	9.2428	9.6080	-72.7
CH_4 (without LULUCF)	2.8619	2.8142	2.8834	2.9988	2.9944	2.6818	2.3921	-55.7
CH_4 (with LULUCF)	2.8620	2.8149	2.8838	2.9993	2.9946	2.6822	2.3929	-55.7
N_2O (without LULUCF)	1.3689	1.1277	1.2705	1.3721	1.3968	1.4416	1.2423	-56.1
N_2O (with LULUCF)	1.5714	1.3179	1.4498	1.5439	1.5621	1.6031	1.4103	-53.0
HFCs	0.1230	0.1570	0.1667	0.1859	0.1989	0.2355	0.2453	N/A
PFCs	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	N/A
SF_6	0.0011	0.0011	0.0011	0.0011	0.0013	0.0014	0.0016	N/A
Total (without LULUCF)	**13.2277**	**13.0092**	**13.2801**	**13.1258**	**13.7640**	**13.7518**	**13.6617**	**-69.8**
Total (with LULUCF)	**12.5029**	**11.8273**	**12.3426**	**12.1325**	**12.9230**	**13.7651**	**13.6582**	**-68.7**

Abbreviations: NA – Not Applicable; NO –Not Occurring).

Halocarbons emissions (HFCs, PFCs) and sulphur hexafluoride (SF_6) emissions have been recorded beginning with 1995, considered as a starting year for monitoring F-gases (HFCs, PFCs and SF_6) (no NF_3 emissions were recorded so far in the Republic of Moldova). Evolution of these emissions denotes a steady trend towards increase in the last years, though their share in the total national emissions structure is insignificant for now.

Carbon dioxide contributes the most to total direct greenhouse gas emissions in the Republic of Moldova. Figure 2-6 demonstrates how the share of direct GHGs varied in the overall national GHG emissions structure in the 1990 and 2020.

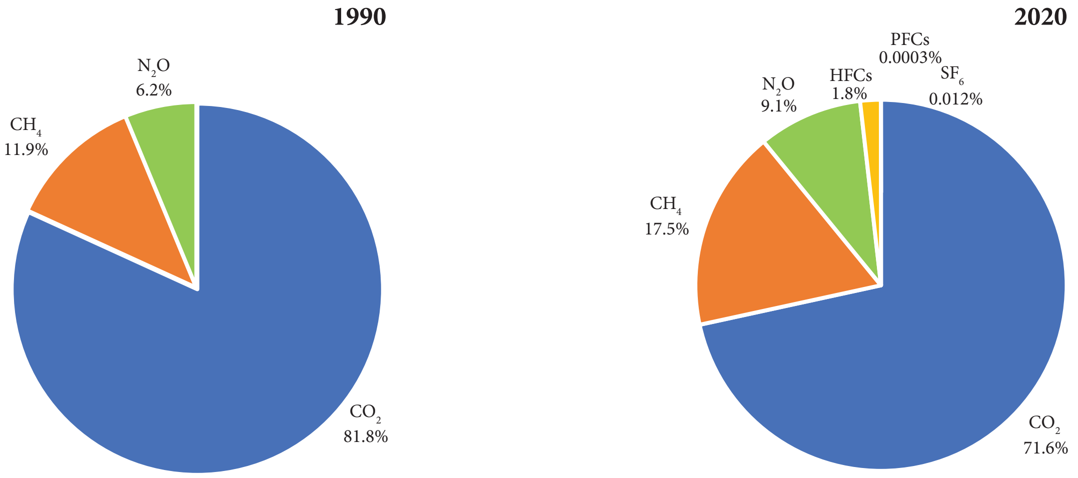


Figure 2-6: Direct GHGs share in the structure of total national GHG emissions in 1990 and 2020 years.

In 2020, the source categories with the highest weight in the structure of total carbon dioxide emissions were: 1A1 “Energy Industries” (37.8% of the total), 1A3 “Transport” (25.6% of the total), 1A4 “Other Sectors” (21.3% of the total), 4A “Forest Land” (-19.6% of the total), 4B “Croplands” (17.0% of the total), 1A2 “Manufacturing Industries and Construction” (8.3% of the total), 2A “Mineral Industry” (5.6% of the total), 4F “Other Land” (3.4% of the total), 4C “Grasslands” (-2.3% of the total), 2D “Non-energy Products from Fuels and Solvent Use” (2.0% of the total) and 4D “Wetlands” (-0.9% of the total) (Fig. 2-7).

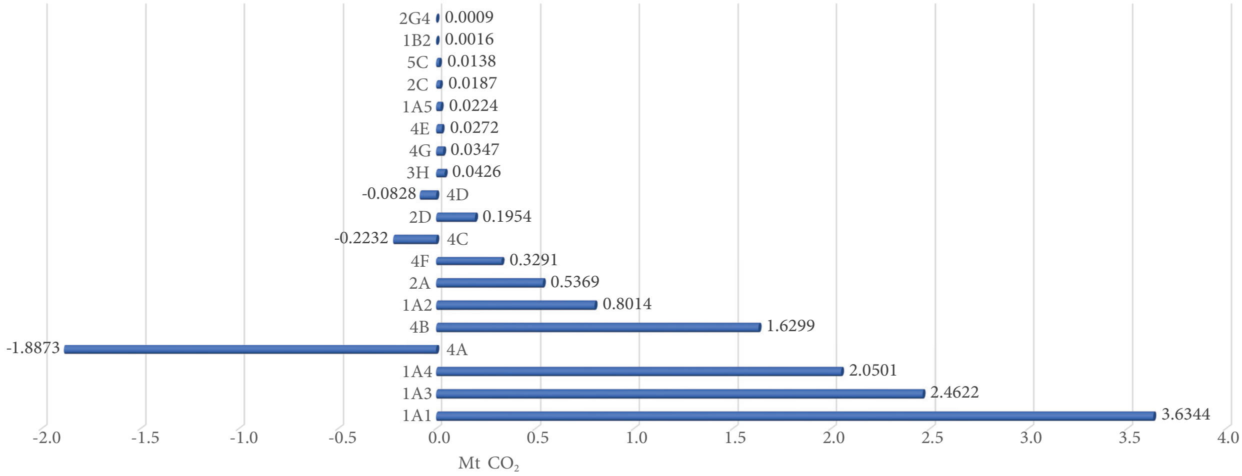


Figure 2-7: Source Categories of CO_2 in the Republic of Moldova in 2020.

The sources categories with the biggest share in the structure of total methane emissions in 2020 were: 5A "Solid Waste Disposal" (52.1% of the total), 3A "Enteric Fermentation" (16.3% of the total), 1B2 "Fugitive Emissions from Natural Gas" (10.0% of the total), 5D "Wastewater Treatment and Discharge" (9.9% of the total), 1A4 "Other Sectors" (8.9% of the total) and 3B "Manure Management" (1.9% of the total) (Fig. 2–8).

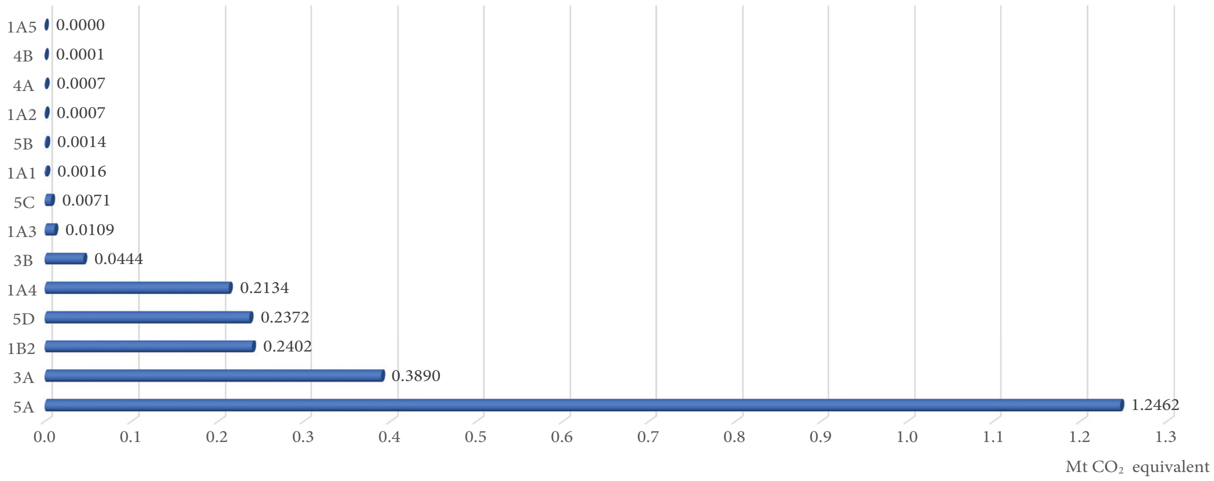


Figure 2-8: Source Categories of CH_4 in the Republic of Moldova in 2020.

In 2020, the source categories with the highest weight in the structure of total nitrogen oxide emissions were: 3D "Agricultural Soils" (64.1% of the total), 4E "Settlements" (11.9% of the total), 3B "Manure Management" (11.8% of the total), 1A4 "Other Sectors" (4.9% of the total), 5D "Wastewater Treatment and Discharge" (4.1% of the total) and 1A3 "Transport" (2.8% of the total) (Fig. 2-9).

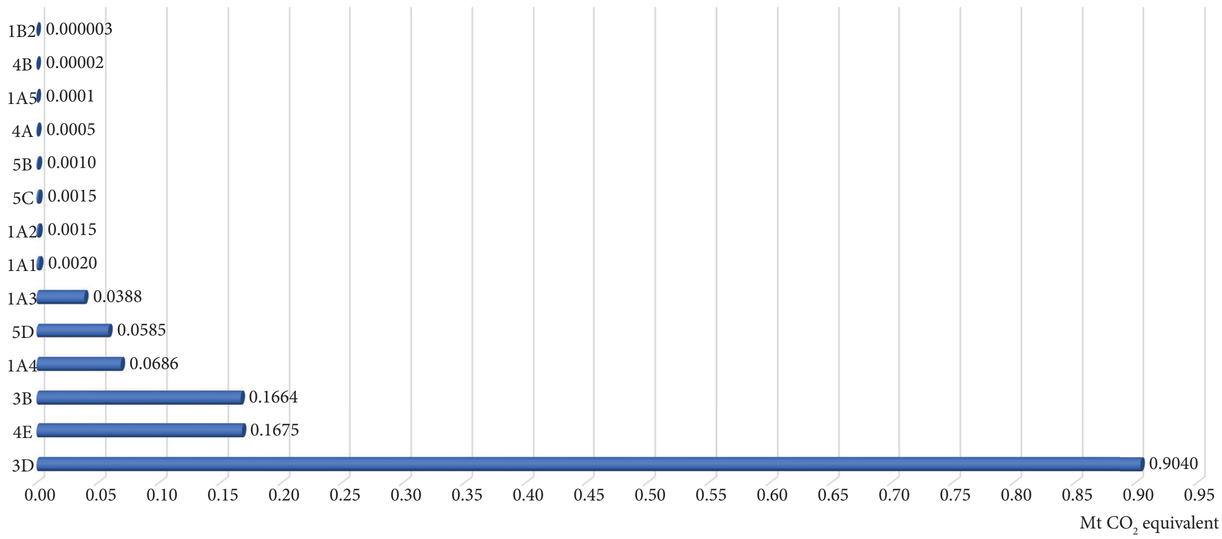


Figure 2-9: Source Categories of N_2O in the Republic of Moldova in 2020.

2.5.3. Emission Trends by Sources

Emissions estimates were grouped into five sectors: (1) "Energy", (2) "Industrial Processes and Product Use", (3) "Agriculture", (4) "Land Use, Land-Use Change and Forestry" (LULUCF) and (5) "Waste". Interpretation of GHG emissions inventory results under LULUCF Sector is different from other sectors: positive figures indicate that this sector is a net source of emissions, while negative figures state that the sector is a net sink of CO_2 removals.

In the period 1990-2020, total GHG emissions tended to decrease, thus, the emissions from the "Energy" sector decreased by about 74.2%, emissions from the "Industrial Processes and Products Use" sector – by about 37.8%, emissions from the "Agriculture" sector – by 69.5%, emissions from the "LULUCF" sector – by 99.8%, and emissions from the "Waste" sector – by 0.4% (Table 2–10).

Table 2-10: Direct Greenhouse Gas Emissions by Sector within 1990-2020, Mt CO_2 equivalent

	1990	1991	1992	1993	1994	1995	1996	1997
1. Energy	36.9929	31.2587	24.4198	18.2540	15.3780	12.3913	12.3740	11.1206
2. Industrial Processes and Products Use	1.6052	1.4113	0.8225	0.7379	0.5566	0.4567	0.4169	0.4548
3. Agriculture	5.0767	4.6954	4.2923	3.7546	3.4834	3.1734	3.0137	2.6246
4. LULUCF	-1.6575	-2.7216	-2.1161	-2.1392	-2.0731	-2.0311	-2.4767	-2.1157
5. Waste	1.5735	1.6044	1.6044	1.6619	1.6418	1.6373	1.6382	1.6305
	1998	1999	2000	2001	2002	2003	2004	2005
1. Energy	9.6520	7.6403	6.9409	7.5701	7.3557	8.0419	8.5459	8.8365
2. Industrial Processes and Products Use	0.3787	0.3422	0.3158	0.3198	0.3703	0.3986	0.4722	0.5731
3. Agriculture	2.5194	2.3069	2.1362	2.2282	2.2975	2.0642	2.0641	2.0632
4. LULUCF	-2.1358	-1.8442	-2.1233	-1.7670	-1.8543	-1.7848	-1.9579	-1.6675
5. Waste	1.6047	1.5988	1.5739	1.5459	1.5339	1.4992	1.4808	1.4785
	2006	2007	2008	2009	2010	2011	2012	2013
1. Energy	7.9821	8.1547	8.4509	8.8753	9.4964	9.7876	9.4652	9.0359
2. Industrial Processes and Products Use	0.6791	0.9373	1.0256	0.5303	0.5612	0.6649	0.6829	0.7332
3. Agriculture	2.0054	1.6241	1.6966	1.7252	1.8037	1.7402	1.6453	1.7747
4. LULUCF	-1.7934	-1.9892	-1.6836	-1.2950	-1.2282	-1.1699	-1.1991	-1.0710
5. Waste	1.4649	1.4525	1.4670	1.4788	1.5015	1.5104	1.4942	1.4355
	2014	2015	2016	2017	2018	2019	2020	%
1. Energy	9.0697	9.1196	9.2566	8.9249	9.4069	9.4014	9.5499	-74.2
2. Industrial Processes and Products Use	0.7602	0.7651	0.7469	0.7797	0.9647	0.9912	0.9988	-37.8
3. Agriculture	1.9740	1.7012	1.8267	1.8817	1.8373	1.7987	1.5464	-69.5
4. LULUCF	-0.7247	-1.1819	-0.9375	-0.9933	-0.8411	0.0133	-0.0035	-99.8
5. Waste	1.4237	1.4232	1.4499	1.5394	1.5552	1.5605	1.5666	-0.4

The energy sector is the largest source of total national direct GHG emissions, its share varying between 81.8% and 69.9% over the 1990-2020 period. Other relevant sources of direct GHG emissions are the agriculture, waste and IPPU sectors (Fig. 2–10). Throughout the period under review, with the exception of 2019, the LULUCF sector was a net source of carbon removal. With the decrease of national direct GHG emissions, the relevance of this sector in the structure of national net GHG emissions has shown a similar trend: in 1990, about 3.7% of total national GHG emissions were removed, while in 2020 only 0.03% of total national GHG emissions were captured.

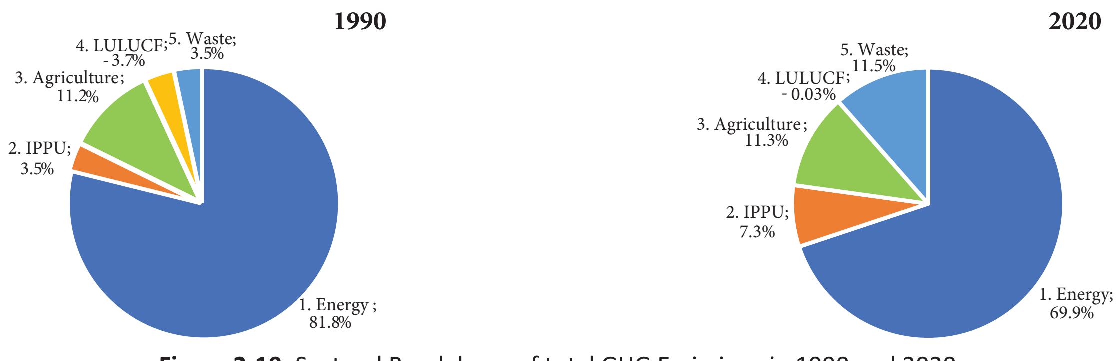


Figure 2-10: Sectoral Breakdown of total GHG Emissions in 1990 and 2020.

Energy Sector

In the Republic of Moldova, energy sector is the most important source of GHG emissions. It includes emissions from stationary and mobile fuel combustion for energy purposes (97.5% of total emissions per sector, in 2020), as well as fugitive emissions from production, processing, transport, storage, delivery and distribution of crude oil and natural gas (2.5% of total emissions per sector, in 2020) (Tab. 2-11, Fig. 2-11).

Together, these emissions accounted for about 69.9% of total national direct GHG emissions in 2020. In the period 1990-2020, total direct GHG emissions from the energy sector decreased by about 74.2%: from 36.99 Mt CO_2 equivalent in 1990 to 9.55 Mt CO_2 equivalent in 2020.

Table 2-11: GHG Emissions from Energy Sector within 1990-2020 periods, Mt CO_2 equivalent

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
1. Energy	**36.9929**	**12.3913**	**6.9409**	**8.8365**	**9.4964**	**9.1196**	**9.2566**	**8.9249**	**9.4069**	**9.4014**	**9.5499**
1A. Fuel Combustion	**36.0815**	**11.6525**	**6.2764**	**7.9877**	**8.8339**	**8.4764**	**8.5681**	**8.2046**	**8.7274**	**8.9297**	**9.3081**
1A.1. Energy Industries	21.3642	7.1924	3.1593	3.2333	4.0530	3.6881	3.6486	2.9995	3.2586	3.1275	3.6380
1A.2. Manufacturing Industries and Construction	1.9218	0.3870	0.5216	0.5774	0.5173	0.5184	0.4896	0.5028	0.5956	0.7200	0.8036
1A.3. Transport	4.8386	1.6603	1.0057	1.8670	2.1888	2.3078	2.4816	2.4634	2.5819	2.6654	2.5119
1A.4. Other Sectors	7.8413	2.2862	1.5529	2.2838	2.0474	1.9392	1.9253	2.1760	2.2678	2.3938	2.3321
1A.5. Other	0.1156	0.1265	0.0368	0.0263	0.0275	0.0229	0.0230	0.0227	0.0235	0.0230	0.0225
1B. Fugitive Emissions from Fuels	**0.9114**	**0.7388**	**0.6645**	**0.8488**	**0.6625**	**0.6433**	**0.6885**	**0.7203**	**0.6794**	**0.4717**	**0.2418**
1B.1. Solid Fuels	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1B.2. Oil and Natural Gas	0.9114	0.7388	0.6645	0.8488	0.6625	0.6433	0.6885	0.7203	0.6794	0.4717	0.2418
1C. CO_2 Transport and Storage	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**

Abbreviations: NO – Not Occurring.

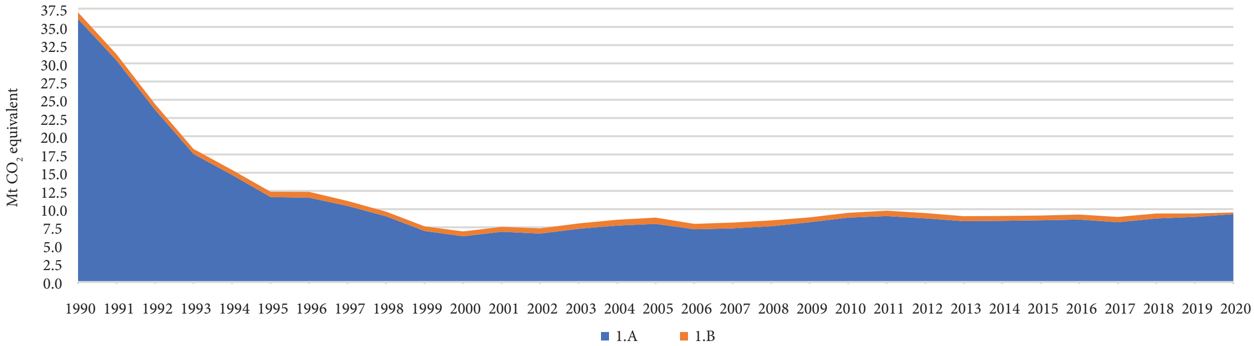


Figure 2-11: GHG Emissions from Energy Sector within 1990-2020 periods.

Within energy sector the most important category of sources is 1A1 "Energy Industries", with a share of about 38.1% of the total by sector, in 2020 (57.8% in 1990). Other relevant sources are represented by source category 1A3 "Transport" with a share of 26.3% of the total on by sector (13.1% in 1990), source category 1A4 "Other Sectors" with a share of about 24.4% of the total (21.2% in 1990) and source category 1A2 "Manufacturing Industries and Construction" with a share of about 8.4% of the total (5.2% in 1990) (Fig. 2-12).

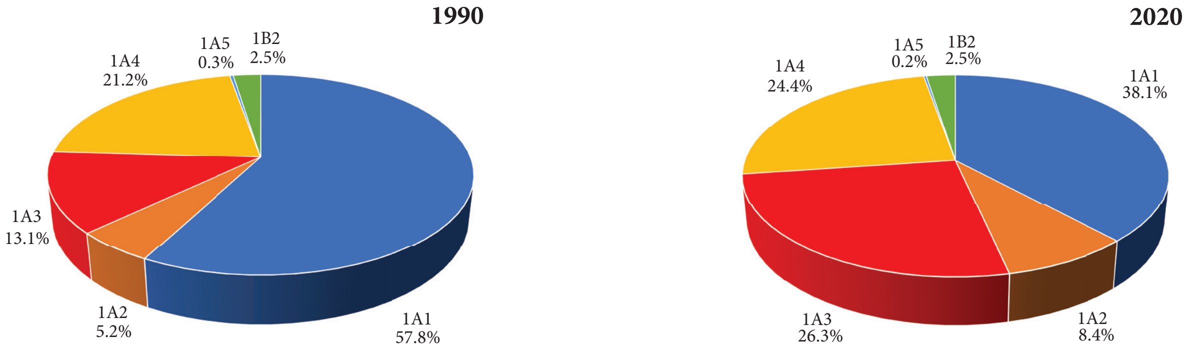


Figure 2-12: Energy Sector Greenhouse Gas Sources in 1990 and 2020 years.

Industrial Processes and Products Use Sector

IPPU sector is a relevant source of GHG emissions and includes emissions from non-energy industrial activities. In 2020, this sector accounted for about 7.3% of total national GHG emissions (3.5% in 1990). During the period 1990-2020, the total GHG emissions from this sector decreased by about 37.8%: from 1.6 Mt CO_2 equivalent in 1990 to 1.0 Mt CO_2 equivalent in 2020 (Tab. 2-12).

Table 2-12: Direct GHG Emissions from IPPU within 1990-2020, Mt CO_2 equivalent

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
2. Industrial Processes and Product Use	**1.6052**	**0.4567**	**0.3158**	**0.5731**	**0.5612**	**0.7651**	**0.7469**	**0.7797**	**0.9647**	**0.9912**	**0.9988**
A. Mineral Industry	1.3390	0.3517	0.2408	0.4392	0.4054	0.5042	0.4880	0.4756	0.5919	0.5937	0.5369
B. Chemical Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
C. Metal Industry	0.0285	0.0262	0.0363	0.0419	0.0097	0.0173	0.0052	0.0189	0.0202	0.0158	0.0187
D. Non-energy Products from Fuels and Solvent Use	0.2344	0.0766	0.0326	0.0682	0.0662	0.0846	0.0848	0.0970	0.1512	0.1436	0.1954
E. Electronic Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Product Uses as Substitutes for ODS	NO	0.0010	0.0051	0.0225	0.0782	0.1570	0.1667	0.1859	0.1989	0.2355	0.2453
G. Other Product Manufacture and Use	0.0034	0.0012	0.0010	0.0012	0.0017	0.0020	0.0022	0.0023	0.0024	0.0026	0.0026
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Abbreviations: NA – Not Applicable; NO – Not Occurring.

Between 2008 and 2009, those emissions were reduced by 48% as a consequence of the economic crisis that significantly affected the industrial sector of the RoM. Subsequently, over the period 2010-2020, direct GHG emissions from this sector tended to increase slightly, in particular as a result of the growth in cement, lime, glass, steel production and increased consumption of halocarbons. Between 2019 and 2020, the total GHG emissions from this sector increased by 0.8% (Fig. 2-13).

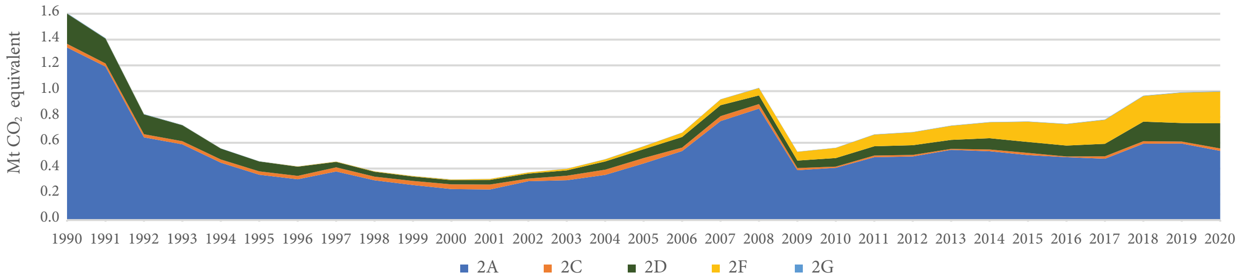


Figure 2-13: Total GHG Emissions from IPPU within 1990-2020 periods.

The most important source category in IPPU sector is 2A1 “Cement Production”, with a share of about 46.8% of the total by sector in 2020 (60.5% in 1990). Other categories of relevant sources in 2020 were represented by 2D3 “Solvent Use” with a share of 18.7% of the total (12.7% in 1990), 2F1 “Refrigerating and Air Conditioning Equipment” with a share of about 15.3% of the total, 2F2 “Foam Blowing Agents” with a share of 8.9% of the total, 2A3 “Glass Production” with a share of 3.3% of the total (1.7% in 1990), 2A2 “Lime Production” with a share of 2.1% of the total (16.5% in 1990), 2C1 “Iron and Steel Production” with a share of 1.9% of the total (1.8% in 1990) and 2A4 “Other Process Uses of Carbonates” with a share of 1.5% of the total (4.7% in 1990) (Fig. 2-14).

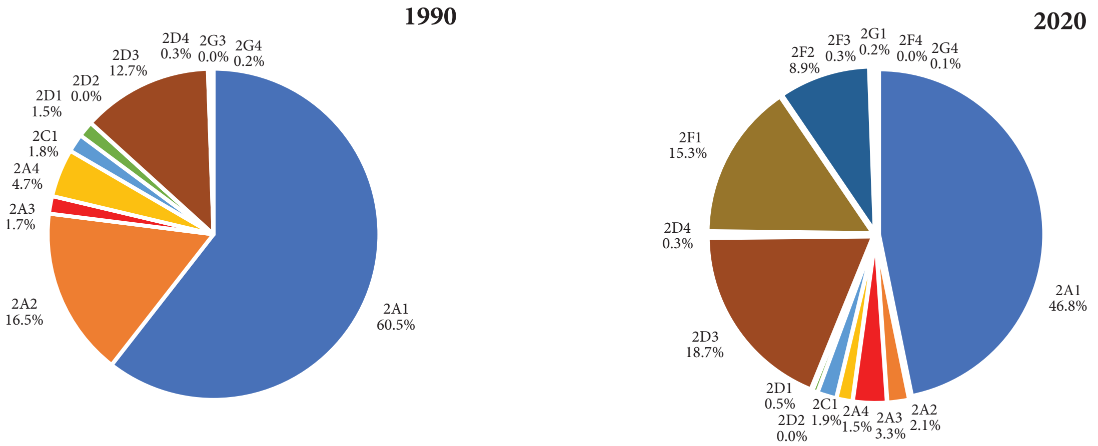


Figure 2-14: Breakdown of IPPU’s GHG Emissions by Category in 1990 and 2020 years.

Agriculture Sector

Agriculture sector is an important source of direct GHG emissions: methane emissions from ‘Enteric Fermentation’ (category 3A) and ‘Manure Management’ (category 3B); nitrous oxide emissions from ‘Manure Management’ (category 3B) and ‘Agricultural Soils’ (category 3D); and CO_2 emissions from ‘Urea Application’ (category 3H).

In the Republic of Moldova there are no emissions from source categories 3C ‘Rice Cultivation’, 3E ‘Prescribed Burning of Savannas’, 3G ‘Liming’, 3I ‘Other Carbon-Containing Fertilizers’ and 3J ‘Other’, and the emissions from ‘Field Burning of Agricultural Residues’ (category 3F) are monitored within LULUCF sector, under category 4B ‘Cropland’.

In 2020, agriculture sector accounted for about 11.3% of total national direct GHG emissions (11.2% in 1990). In the period 1990-2020, the total GHG emissions from this sector decreased by about 69.5%: from 5.08 Mt CO_2 equivalent in 1990 to 1.55 Mt CO_2 equivalent in 2020 (Table 2-13), mainly due to a sharp drop in such indicators as: livestock and poultry, amount of nitrogenous and organic chemical fertilizers incorporated in the soil, amount of agricultural crop residues returned to the soil and increase of carbon losses resulting from the change of agricultural land use.

Table 2-13: Direct GHG Emissions from Agriculture Sector within 1990-2020, Mt CO_2 equivalent

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
3. Agriculture	**5.0767**	**3.1734**	**2.1362**	**2.0632**	**1.8037**	**1.7012**	**1.8267**	**1.8817**	**1.8373**	**1.7987**	**1.5464**
A. Enteric fermentation	2.1894	1.6181	1.0858	0.9240	0.7082	0.6292	0.6220	0.5784	0.5165	0.4409	0.3890
B. Manure management	1.3948	0.7440	0.4189	0.4208	0.3796	0.3188	0.3213	0.3066	0.2697	0.2463	0.2108
C. Rice cultivation	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
D. Agricultural soils	1.4919	0.8113	0.6310	0.7182	0.7142	0.7420	0.8711	0.9706	1.0078	1.0719	0.9040
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
F. Field burning of agricultural residues	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
G. Liming	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
H. Urea application	0.0006	0.0001	0.0004	0.0002	0.0017	0.0112	0.0123	0.0262	0.0434	0.0396	0.0426
I. Other carbon-containing fertilizers	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Abbreviations: IE –Included Elsewhere; NO – Not Occurring.

Between 2019 and 2020, direct GHG emissions from agriculture sector decreased by about 14.0% (Fig. 2-15), mainly due to the unfavorable agrometeorological conditions caused by the severe drought that affected the Republic of Moldova, and the strong reduction of livestock and poultry.

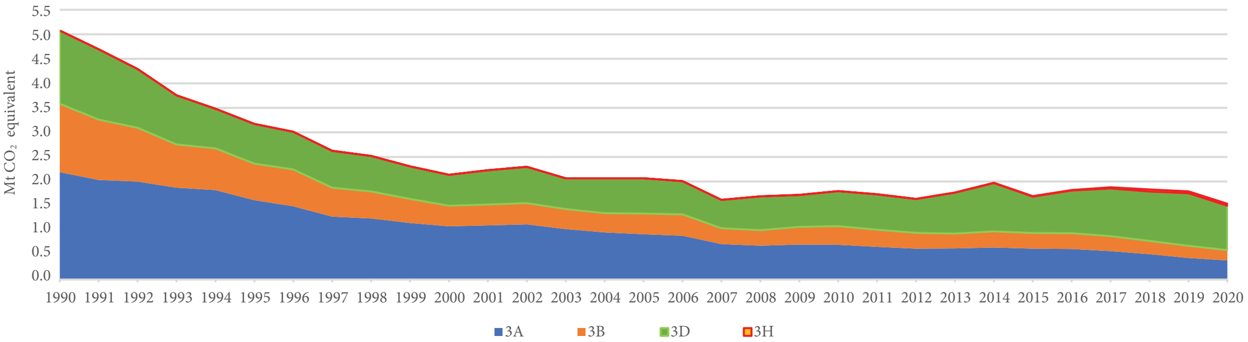


Figure 2-15: Total Direct GHG Emissions from Agriculture Sector within 1990-2020 periods.

In 2020, the most important category of sources was 3D 'Agricultural Soils', with a share of about 58.5% of the total by sector (29.4% in 1990). Other relevant source categories are represented by 3A 'Enteric Fermentation' with a share of 25.2% of the total (43.1% in 1990) and 3B 'Manure Management' with a share of about 13.6% of the total (29.4% in 1990). The share of category 3H 'Urea Application' for the time being is insignificant at sector level (Fig. 2-16), though showing a trend of steady growth.

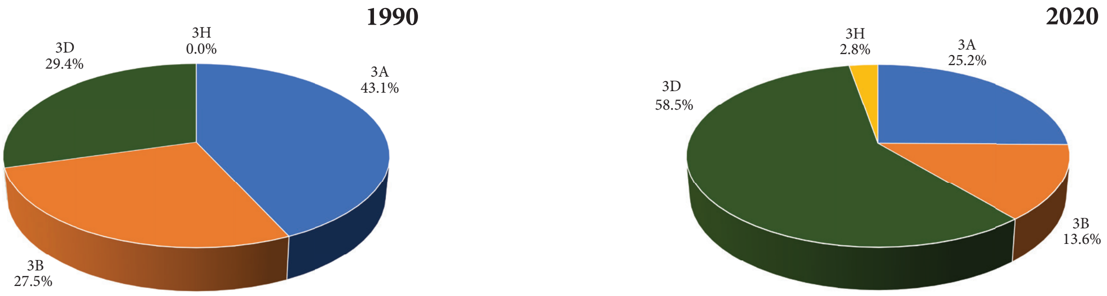


Figure 2-16: Breakdown of Agriculture GHG Emissions by Category in 1990 and 2020 years.

LULUCF Sector

Except for 2019, during the period 1990-2020, LULUCF sector was a source of net carbon removals in the Republic of Moldova. In 2019, this sector became a net source of emissions at national level. During the period 1990-2020, the dynamics of net CO_2 removals/emissions showed a decreasing trend, dropping by about 99.8%, from -1.6575 Mt CO_2 equivalent in 1990, to -0.0035 Mt CO_2 equivalent in 2020 (Table 2-14, Fig. 2-17).

Table 2-14: Emissions and removals in LULUCF sector in 1990-2020 periods, Mt CO_2 equivalent

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
4. LULUCF	**-1.6575**	**-2.0311**	**-2.1233**	**-1.6675**	**-1.2282**	**-1.1819**	**-0.9375**	**-0.9933**	**-0.8411**	**0.0133**	**-0.0035**
A. Forest Land	-2.5631	-2.0451	-2.3074	-2.4095	-2.4840	-2.1584	-2.1153	-2.0157	-1.9691	-1.9501	-1.8861
B. Cropland	2.3823	1.3197	1.2239	1.2720	1.2719	1.1127	1.1121	1.0897	1.2064	1.5075	1.6300
C. Grassland	-1.2057	-1.6011	-1.2919	-1.0581	-0.6920	-0.4185	-0.4024	-0.3840	-0.4402	-0.2933	-0.2232
D. Wetlands	-0.5554	-0.4694	-0.3284	-0.1874	-0.0464	-0.0828	-0.0828	-0.0828	-0.0828	-0.0828	-0.0828
E. Settlements	0.2542	0.3577	0.3962	0.3401	0.3037	0.2290	0.1984	0.2489	0.1869	0.2778	0.1947
F. Other Land	0.1524	0.4011	0.1785	0.4165	0.4415	0.0868	0.3516	0.2182	0.3212	0.6118	0.3291
G. Harvested Wood Products	-0.1222	0.0060	0.0058	-0.0411	-0.0228	0.0492	0.0009	-0.0674	-0.0635	-0.0576	0.0347
H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Abbreviations: NE – Not Estimated; NO – Not Occurring.

In particular, this is due to the change in the use and management practices of cropland (category 4B), which have led to a considerable reduction in organic carbon reserves in agricultural soils[54], thus changing the humus balance from

[54] The organic carbon and nitrogen in soil are highly dependent on the humus content in soil; carbon losses through the oxidation process due to changes in the use and management of agricultural soils are accompanied by simultaneous mineralization (biochemical decomposition) of nitrogen.

positive to negative and/or deeply negative one. This process was also influenced by some changes in forest management and use (category 4A), such as the increase of the authorized harvesting of wood, the substantial increase of illicit logging, increased conversion of cropland to forestland, etc.

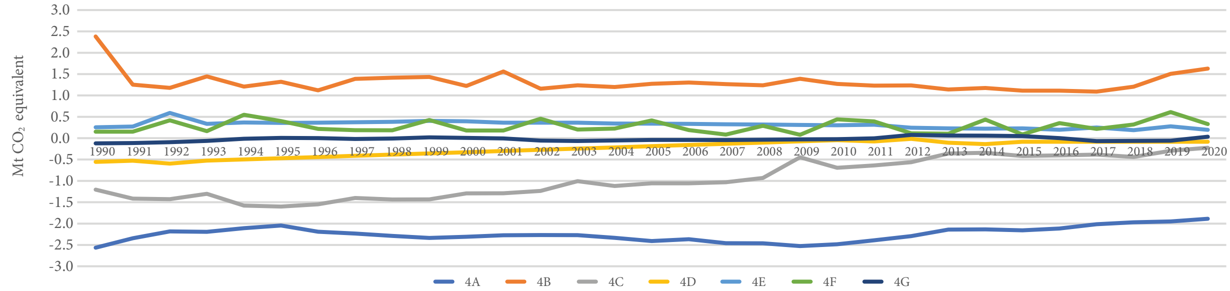


Figure 2-17: Direct GHG Emissions/Removals in LULUCF Sector by Source/Sink Categories within 1990-2020 period.

In 2020, the main sink of CO_2 removals in LULUCF sector was the category 4A 'Forest Land' (forest vegetation – forests, protection forest belts, etc.) with a share of 43.1% of the total (35.4% in 1990), followed by the category 4C 'Grassland' with a share of about 5.1% (16.7% in 1990) and category 4D 'Wetlands' with a share of about 1.9% (7.7% in 1990). Category 4B 'Cropland' is a net source of emissions in LULUCF sector, with a share of 37.2 % (32.9% in 1990), followed by category 4F 'Other Land', with a share of about 7.5% (2.1% in 1990) and category 4E 'Settlements', with a share of about 4.4% (3.5% in 1990) (Fig. 2-18).

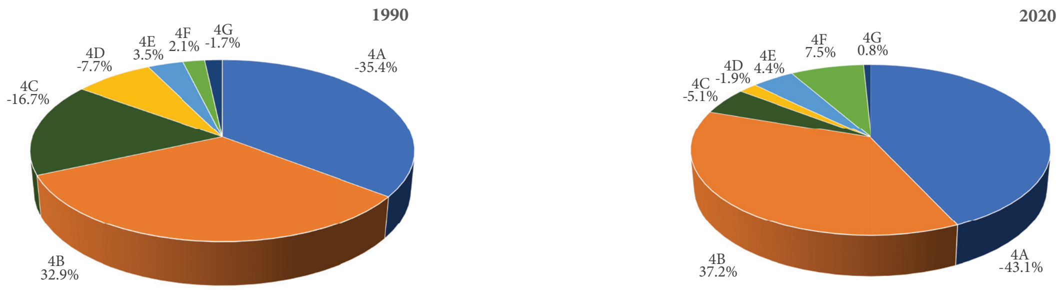


Figure 2-18: Breakdown of GHG Emissions and Removals by Source and Sink Categories in LULUCF Sector in 1990 and 2020 years.

Waste Sector

Waste sector is an important source of GHG emissions in the RoM: carbon dioxide emissions from the 'Incineration and Open Burning of Waste' (category 5C), methane emissions from 'Solid Waste Disposal' (category 5A), 'Biological Treatment of Solid Waste' (category 5B), 'Incineration and Open Burning of Waste' (category 5C) and 'Wastewater Treatment and Discharge' (category 5D), nitrogen oxide emissions from the 'Biological Treatment of Waste' (category 5B), 'Incineration and Open Burning of Waste' (category 5C) and 'Wastewater Treatment and Discharge' (human sludge) (category 5D). In the RoM there are no emissions from the source category 5E 'Other'.

In 2020, waste sector accounted for about 11.5% of total national direct GHG emissions (3.5% in 1990). In the period 1990-2020, total direct GHG emissions from this sector decreased by about 0.4%: from 1.5735 Mt CO_2 equivalent in 1990 to 1.5666 Mt CO_2 equivalent in 2020 (Table 2-15). Between 2019 and 2020, direct GHG emissions generated by waste sector increased by about 0.4%.

Table 2-15: GHG Emissions from Waste Sector within 1990-2020 periods, Mt CO_2 equivalent

	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020
5. Waste	**1.5735**	**1.6373**	**1.5739**	**1.4785**	**1.5015**	**1.4232**	**1.4499**	**1.5394**	**1.5552**	**1.5605**	**1.5666**
A. Solid Waste Disposal	1.1060	1.2561	1.2070	1.0936	1.1607	1.1045	1.1320	1.2209	1.2325	1.2392	1.2462
B. Biological Treatment of Solid Waste	0.0023	0.0011	0.0009	0.0010	0.0018	0.0022	0.0022	0.0025	0.0022	0.0022	0.0024
C. Incineration and Open Burning of Waste	0.0243	0.0245	0.0243	0.0234	0.0208	0.0215	0.0211	0.0237	0.0231	0.0226	0.0223
D. Wastewater Treatment and Discharge	0.4409	0.3557	0.3417	0.3604	0.3181	0.2950	0.2946	0.2923	0.2973	0.2964	0.2957
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Abbreviations: NO –Not Occurring.

Reduction of total GHG emissions from the waste sector, in particular until 2000, could be explained by the economic decline that occurred in the RoM during the respective period, by a significant drop in the wellbeing of population, and respectively, capacity to generate wastes. At the same time, starting with 2005, there has been a slight growing trend of direct GHG emissions (Fig. 2-19).

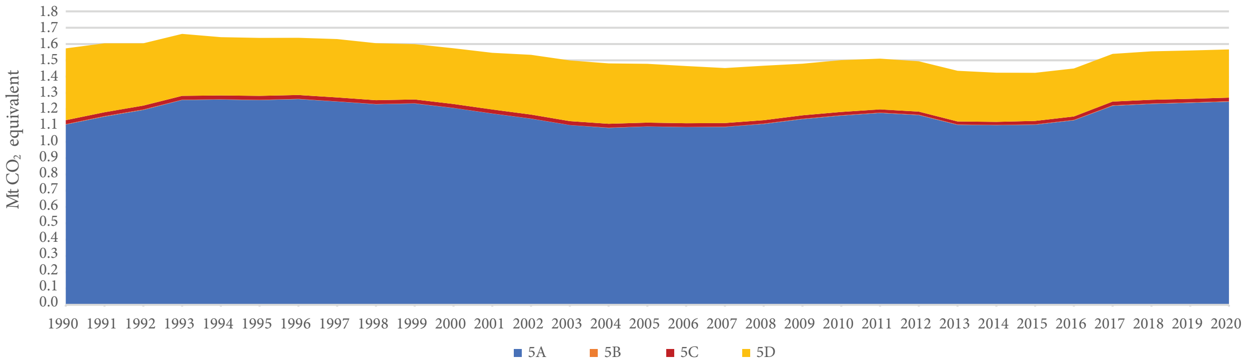


Figure 2-19: Total Waste Sector GHG Emissions Trends within 1990-2020 period.

In 2020, the most important category of sources in this sector was category 5A "Solid Waste Disposal", with a share of about 79.5% of the total by sector (70.3% in 1990), followed by category 5D "Waste Water Treatment and Disposal", with a share of about 18.9% of the total (28.0% in 1990), respectively category 5C "Incineration and Open Burning of Waste", with a share of about 1.4% of the total (1.5% in 1990) (Fig. 2-20).

Figure 2-20: Breakdown of Waste GHG Emissions by Category in 1990 and 2020 years.

2.5.4. Emission Trends for Ozone and Aerosol Precursors

Though not considered greenhouse gases, photochemically active gases like carbon monoxide (CO), nitrogen oxides (NO_x) and non-methane volatile organic compounds (NMVOC), have an indirect global warming effect. These gases are considered as ozone precursors influencing the formation and destruction of tropospheric and stratospheric ozone. In particular, they are emitted from transportation, fossil fuel combustion, consumption of solvents and other household products, etc. Thus, the national GHG inventory of the Republic of Moldova includes emissions of the following ozone and aerosol precursors: NOx, CO, NMVOC and SO_2.

In 1990-2020, total nitrogen oxides emissions decreased by about 74.4%: from 95.55 kt in 1990 to 24.47 kt in 2020, total carbon monoxide emissions decreased by about 49.3%: from 278.79 kt in 1990 to 141.37 kt in 2020, emissions of non-methane volatile organic compounds decreased by about 21.2%: from 141.57 kt in 1990 to 111.56 kt in 2020, and sulphur dioxide emissions decreased by about 97.1%: from 150.11 kt in 1990 to 4.29 kt in 2020 (Tab. 2-16).

Table 2-16: Ozone and Aerosol Precursors (NO_x, CO and NMVOC) and SO_2 Emission Trends in the RM within 1990-2020 period, kt

	1990	1991	1992	1993	1994	1995	1996	1997
NO_x	95.5512	78.4217	58.5033	46.5799	36.6026	30.8466	28.8884	25.9441
CO	278.7930	203.7123	130.6554	66.9326	74.0283	63.4598	76.6445	70.2812
NMVOC	141.5732	114.3401	90.3583	71.4281	52.6015	48.1949	46.5154	31.7581
SO_2	150.1134	124.4509	91.8546	72.3744	57.4117	31.8008	31.9788	16.7550
	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
NO_x	21.7918	15.9443	14.8007	16.1643	16.8895	17.9390	19.2975	19.9620
CO	54.3680	42.2865	39.9908	38.9542	45.4014	55.2136	52.5471	54.4534
NMVOC	27.7926	23.4240	22.9213	24.4817	26.8842	27.8119	39.4607	42.1519
SO_2	12.4820	5.9010	4.5137	3.9943	4.8222	6.3270	5.4764	5.1861
	2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
NO_x	19.0276	19.9797	20.8382	19.4561	21.4697	22.0956	20.9137	21.2070
CO	54.9733	49.6659	52.3467	50.6392	53.0984	55.8416	54.3956	55.1415
NMVOC	47.5410	47.4475	41.0502	35.9526	40.8386	43.5601	44.8404	43.8719
SO_2	5.3328	4.0330	5.6386	5.2233	5.3806	5.5088	5.5982	13.1659
	2014	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**%**
NO_x	20.9688	21.8663	22.5799	22.9189	24.8043	25.0238	24.4709	-74.4
CO	82.1869	86.7007	89.7942	112.6536	161.9930	146.6523	141.3672	-49.3
NMVOC	56.3396	54.1274	55.4061	64.7482	95.9239	90.1994	111.5648	-21.2
SO_2	5.3742	4.8979	4.0432	4.9513	4.4461	5.2165	4.2932	-97.1

In 2020, the source categories with the biggest share in the structure of total nitrogen oxides emissions were: 1A3 'Transport' (39.6% of the total), 1A4 'Other Sectors' (26.6% of the total), 1A1 'Energy Industries' (23.6% of the total), 2A 'Mineral Industry' (7.2% of the total) and 1A2 'Manufacturing Industries and Construction' (1.8% of the total) (Fig. 2-21).

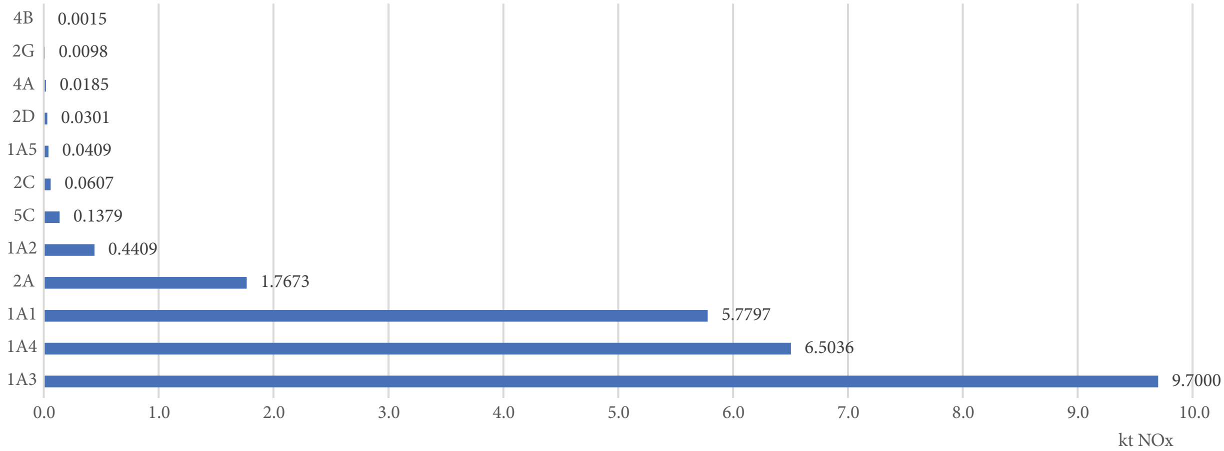


Figure 2-21: Source Categories of NO_x in the Republic of Moldova in 2020.

The source categories with the biggest share in the structure of total carbon monoxides emissions in 2020 were: 1A4 'Other Sectors' (80.1% of the total), 1A3 'Transport' (12.9% of the total), 1A1 'Energy Industries' (1.8% of the total), 5C 'Incineration and Open Burning of Waste' (1.7% of the total), 1A2 'Manufacturing Industries and Construction' (1.0% of the total) and 2A 'Mineral Products Industry' (1.0% of the total) (Fig. 2-22).

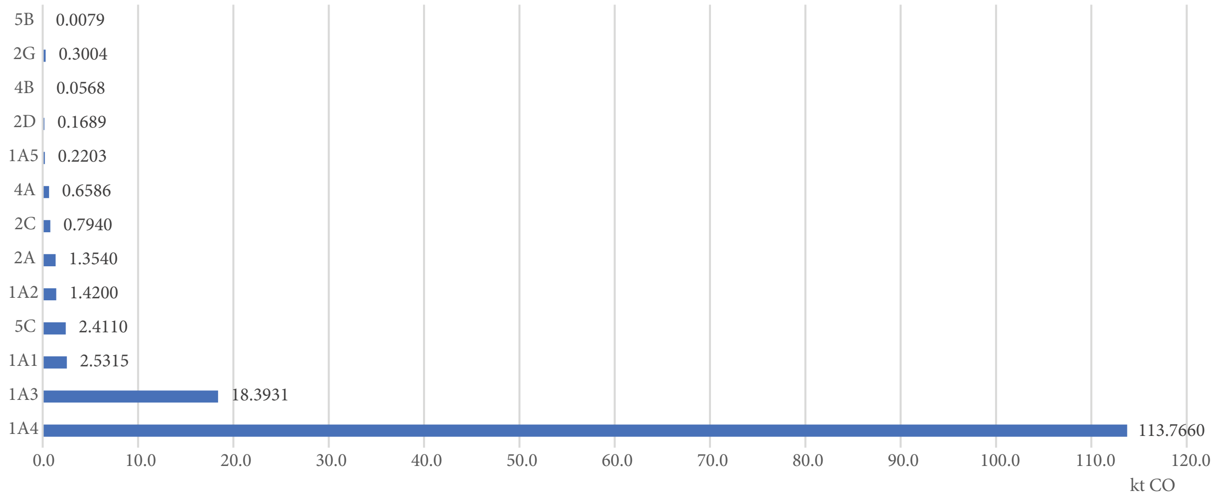


Figure 2-22: Source Categories of CO in the Republic of Moldova in 2020.

In 2020, the source categories with the biggest share in the structure of total emissions of non-methane volatile organic compounds were: 2D 'Non-energy Products from Fuels and Solvent Use' (76.1% of the total), 1A4 'Other Sectors' (15.2% of the total), 2H 'Other' (food products and alcoholic beverages) (3.1% of the total), 1A3 'Transport' (2.2% of the total) and 5A 'Solid Waste Disposal' (1.9% of the total) (Fig. 2-23).

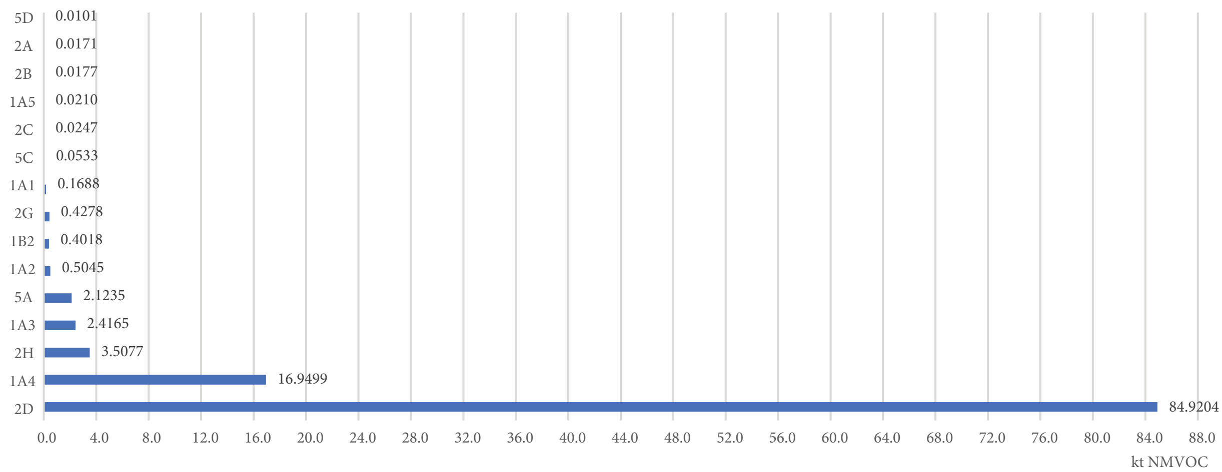


Figure 2-23: Source Categories of NMVOC in the Republic of Moldova in 2020.

The source categories with the biggest share in the structure of total SO_2 emissions in 2020 were: 1A4 'Other Sectors' (57.6% of the total), 1A2 'Manufacturing Industries and Construction' (18.1% of the total), 2A 'Mineral Industry' (17.6% of the total) and 1A5 'Other Works and Energy Needs' (4.6% of the total) (Fig. 2-24).

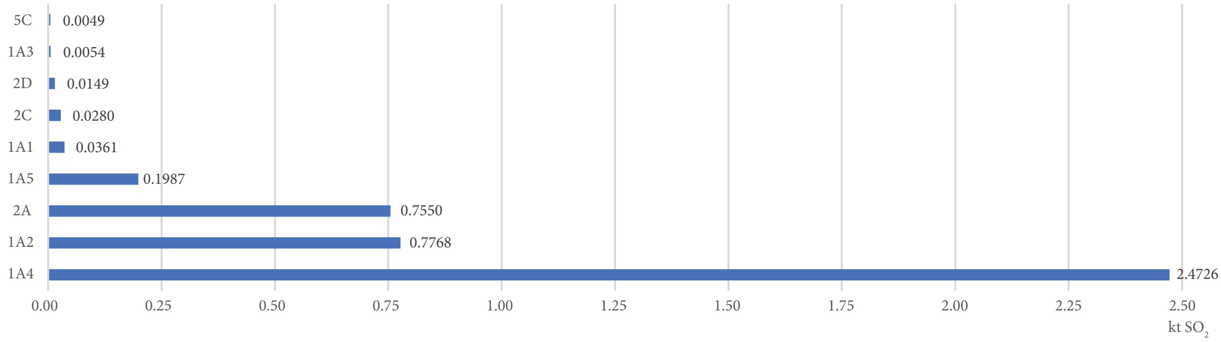
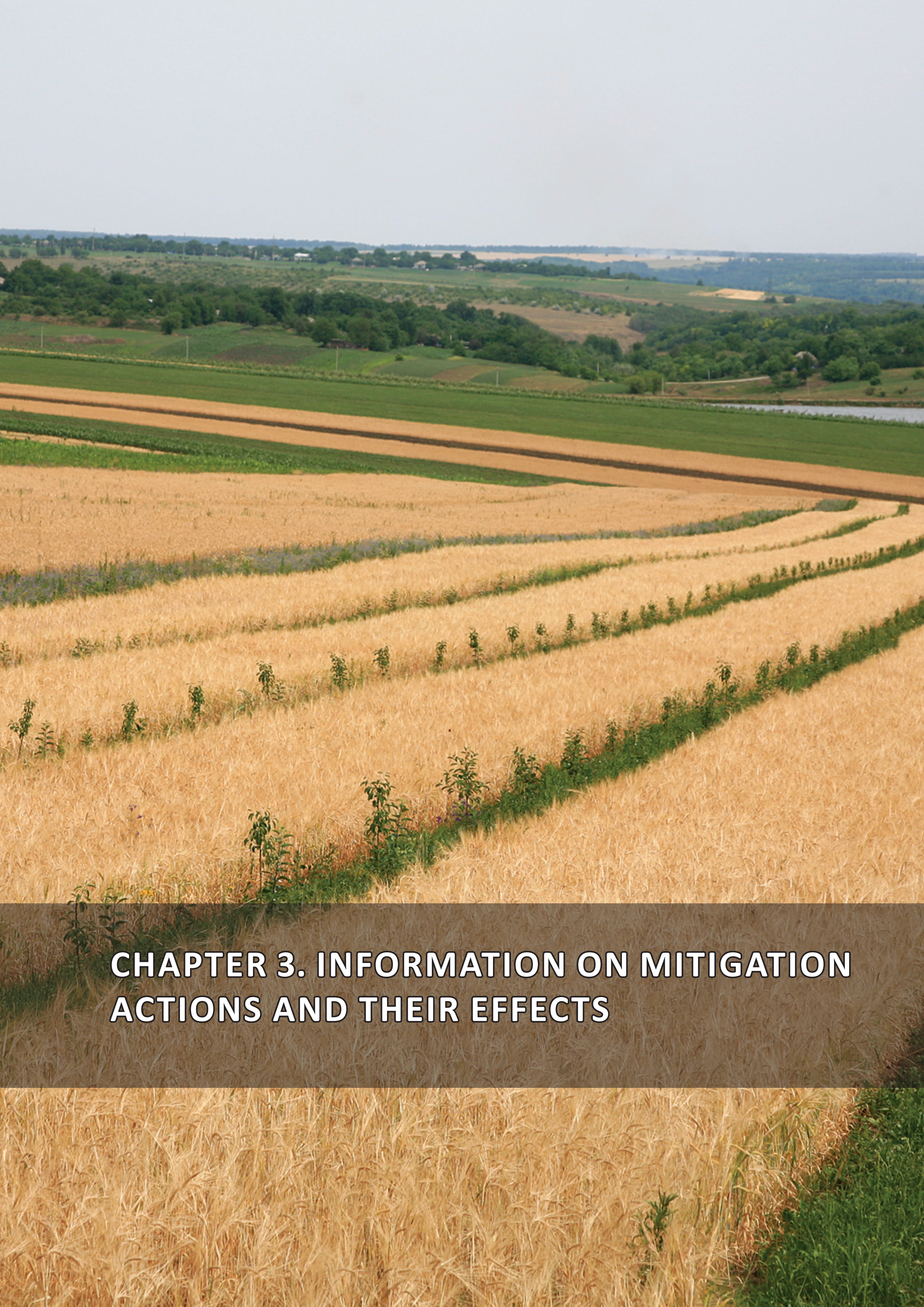


Figure 2-24: Source Categories of SO_2 in the Republic of Moldova in 2020.

CHAPTER 3. INFORMATION ON MITIGATION ACTIONS AND THEIR EFFECTS



CHAPTER 3. INFORMATION ON MITIGATION ACTIONS AND THEIR EFFECTS

3.1. Quantified Economy-Wide Emissions Targets

Paris Agreement (2015), ratified by the RoM by the Law no.78/2017[55], established an action plan to limit global warming below 2°C. In order to achieve the objective of the Paris Agreement (2015), all its signatory Parties shall communicate to the UNFCCC through the Nationally Determined Contributions (NDC) about the GHG emissions reductions efforts undertaken at national level. The RoM submitted the intended NDC to UNFCCC on 25 September 2015 by which the country committed to achieve the unconditional target of 64% greenhouse gas emissions reduction by 2030, compared to the baseline of 1990. The reduction commitment could be increased conditionally up to 78%, with donor support.

In order to achieve the NDC objectives, the Government developed and approved the Low Emission Development Strategy until 2030 (LEDS 2030) and the Action Plan for its implementation[56] in 2016.

According to the Decision 1/CP.21, the Parties to the Paris Agreement (2015) whose NDCs have the implementation deadline by 2030, have to update them by 2020, and shall do so every five years thereafter, in accordance with the requirements of Article 4, paragraph 9 of the Paris Agreement.

The NDA was updated and submitted to the UNSCC Secretariat on March 4, 2020[57]. In the updated NDC (2020), RoM intends to achieve more ambitious reduction targets than those included in the intended NDC (2015). The updated unconditional target provides for the reduction of GHG emissions by up to 70% by 2030 compared to the level of the 1990 reference year, instead of 64-67% assumed in the intended NDC. As regards the conditional target, instead of the 78% assumed in the intended NDC, the reduction commitment expressed above could be increased to 88% below 1990 level, provided external support is obtained, including in the form of financial resources at low costs, technology transfer and technical cooperation, etc.

As soon as the NDC had been updated with more ambitious GHG emission reduction targets, in April 2021 the RoM proceeded to development of the Low Emission Development Program until 2030 (LEDP 2030) and of the Action Plan for its implementation, which will replace the LEDS 2030 and will serve as a guide and officially approved document for achieving the targets stated in the updated NDC (2020). According to this, the following sectoral and intermediate GHG emission reduction targets are pursued to be achieved in comparison to the 1990 reference year level (Table 3-1).

Table 3-1: Sectorial targets for reducing GHG emissions, %

Sectors	By 2025		Until 2030	
	unconditionally	conditionally	unconditionally	conditionally
Energy	83	87	81	87
Transport	56	58	52	55
Buildings	76	78	74	77
Industry	34	37	27	31
Agriculture	48	50	44	47
LULUCF	-33	195	10	391
Waste	16	19	14	18
TOTAL	**71**	**83**	**70**	**88**

The LEDP 2030 will allow the RoM to adjust its development path towards a low-carbon economy and achieve a green sustainable development, based on the country's socio-economic and development priorities, outlined in the draft NDS "Moldova 2030"[58].

3.2. Activities Related to National Appropriate Mitigation Actions

In order to achieve the general and specific targets of the LEDP 2030, appropriate mitigation actions (technologies and/or measures) (NAMA) have been identified at national level for each sector under review (energy, transport, buildings, industry, agriculture, LULUCF and waste), prioritized with the participation of all stakeholders.

Actions are divided into three categories:

1. Unconditional (unilateral): mitigation actions undertaken on the country's own account;
2. Conditional (supported): mitigation actions supported by financing, technology transfer and capacity building from developed UNFCCC Annex 1 countries; and
3. Credited: mitigation actions with the potential to generate credits for the carbon market.

According to the LEDP 2030, the achievement of the unconditional target of the updated NDC (2020) is based on implementation of several NAMAs, 12 of which are registered in the NAMA Registry[59]. The list of NAMA's requiring implementation support, registered in the NAMA Register, was presented in Annex 3 of the BUR3 (2021). The largest contribution towards achieving the conditional objective of the updated NDC (2020) is expected to be received through the financial mechanisms of the Paris Agreement, including the Green Climate Fund (GCF). In this respect, the RoM's Country Program for projects supported by the Green Climate Fund during the period 2019-2024 was finalized in 2019[60]. This activity was carried out within the GCF Project "Support for the Republic of Moldova in establishing and strengthening the Designated National Authority (DNA), development of the strategic framework and development of the National

[55] The Law no. 78 of 04-05-2017 on Ratification of the Paris Agreement. Official Gazette no. 162-170 of 26.05.2017.
[56] Government Decision no. 1470 of 30.12.16 approving the Low Emission Development Strategy until 2030 and the Action Plan for its implementation. Official Gazette no. 85-91 of 24.03.2017.
[57] <https://www4.unfccc.int/sites/ndcstaging/Pages/LatestSubmissions.aspx>.
[58] Government Decision no. 377 of 10.06.2020 approving the Draft Law for on the National Development Strategy "Moldova 2030". Published in the Official Gazette no. 153-158 art. 508 on 26.06-2020. <https://www.legis.md/cautare/getResults?doc_id=121920&lang=ro>.
[59] <http://www4.unfccc.int/sites/nama/SitePages/NamaImplementation.aspx>
[60] <http://portal.clima.md/public/files/FS_Country_Programme_En.pdf>

Engagement Program with the GCF". In an aggregated form, the measures identified to achieve the updated NDC objectives are presented in Annex 2 of the BUR3, set out in the format specified in Annex III of the Decision 2/CP.17 of the Conference of the Parties in Durban. The financial, technology transfer and capacity building needs to achieve the updated NDC objectives are reflected in Chapter 9.

3.3. Clean Development Mechanism of the Kyoto Protocol

The Doha Amendment (2012) extended the applicability of the Kyoto Protocol (1997) to 2012-2020, and also set new GHG emission reduction commitments. The market GHG emissions reduction mechanisms established by the Kyoto Protocol, namely: emissions trading (carbon market) and joint implementation of projects (to encourage foreign investment and technology transfer), are also found in the Paris Agreement, during its period of action (2021-2030).

Regarding the Clean Development Mechanism (CDM) of the Kyoto Protocol, so far there have been ten requests to launch CDM projects, eight of which have been registered by the Executive Board of the CDM[61], all until 2012. Only two are still in progress. During the second implementation period (2012-2020) of the Kyoto Protocol, no new CDM project was submitted.

The RoM does not have a carbon trading market and a specially created budget for carbon reductions is not designated. In order to assess the possibility of creating such a market, a feasibility study was carried out[62]. It identified that the implementation of the EU GHG emissions trading scheme in the RoM will only be possible when it becomes a member of the EU[63].

3.4. Economic Instruments

Taxes and other economic instruments can play a significant role in achieving climate change objectives. They can provide incentives for behavior that protects or enhances the environment while discouraging actions with negative impact on the environment. Such an economic instrument as "taxes" contributes to the effective achievement of environmental objectives at low cost. Once the taxes are reflected in the prices of products and services, the latter signal out towards structural change in the economy, making it more sustainable. They can encourage innovation and the development of new technologies. The revenues from environmental taxes can then be used to reduce the level of other taxes, thereby helping to lessen distortions in the economy.

From other countries experience, an introduced tax must pass the test of success before it can get the green light in the long run. That is, it must be well-designed, to avoid accumulation of negative impacts in the future, which if do occur, should be minimal. Of course, the implications for international competitiveness must also be taken into account. Where environmental taxes meet these requirements, the Government should implement them.

[61] <https://cdm.unfccc.int/Projects/projsearch.html> (click "Database for PAs and PoAs").
[62] <http://www.undp.org/content/dam/moldova/docs/Publications/ETS_Feasibility_Study_UNDP.pdf>
[63] <http://www.mfa.gov.md/img/docs/Annex_6_to_zicress_Report.pdf>

To date, few such instruments have been used in the RoM, in particular to reduce GHG emissions. Thus, the Law on Environmental Pollution Payments[64], updated along the way, including in 2021, sets pollution payments in a way that they do not induce significant reduction of GHG emissions. For example, payment for emissions of pollutants from stationary sources covers a list of pollutants to which greenhouse gases do not belong. The tax for goods which, in the process of use (the Law does not specify separately the mobile sources) cause environmental pollution (hydrocarbons, used vehicles, fertilizers, etc., according to Annex 8[65] of the Law) is: (a) 0.6% of the customs value of imported goods and of those purchased from businesses on the territory of the RoM that do not have fiscal relations with the budgetary system, and (b) 0.6% of the value of the delivery, excluding VAT, of goods delivered by domestic producers.

The environmental pollution tax set for road transport[66] aimed at reducing carbon monoxide, but not carbon dioxide emissions. At the same time, the said Instruction was repealed in 2019.

In order to marginalize import of second-hand vehicles, which are regarded as high-rate sources of emissions, the Moldovan Parliament introduced an age limit for vehicles imported into the country[67]. Subsequently, the Law on the amendment of certain normative acts no. 257 of 16.12.2020[68], removed the restrictions related to the age of transport means imported into the Republic of Moldova, provided in the Customs Code. On the other hand, increased excise duties were set for transport means having an operation age of more than 10 years. The legislative amendments aim to stimulate import of new means of transport with a shorter exploitation term (less polluting) and, respectively, to discourage purchase of old vehicles (with a higher or increased pollution).

Aiming at coping with the increasing pollution from motor vehicles, the authorities have stepped in to halve customs duties on hybrid powered vehicles imported into the country. As a result, in 2017 every eighth car imported into the RoM was a hybrid car, and since 2020, imports of electrically powered means of transport have been exempted from VAT.

3.5. Policies and Measures to Mitigate Climate Change by Sectors

3.5.1. Energy Sector

The core document drawing up the policies in the energy sector is the Energy Strategy of the Republic of Moldova until 2030. Approved in 2013, the document contains concrete objectives only towards 2020, the fulfillment of which is reflected in Table 3-2.

[64] The Law on Environmental Pollution Payments, no.1540-XIII of 25.02.1998, Official Gazette no.54-55/378 of 18.06.1998.
[65] <http://lex.justice.md/UserFiles/File/2016/mo472-477md/an.8_1540.doc>.
[66] Instruction on calculation of environmental pollution payments when applying instrumental ecological control of the road transport means of 25.11.98. Official Gazette no.109-110/211 of 10.12.1998.
[67] The Law on the modification and completion of certain legislative acts, no.154 of 21.07.2005, Official Gazette of the Republic of Moldova no.126-128/611 of 23.09.2005 (the age limit for imported motor vehicles was increased from 7 to 10 years by the Law on amendment and completion of certain legislative acts, no.178 of 11.07.2012, the Official Gazette of the Republic of Moldova no.190-192/644 of 14.09.2012; however, higher taxes are charged for imported vehicles older than 7 years).
[68] <https://www.legis.md/cautare/getResults?doc_id=124566&lang=ro>.

Table 3-2: Status of reaching 2020 targets in the energy sector

Objectives	Targets by 2020	Status of implementation by the end of 2020	Comments, lessons learned
Energy security			
Implementation of energy interconnections	139 km power lines and 40 km natural gas pipelines	Power lines are being designed; natural gas pipelines are already built.	
Increasing domestic electricity generation capacity	Up to 800 MW	The need for capacity building is still being debated.	The target has been overestimated and a World Bank study in 2015 established that the most appropriate solution to achieve the country's energy security is to build interconnection lines with ENTSO-E. It is also worth noting that the construction of 800 MW of power plants on traditional fuels would have a negative impact on the achievement of the NDA's objectives.
2.2 Energy efficiency			
Reduction of energy intensity	By 10% compared to 2010	The energy intensity in 2010 was 0.6 toe/thousand. Euro, in 2017 – 0.35 toe/thousand. Euro, that's a 40% drop. The established trend allows us to consider that the target formulated for 2020 will be reached.	
Reducing losses in transmission and distribution networks	By up to 11% for electricity, 39% for natural gas and 5% for heat compared to 2010	The reduction of electricity losses in 2016 was 0.03 ktoe, while in 2018 – 0.2 ktoe; respectively, natural gas: 8.1 ktoe in 2016 and 6.3 ktoe in 2018; heat: 0 ktoe in 2016 and 0.24 ktoe in 2018. The established trend allows to consider that the targets formulated for 2020 will be achieved.	
Reducing energy consumption in buildings	20% compared to 2010	The reduction of energy consumption in buildings in 2016 was 43.2 ktoe, while in 2018 – 75.9 ktoe. The established trend allows to consider that the target formulated for 2020 will be reached.	
Rehabilitation of public buildings	Rehabilitation of 10% of public buildings	No data are available. But the reduction of energy consumption in the public buildings specified above demonstrates that the target will be achieved.	It is necessary to improve national statistics or to map the objectives in a format in which they can be monitored on the basis of the available information.
3. Development of RES for electricity production			
Stimulation of the use of energy produced from renewable energy sources in relation to total domestic gross consumption	20% of RES energy in total gross domestic consumption	27% were already registered in 2018. The 2020 target will be reached.	
Ensuring the use of biofuels	10% of total fuel used in transport sector	Information is not available. But there is a reduction in the amount of fuels consumed in the transport sector.	It is necessary to improve national statistics or to map the objectives in a format in which they can be monitored on the basis of the available information.
Increased production of electricity from renewable sources	Ensuring a 10% share of annual electricity production from renewable energy sources	A 2.6% share of the electricity demand covered by RES is expected to be reached by the end of 2020	GD no. 401/2021 on the approval of capacity limits[2] provides for the installation of 410 MW of renewable energy sources by 2025, including: 120MW of wind installations; 200MW – photovoltaic solar installations; 90MW – cogeneration installations on biogas and other renewable sources. Renewable electricity is expected to meet 25-30% of the country's electricity demand by 2025.
4. Reducing GHG emissions (compared to 1990)	By 25%	With 72.9% in 2016[3]. The 2020 target has already been overachieved.	

[69] <https://gov.md/sites/default/files/document/attachments/subiect-06-nu-419-midr.pdf >
[70] <http://www.clima.md/lib.php?l=en&idc=82&>

Below are presented the most relevant energy policies of the RoM in force, or in the form of projects in public debates, which may have or have an impact on the With Existing Measures (WEM) and With Additional Measures (WAM) scenarios regarding GHG emissions until 2035.

Energy Strategy of the Republic of Moldova until 2030, GD no. 102/2013[71]

Objective: The document provides concrete landmarks for the development of the energy sector in the Republic of Moldova, including in energy efficiency and development of renewable energy sources, and the objectives correspond to the NDS "Moldova 2020". The strategy has three main objectives: security of energy supply, given the country is importing about 74.6%[72] of the necessary energy resources; developing competitive markets and regional and European integration thereof; environmental sustainability and climate change control. "Environmental sustainability and climate change control" objective aims at increasing energy efficiency and use of renewable energy sources by creating a modern regulatory framework.

The objectives set for the period until 2020 are:

- reducing energy intensity by 20% by 2020;
- reducing losses in transmission and distribution networks: by up to 11% by 2020 for electricity; by 39% by 2020 for natural gas; by 5% by 2020 for heat;
- reducing greenhouse gas emissions by 25% by 2020;
- reducing energy consumption in buildings by 20% by 2020;
- the share of refurbished public buildings - 10% by 2020;
- ensuring a 10% share of annual electricity production from renewable energy sources by 2020;
- achieving a 10% share of biofuels in total fuels by 2020.

[71] <http://lex.justice.md/md/346670/>.
[72] Energy Balance of the Republic of Moldova. Statistical compilation 2016. National Bureau of Statistics of the Republic of Moldova, Chisinau, 2012. Chisinau, 2017.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory and economic

Status: ongoing since 2013

Start of implementation: 2013

Included in: With Existing Measures scenario (WEM)

Responsible entity: Ministry of Infrastructure and Regional Development (MIRD)

Monitoring and evaluation indicators: energy intensity; losses of power, gas and heat in transmission and distribution networks; GHG emissions; energy consumption in buildings; number of renovated public buildings; share of renewable electricity in demand coverage; share of biofuels in total fuels consumed in transport.

Mitigation impact: Reduction of GHG emissions (compared to 1990) by 25% in 2020

Estimated costs and benefits: 617.5 million Euro for the construction of 650 MW combined cycle power plan; other costs and benefits are not available.

***Capacity limits, maximum quotas and capacity categories in the field of electricity from renewable sources until 31 December 2025, GD no. 401/2021*[73]**

Objective: The project was developed to adjust the legal framework for the application/ implementation of the support schemes provided in Art. 34 of Law no.10/2016 on promotion of the use of energy from renewable sources to current conditions, specifically the fixed price, set by tendering, for eligible producers who own or will own power plants with a cumulative power higher than the capacity limit established by the Government, and fixed tariff, established and approved by ANRE for eligible producers who own or will own power plants with a cumulative power not exceeding the capacity limit established by the Government, but which must not be less than 10 kW.

The document provides for the allocation of new shares of renewable electricity generation capacity, for a longer period of time, namely until 2025, which will be supported by support schemes provided for by the framework law – fixed price and fixed tariff, respectively.

At the same time, the project provides for the allocation of shares of intermittent generation capacities, such as 310 MW photovoltaic and wind installations, as well as for non-intermittent technologies, such as 90 MW cogeneration and hydroelectric installations, for the announced period of time.

The draft decision and the related policies will have a positive impact on the economy and the state budget, with investments ranging from 400 to 800 million Euro to be mobilized by the private sector (potential investors), contributing also to the economic recovery by generating new revenues to the budget, creating new jobs, etc.

In the preparation of the project, the many policy documents and commitments in the field of energy or related issues were taken into account, such as climate change, environmental change, sustainable development of the national economy. According to them, RoM should take actions to confirm in fact the awareness about the importance of reducing greenhouse gas emissions, reducing the impact of the energy sector on the environment, the commitments made to population to ensure a sustainable development of the three elements behind the concept of sustainable development: (i) environment, (ii) society and (iii) economy.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: planning

Status: ongoing since 10.12.2021

Start of implementation: 2022

Included in: With Additional Measures scenario (WAM)

Responsible entity: MIRD

Monitoring and evaluation indicators: share of renewable resources in final electricity consumption.

Mitigation impact: Not available

Estimated costs and benefits: Based on the data provided by the relevant international institutions, the value of the investments necessary for construction of all the capacities proposed to be allocated by the Government, of the respective lot of generation units would range between 400 and 800 million Euro, depending on the interest in the development of projects, the cost of technologies and, implicitly, the effect of the "economy of scale".

***The Law on Labelling of Energy-related Products, no. 44/2014*[74]*, amended by the Law no. 79/2018*[75]**

Objective: Establish the regulatory framework for labelling and standard information on energy-related products

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory

Status: under implementation

Start of implementation: 2014

Included in: With Existing Measures scenario

Responsible entity: MIRD, Energy Efficiency Agency

Monitoring and evaluation indicators: labels and product sheets supplied and displayed by economic operators on the market.

Mitigation impact: not available

Estimated costs and benefits: not available.

The Environmental Strategy for 2014-2023 and the Action Plan for its implementation, GD no. 301/2014[76], amended by GD no. 1143/2018[77]

Objective: To reduce GHG emissions from the energy sector by at least 25%; to reduce GHG emissions from housing, industry and agriculture by 20%; to reduce GHG emissions from transport by 15%.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Policy category: Regulatory

Status: under implementation

[73] Government Decision no. 401 of 08-12-2021 approving the capacity limits, maximum quotas and capacity categories in the field of electricity from renewable sources valid until 31 December 2025. Published: 10-12-2021 in the Official Gazette no. 302-306 art. 684. <https://www.legis.md/cautare/getResults?doc_id=128987&lang=ro>

[74] <https://www.legis.md/cautare/getResults?doc_id=21702&lang=ro>.

[75] <https://www.legis.md/cautare/getResults?doc_id=106000&lang=ro>.

[76] <https://www.legis.md/cautare/getResults?doc_id=48131&lang=ro>.

[77] <http://lex.justice.md/md/378910/>.

Start of implementation: 2014

Included in: With Exiting Measures scenario

Responsible entity: Ministry of Environment

Monitoring and evaluation indicators: strategic, legislative and normative framework harmonized with the provisions of the EU environmental directives, approved and implemented; integrated environmental information system created and functional; new economic and fiscal environmental instruments developed and applied; integrated environmental monitoring system developed and applied; water supply and sewerage infrastructure ensured; year 2020: Euro 4 standard – applied to import of cars; year 2023: increase in the number of cars imported with hybrid and electric propulsion; share of biofuels in the total fuel consumption.

Mitigation impact: reduction of at least 20% of greenhouse gases by 2020 compared to the baseline scenario.

Estimated costs and benefits: reducing air pollution, greenhouse gas emissions and emissions from vehicles can bring annual benefits up to 2.5% of GDP; long-term economic benefits due to improvement of sewerage systems, wastewater collection and treatment would amount to 0.44% – 1.73% of GDP; 66.2 million lei in the transport sector, which will lead to carbon emissions reduction in this sector by 15% compared to the baseline scenario; about 329 million lei for the implementation of mitigation measures with direct or indirect impact on GHG emissions generated by the industrial sector.

The Law on Heating and Promotion of Cogeneration, no. 92/2014[78], amended by the Law no. 185/2017[79] and Law no. 74/2020[80]

Objective: the law regulates the activities carried out in the heat generation sector; establishes the principles and objectives of the state policy in the field of centralized heat supply systems; state management of the thermal power sector; reducing the negative impact of the thermal energy sector on the environment; the determination and approval of the regulated tariffs for thermal energy; the licensing of the activities carried out in the thermal energy sector, etc. Among the most important objectives of the Law are:

- promoting the production of heat in cogeneration mode;
- ensuring the security, quality and reliability of heat supply;
- ensuring affordability of heat tariffs for heat consumers;
- promoting district heating systems;
- efficient use of energy resources and reducing its impact on the environment.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory and economic

Status: under implementation

Start of implementation: 2014

Included in: with Existing Measures Scenario

Responsible entity: MIRD, EEA, local public administration authorities

[78] <https://www.legis.md/cautare/getResults?doc_id=48676&lang=ro>.
[79] <https://www.legis.md/cautare/getResults?doc_id=101154&lang=ro>.
[80] <https://www.legis.md/cautare/getResults?doc_id=121896&lang=ro>.

Monitoring and evaluation indicators: updated legal and regulatory framework; the power of thermal power plants refurbished into mini-CHPs; implemented contracts.

Mitigation impact: not available.

Estimated costs and benefits: not available.

The Law on Energy Performance of Buildings, no. 128/2014[81], amended by the Law no. 160/2016[82]

Objective: The Law promotes the improvement of energy performance of buildings and establishes requirements regarding: the general framework for the methodology for calculating the energy performance of buildings and their units; the application of minimum energy performance requirements for buildings; certification of the energy performance of buildings; periodic inspection of the heating and air-conditioning system in buildings; the respective monitoring systems, etc. After 30 June 2019, new public buildings must be nearly zero-energy buildings. After 30 June 2021, all new buildings must be buildings with almost zero energy consumption.

Certification of the energy performance of buildings is mandatory for:

a) new buildings and their elements;
b) existing buildings and their elements offered for sale or rent;
c) existing public buildings with a total useful area of over 500 m^2. With effect from 30 September 2016, the 500 m^2 threshold shall be reduced to 250 m^2;
d) existing buildings frequently visited by the public, with a total useful area of over 500 m^2. With effect from 30 September 2016, the 500 m^2 threshold shall be reduced to 250 m^2;
e) existing buildings and their elements undergoing major renovation;
f) existing public buildings that have an energy performance certificate and have undergone modifications (reconstructions, extensions, upgrades, etc.) that have significantly influenced their energy performance.

After 30 June 2019, new public buildings must be buildings with almost zero energy consumption. After 30 June 2021, all new buildings must be buildings with almost zero energy consumption.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory

Status: under implementation

Start of implementation: 2015

Included in: with Existing Measures scenario

Responsible entity: Specialized central body of the public administration in the field of construction, Energy Efficiency Agency, public authorities in the field of energy efficiency

Monitoring and evaluation indicators: updated legislative and normative framework; building construction and rehabilitation according to new requirements; building

[81] <https://www.legis.md/cautare/getResults?doc_id=21474&lang=ru#>
[82] <https://www.legis.md/cautare/getResults?doc_id=95000&lang=ru>

performance certificates developed; periodic inspection of implemented heating and air-conditioning systems.

Mitigation impact: not available.

Estimated costs and benefits: increasing the energy performance of buildings; costs are not available.

The Law on Promoting Use of Energy from Renewable Sources 10/2016[83], amended by the Law no. 34/2018[84]

Objective: The law creates the necessary framework for implementing Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promoting use of energy from renewable sources. It aims to establish a legal framework for the promotion and use of renewable energy. The document defines rules on support schemes, guarantees of origin, administrative procedures, access to networks for renewable energy producers. The Law provides for reaching by 2020 at least 17% share of energy from renewable sources in the gross final energy consumption, as well as at least 10% share of energy from renewable sources in the final consumption of energy in transport.

It is important to emphasize the RoM has approved the support scheme for renewable energy – capped price tenders, aiming at the lowest price and the latest technologies proposed by investors, with the obligation of suppliers to purchase the entire amount of energy produced by the eligible producer of renewable electricity.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory and economic

Status: under implementation

Start of implementation: 2018

Included in: With Existing Measures scenario

Responsible person: MIRD, ANRE, license holders

Monitoring and evaluation indicators: feed-in tariffs and cap prices; RES electricity capacity; number of eligible producers; number of consumers benefiting from net metering; quantity of renewable energy in the energy balance, including electricity, heat and biofuels produced from renewable sources.

Mitigation impact: not available

Estimated costs and benefits: reduction of environmental impact; increased energy security; costs not available

The Low Emission Development Strategy until 2030 and the Action Plan for its implementation, GD no. 1470/2016[85], as amended by the GD no. 738/2018[86] and GD no. 1143/2018[87]

Objective: The objective is in line with the one set in the intended Nationally Determined Contribution (2015) and is oriented towards the unconditional reduction, by 2030, of the total national emissions of net greenhouse gases by no less than 64% compared to 1990. The emission reduction target could be increased to 78% conditionally, provided external support is available.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory and economic

Status: under implementation

Start of implementation: 2017

Included in: WEM and WAM scenarios

Responsible entity: Ministry of Environment

Monitoring and evaluation indicators: According to the progress indicators in Annex 2 of the LEDS 2030

Mitigation impact: reduction of GHG emissions by sector, % compared to 1990, as follows:

Sectors	Until 2020		UNtil 2025		Until 2030	
	unconditionally	conditional	unconditionally	conditional	unconditionally	conditional
Energy	78	82	76	82	74	82
Transport	49	56	41	48	30	40
Buildings	78	79	79	81	77	80
Industrial music	58	62	51	59	45	56
Agriculture	48	50	43	45	37	41
LULUCF	12	18	43	54	62	76
Waste	23	26	46	51	38	47
TOTAL	**65**	**71**	**69**	**76**	**64-67**	**78**

Estimated costs and benefits: for the period 2021-2030 – 3.3 billion US dollars unconditionally and 2.5 billion US dollars conditionally.

Program for the promoting "green" economy for 2018-2020 and the Action Plan for its implementation, GD no. 160/2018[88]

Objective: to promote implementation of the "green" economy principles in the RoM in harmony with economic development and social welfare. The implementation of the Program will ensure the development of the necessary capacities of all those involved in the planned activities, by achieving the following specific objectives, by 2020:

1) ensuring conditions for good governance and strengthening of the institutional and management potential in promoting "green" economy by 30% at national level;
2) ensuring promotion of measures aimed at implementing the principles of the "green" economy, so that 17% of gross final energy consumption is derived from renewable energy sources and energy efficiency is improved by 8.2%;
3) ensuring the greening of about 30% of small and medium-sized enterprises through adequate support in the implementation of "green" economy principles;
4) ensuring promotion of organic farming by implementing the principles of "green" economy and extending the

[83] <https://www.legis.md/cautare/getResults?doc_id=98936&lang=ru#>
[84] <https://www.legis.md/cautare/getResults?doc_id=105420&lang=ru>
[85] <https://www.legis.md/cautare/getResults?doc_id=98493&lang=ro>
[86] <https://www.legis.md/cautare/getResults?doc_id=108888&lang=ro>
[87] <https://www.legis.md/cautare/getResults?doc_id=112021&lang=ro>
[88] <https://www.legis.md/cautare/getResults?doc_id=102127&lang=ro>

area of agricultural land used for organic farming by about 20%;

5) reducing air pollution by 30% through development of sustainable transport;
6) ensuring promotion of measures aimed at implementing the principles of "green" economy in construction by 15%;
7) ensuring the implementation of the principles of resource efficiency and clean production in about 30% of enterprises and organizations;
8) ensuring at least 15% of all public procurement corresponding to sustainable procurement criteria;
9) increasing knowledge about "green" economy and sustainable development among students by at least 30%;
10) raising public awareness about "green" economy and sustainable development by at least 30%;
11) setting up the system for monitoring green growth indicators.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory

Status: under implementation

Start of implementation: 2018

Included in: With Existing Measures scenario

Responsible entity: Ministry of Environment

Monitoring and evaluation indicators: GDP growth (%, in absolute values and *per capita*); greenhouse gas emissions; CO_2 emissions from all sources in relation to real GDP; final energy consumption; energy intensity; share of renewable energy in final energy consumption

Mitigation impact: not available.

Estimated costs and benefits: The general cost for the implementation of the Program is estimated at about 122.5 million lei.

***The Law on Energy Efficiency no. 139/2018*[89]**

Objective: creating the legal framework necessary for promoting and improving energy efficiency by implementing action plans in energy efficiency, by developing the energy services market, and by implementing other energy efficiency measures. In order to meet at least the minimum energy performance requirements, the annual public buildings renovation rate shall be 1% of the total area of state-owned public buildings, with a total usable area of over 250 m^2. The national objectives in energy efficiency for 2020 are set at a level that shall not exceed the final energy consumption of 2796 thousand tons of oil equivalent (ktoe) or 2968 ktoe primary energy.

[89] <https://www.legis.md/cautare/getResults?doc_id=105498&lang=ro>

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory

Status: under implementation

Start of implementation: 2018

Included in: With Existing Measures scenario

Responsible entity: MIRD, EEA

Monitoring and evaluation indicators: secondary legislation developed and approved, area of public buildings rehabilitated annually, final and primary energy consumption

Mitigation impact: not available

Estimated costs and benefits: not available.

***The program regarding the implementation of the obligation regarding the renovation of the buildings of the specialized central public administration authorities for the years 2020-2022, GD no. 372/2020*[90]**

Objective: The implementation in the period 2020-2022 of the necessary measures for the annual renovation of a rate of 1% of the total surface of the buildings in the public domain of the state, equivalent to the rehabilitation of an area of about 10,086 m^2

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory and economic

Status: under implementation

Start of implementation: 2020

Included in: With Existing Measures scenario

Responsible entity: MIRD

Monitoring and evaluation indicators: energy audits carried out annually, area of public buildings rehabilitated annually, achievement of estimated energy savings.

Mitigation impact: approx. 140.3 tones CO_2/year

Estimated costs and benefits: investments amounting to about 38 million lei; energy savings of about 694.9 MWh/year.

***National Energy Efficiency Action Plan for 2019-2021, GD no. 698/2019*[91]**

Objective: The energy efficiency objectives correspond to those in the table, ktoe

[90] <https://www.legis.md/cautare/getResults?doc_id=121818&lang=ro>
[91] <https://www.legis.md/cautare/getResults?doc_id=119890&lang=ro>

Indicators	Objectives according to Law no.139/2018		NEEAP objective 2019-2021
	2019	2020	2021
General objective, energy reductions	**144.4**	**167.2**	**193.6**
Government buildings (art. 14 of the Law 139/2018)	0.05	0.1	
Energy efficiency obligation scheme or alternative policy measures (Art. 8 of the Law 139/2018)	12.23	24.46	
Primary energy consumption	**2936**	**2968**	**2990**
Final energy consumption	**2723**	**2769**	**2808**
energy savings in final energy consumption – (residential) buildings	62.33	72.2	83.6
energy savings in final energy consumption – industry	12.96	15.0	17.0
energy savings in final energy consumption – transport	25. 92	30. 0	35.0
energy savings in final energy consumption – others (public sector)	43.18	50.0	58.0
Primary energy intensity, toe/thousand euro	**0.22**	**0.19**	**0.17**

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory and economic

Status: under implementation

Start of implementation: 2020

Included in: With Existing Measures scenario

Responsible entity: MIRD

Monitoring and evaluation indicators: area of rehabilitated residential and public buildings, energy savings by sectors

Mitigation impact: in 2019-2021 emissions reduction: in the residential sector by about 67.55 kt CO_2, in the public sector – by 68.96 kt CO_2, in the district heating supply system - by 13.88 kt CO_2

Estimated costs and benefits: investments of about MDL 1 billion/year; enhanced energy security; spending strategy for 2019-2021 provides a budget of about MDL 11,318 billion, distributed as follows: 2019 – MDL 3,722 billion; 2020 – MDL 3,875 billion; 2021 – MDL 3,721 billion.

***The Law on Ratification of the Loan Agreement between the Republic of Moldova and the International Bank for Reconstruction and Development on the Implementation of the Second Project for Improving the Efficiency of the District Heat Supply System, no. 193/2020*[92]**

Objective: Increasing the energy efficiency of Chisinau CHSS

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: economic

Status: under implementation

Start of implementation: 2020

Included in: With Existing Measures scenario

Responsible entity: MIRD

Monitoring and evaluation indicators: reconstruction of CHP-1, power of modular units based on internal combustion engines installed at HP-West and CHP-3, the number of individual heat points installed, the area of residential and public buildings with refurbished heat supply systems, the area of thermally rehabilitated residential and public buildings.

Mitigation impact: not available

Estimated costs and benefits: 92 million Euro.

***Law on Ratification of the Loan Agreement between the RoM and the EBRD for the implementation of the Project Thermal Energy System of Balti municipality ("CET-Nord SA") - Phase II, Presidential Decree no. 289/2021*[93]**

Objective: The project aims to increase the quality of the services provided to the inhabitants of the municipality by restoring the domestic hot water supply system, implementing the intra-block horizontal distribution system, ensuring the thermal comfort in the buildings by individual management of heat consumption, optimizing the operational costs, remote centralized control and monitoring, reducing the thermal energy losses, etc.

The investment will help alleviate infrastructure problems and promote systemic decarbonization. This will encourage reduction in electricity imports, leading to better energy security and significant savings in CO_2 emissions.

The new investment is based on the improvements achieved in the first stage of the project, completed in 2019, which led to a significant reduction in natural gas consumption, reduction of CO_2 emissions and better-quality district heating services.

The provisions of the project result from the need to fulfil the commitments undertaken by our country towards sustainable development, energy efficiency and achieve the objectives of the Energy Strategy of the Republic of Moldova until 2030.

Thus, for Project implementation purposes, the Republic of Moldova will contract a 15 million Euro loan from the EBRD, as well as a 2 million Euro grant from the Eastern Europe Partnership for Energy Efficiency and Environment (E5P).

The total budget of the Project is 17 million Euro, with an implementation period of 3 years (2022 – 2025).

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: economic

Status: in force since 24.12.2021

Start of implementation: 2022

Included in: With Additional Measures scenario

Responsible entity: MIRD and JSC 'CET-Nord'

Monitoring and evaluation indicators: energy efficiency in buildings, electricity and heat savings in buildings, losses in heat distribution networks.

Mitigation impact: Not available;

Estimated costs and benefits: Investments through energy efficiency measures in public buildings worth 75.5 million Euro. Monetary savings estimated at 5.2 million Euro/year (which could be excluded from the budgets of public institutions or could be directed by the management of these institutions to cover other needs).

***Decision on initiation of negotiations on the draft Financing Contract of the "Energy Efficiency in the Republic of Moldova" Project between the Republic of Moldova and the European Investment Bank and granting of powers for its negotiation, GD no. 218/2020*[94]**

Objective: To create a necessary financial instrument for the energy rehabilitation of the real estate fund of the RoM, comprising public buildings owned by central and local public authorities.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: economic

Status: approved

Start of implementation: as negotiated

Included in: With Additional Measures scenario

Responsible entity: MIRD

Monitoring and evaluation indicators: financing contract signed

[92] <https://www.legis.md/cautare/getResults?doc_id=124251&lang=ro>

[93] Decree of the President of the Republic of Moldova no. 289 of 22-12-2021 approving the signing of the Loan Agreement between the Republic of Moldova and the European Bank for Reconstruction and Development for the implementation of the Project "Thermal energy system of the Balti municipality ("CET-Nord" SA)" - Phase II. Published: 24-12-2021 in the Official Gazette no. 315-324 art. <https://www.legis.md/cautare/getResults?doc_id=110607&lang=ro>.

[94] <https://www.legis.md/cautare/getResults?doc_id=121088&lang=ro>

Mitigation impact: not available

Estimated costs and benefits: 75 million Euro; electricity savings – 16.8 GWh/ year; heat savings – 55.3 GWh/year; monetary savings – 5.2 million Euro/year; simple duration of recovery of the investment – 15.3 years.

The Draft Law on Approval of the NDS "Moldova 2030"[95], GD no. 377/2020[96]

Objective: to increase people's access to safe sources of water, energy, sewage systems, road infrastructure and information technology infrastructure; to facilitate creation of regional eco-energy centers to increase the level of energy autonomy locally by using renewable energy resources; to strengthen the district heating supply systems in urban areas; to create conditions for competitive energy markets development; to promote projects for efficient consumption of energy resources and use of renewable energy.

In this respect: universal access to adequate and equitable health conditions will be ensured for 65% of the population and communities by 2023, and by 2030 such access will be ensured for all, with particular focus on the needs of women and girls and persons in difficulty. The share of renewable resources in the final consumption of electricity, the intermediate targets for 2022, 2026, 2030, are 0%.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory

Status: approved

Start of implementation: 2022 (assumed)

Included in: With Additional Measures scenario

Responsible entity: MIRD

Monitoring and evaluation indicators: Share of renewable resources in the final consumption of electricity, availability of water supply and sewerage, level of energy efficiency, the extent of free energy markets openness

Mitigation impact: not available

Estimated costs and benefits: not available.

The Law on Environmental Protection, no. 1515/1993[97], the last amendment by the Law no. 253/2018[98]

Objective: approval of the annual limits for energy production and consumption, harmful emissions into the atmosphere from fixed and mobile sources; creating and ensuring the country's air quality monitoring system operation; ensuring the reduction of energy and fuel consumption in all fields of activity.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory and economic

Status: under implementation

Start of implementation: 1993

Included in: With Existing Measures scenario

Responsible entity: Ministry of Environment

[95] <https://gov.md/sites/default/files/document/attachments/intr40_12_0.pdf>
[96] <https://www.legis.md/cautare/getResults?doc_id=121920&lang=ro>
[97] <https://www.legis.md/cautare/getResults?doc_id=88192&lang=ro>
[98] <https://www.legis.md/cautare/getResults?doc_id=110599&lang=ro>

Monitoring and evaluation indicators: annual energy production and consumption limits developed and approved, annual allowable limits of harmful emissions into the atmosphere from fixed and mobile sources developed and approved, air quality monitoring system implemented.

Mitigation impact: not available.

Estimated costs and benefits: not available.

The Law on Environmental Pollution Payments no. 1540/1998[99], the last amendment by the Law no. 170/2019[100]

Objective: creating an economic activity system where it becomes inconvenient to cause any damage to the environment; to stimulate construction and operation of pollutants capturing and neutralization systems; to pool together ecological funds to finance activities aimed at improving the quality of the environment.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory and economic

Status: under implementation

Start of implementation: 1998

Included in: With Existing Measures scenario

Responsible entity: Ministry of Environment

Monitoring and evaluation indicators: financial means paid annually for the relevant imported goods.

Mitigation impact: not available.

Estimated costs and benefits: not available.

National Gasification Program, GD no. 1643/2002[101], as amended by the GD no. 1168/2007[102]

Objective: development of gas supply systems, gasification of settlements across the country, gas supply to consumers

GHGs targeted by the policy: CO_2, CH_4 and N_2O

Category of measure: regulatory and economic

Status: under implementation

Start of implementation: 2002

Included in: With Existing Measures scenario

Responsible entity: MIRD

Monitoring and evaluation indicators: number of gasified localities

Mitigation impact: not available

Estimated costs and benefits: not available.

Technical regulations "Efficiency requirements for new hot water boilers with liquid or gaseous combustion", GD no. 428/2009[103], amended by the GD no. 1088/2017[104] and GD no. 1089/2017[105]

Objective: Stability of energy efficiency requirements for new hot water boilers placed on the market running on liquid

[99] <https://www.legis.md/cautare/getResults?doc_id=66796&lang=ro#>
[100] <https://www.legis.md/cautare/getResults?doc_id=119646&lang=ro>
[101] <https://www.legis.md/cautare/getResults?doc_id=70171&lang=ro#>
[102] <https://www.legis.md/cautare/getResults?doc_id=24227&lang=ro>
[103] <https://www.legis.md/cautare/getResults?doc_id=60420&lang=ro#>
[104] <https://www.legis.md/cautare/getResults?doc_id=102431&lang=ro>
[105] <https://www.legis.md/cautare/getResults?doc_id=102365&lang=ro>

or gaseous fuels and having a rated output of 4 or more but not more than 400 kW.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory

Status: under implementation

Start of implementation: 2009

Included in: With Existing Measures Scenario

Responsible entity: Main State Inspectorate for Market Surveillance, Metrology and Consumer Protection; Main State Inspectorate for Technical Surveillance of Dangerous Industrial Objects.

Monitoring and evaluation indicators: performance of hot water boilers.

Mitigation impact: not available.

Estimation of costs and benefits: not available.

The Law on Accession of the RoM to the Energy Community Treaty no. 117/2009[106]

Objective: The task of the Energy Community shall be to set up relations between the Parties and to create a legal and economic framework for the Energy Network to improve the environmental situation, increase energy efficiency, promote the use of renewable energy and establish the conditions for trading energy in the single regulatory field[107]. Energy Network includes the electricity and gas sectors.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory and economic

Status: under implementation

Start of implementation: 2010

Included in: With Existing Measures scenario

Responsible entity: MIRD

Monitoring and evaluation indicators: extent of electricity and natural gas market opening; presence of renewable sources in demand coverage; energy efficiency indicators; fuel quality.

Mitigation impact: not available

Estimated costs and benefits: not fully established.

Regulation on Solid Biofuel, GD no. 1070/2013[108], amended by GD no. 738/2018[109]

Objective: Setting out the notions, classes and quality requirements, labelling requirements, as well as the conditions for placing on the market and supervision of biomass products, both domestic and imported, intended for use in households and small buildings in the residential, commercial and public sector.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory and economic

Status: under implementation

Start of implementation: 2014

Included in: With Existing Measures scenario

Responsible entity: MIRD

Monitoring and evaluation indicators: biofuel quality requirements

Mitigation impact: not available

Estimated costs and benefits: not available.

Creation of the energy statistics system, GD no. 141/2014[110], amended by the GD no. 45/2019[111]

Objective: to create an information technologies-based energy statistics system. The energy statistics system will have three main components:

- NBS component: historical energy balances and consolidated energy sector indicators, which are official energy statistics;
- component of the MIRD: energy balances for the next year and in the medium and long term, which are the official forecasts aimed at ensuring the national security of energy supply;
- component of the Energy Efficiency Agency: database on energy efficiency and renewable energy sources for monitoring and verification of the National Energy Efficiency and RES Action Plan.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory

Status: under implementation

Start of implementation: 2014

Included in: With Existing Measures scenario

Responsible entity: MIRD

Monitoring and evaluation indicators: energy balances and energy consumption forecasts

Mitigation impact: not available

Estimated costs and benefits: not available.

The Law on Environmental Impact Assessment, no. 86/2014[112], amended by the Law no. 185/2017[113]

Objective: establishment of a legal framework for the operation of the environmental impact assessment mechanism of some public and private projects or of some types of planned activities, to ensure the prevention or minimization, at the initial stages, of the negative impact on the environment and public health

GHGs targeted by the policy: CO_2, CH_4, N_2O

Policy Category: Regulatory

Status: under implementation

Start of implementation: 2015

Included in: With Existing Measures Scenario

Responsible entity: Ministry of Environment

Monitoring and evaluation indicators: evaluation procedures followed

Mitigation impact: not available

[106] https://www.legis.md/cautare/getResults?doc_id=110607&lang=ro
[107] <https://lege5.ro/Gratuit/he3tgnzv/tratatul-de-constituire-a-comunitatii-energiei-din-25102005>
[108] <https://www.legis.md/cautare/getResults?doc_id=18489&lang=ro#>
[109] <https://www.legis.md/cautare/getResults?doc_id=108888&lang=ro>
[110] <https://www.legis.md/cautare/getResults?doc_id=54245&lang=ro#>
[111] <https://www.legis.md/cautare/getResults?doc_id=112491&lang=ro>
[112] <https://www.legis.md/cautare/getResults?doc_id=21797&lang=ro>
[113] <https://www.legis.md/cautare/getResults?doc_id=101154&lang=ro>

Estimated costs and benefits: not available

The Law on eco-design requirements for energy-related products, no. 151/2014[114], amended by the Law no. 79/2018[115]

Objective: Transposition of Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of eco-design requirements for energy-related products

GHGs targeted by the policy: CO_2, CH_4 and N_2O

Category of measure: regulatory and economic

Status: under implementation

Start of implementation: 2015

Included in: With Existing Measures Scenario

Responsible entity: MIRD

Monitoring and evaluation indicators: Directive 2009/125/EC transposed into national law

Mitigation impact: not available

Estimated costs and benefits: not available.

National Action Plan for the Implementation of the Association Agreement between the RoM and the EU for the period 2017–2019, GD no. 1472/2016[116], as amended by GD no. 559/2019[117]

Objective: In the field of energy: developing strategies and policies, promoting energy efficiency, developing renewable energy sources economically and environmentally, reducing greenhouse gas emissions

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory and economic

Status: under implementation

Start of implementation: 2017

Included in: With Existing Measures scenario

Responsible entity: Ministry of External Affairs and European Integration

Monitoring and evaluation indicators: EU Directives transposed into national law

Mitigation impact: not available

Estimated costs and benefits: not available.

The Law on Energy, no. 174/2017[118], amended by the Law no. 238/2018[119]

Objective: sets the legal framework for the organization, regulation and assurance of the efficient and safe functioning of the energy sectors

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory and economic

Status: under implementation

Start of implementation: 2017

Included in: With Existing Measures scenario

[114] <https://www.legis.md/cautare/getResults?doc_id=48665&lang=ro>
[115] <https://www.legis.md/cautare/getResults?doc_id=105456&lang=ro>
[116] <https://www.legis.md/cautare/getResults?doc_id=102622&lang=ro#>
[117] <https://www.legis.md/cautare/getResults?doc_id=119036&lang=ro>
[118] <https://www.legis.md/cautare/getResults?doc_id=101612&lang=ro#>
[119] <https://www.legis.md/cautare/getResults?doc_id=109778&lang=ro>

Responsible entity: MIRD

Monitoring and evaluation indicators: clauses of the fulfilled law

Mitigation impact: not available

Estimated costs and benefits: not available.

Decision on the establishment and functioning of the National Monitoring and Reporting System of GHG emissions and other climate change relevant information, GD no. 1277/2018[120]

Objective: to implement the provisions of the UNFCCC, the Kyoto Protocol and the Paris Agreement

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory

Status: under implementation

Start of implementation: 2019

Included in: With Existing Measures Scenario

Responsible entity: Environment Agency, Ministry of Environment

Monitoring and evaluation indicators: Reports established by the UNFCCC developed and submitted

Mitigation impact: not available

Estimated costs and benefits: not available.

Decision on the establishment of the mechanism for coordinating activities in the field of climate change, GD no.444/2020[121]

Objective: establishment of the National Commission on Climate Change, its organization and functioning; of the cross-sector coordination mechanism; of the NAMAs coordination mechanism

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory

Status: under implementation

Start of implementation: 2020

Included in: WEM and WAM scenarios

Responsible entity: Ministry of Environment, PI “EPNIO”

Monitoring and evaluation indicators: actions developed, promoted and implemented

Mitigation impact: not available

Estimated costs and benefits: not available.

Roadmaps for the energy sector for 2015-2030, GD no. 409/2015

Objective: Creating the regulatory, institutional and organizational framework in the electricity sector and the natural gas sector; ensuring the security of electricity and natural gas supply

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory and economic

Status: under implementation

Start of implementation: 2015

[120] <https://www.legis.md/cautare/getResults?doc_id=112485&lang=ro>
[121] <https://www.legis.md/cautare/getResults?doc_id=122314&lang=ro>

Included in: With Existing Measures scenario

Responsible entity: MIRD, license holders in the electricity and natural gas sector

Monitoring and evaluation indicators: regulatory framework worked out and adopted; development of the electricity and gas market energy security; implemented interconnection projects; adherence to ENTSO-E and ENTSO-G, GHG emissions.

Mitigation impact: Greenhouse gas emissions will be assessed together with the implementation of Energy Package II and Energy Package III, respectively.

Estimated costs and benefits: Costs and benefits are not available, but will be estimated at the stage of implementation of interconnection projects and, respectively, upon increasing the electricity and gas system operation efficiency.

***Methodology for determining the fixed tariffs and the prices of electricity produced by eligible producers from renewable energy sources, approved by the Decision of the Board of Directors of ANRE no. 375/2017*[122]**

Objective: Establishing the principles and method of setting the cap prices and feed-in tariff for the electricity produced from renewable energy sources by eligible producers, who have been confirmed and granted the status of eligible producers, the manner of adjusting the feed-in tariffs and prices of electricity produced from renewable sources

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory and economic

Status: under implementation

Included in: With Existing Measures scenario

Start of implementation: 2018

Responsible entity: MIRD, eligible producers

Monitoring and evaluation indicators: feed-in tariffs and cap prices for electricity produced from renewable sources; GHG emissions

Mitigation impact: not available

Estimated costs and benefits: Costs and benefits are not available. They will be estimated at the stage of support schemes evaluation and implementation.

***Ratification of the Financing Contract between the RoM and the EIB for the implementation of the project "Energy Efficiency in the Republic of Moldova", GD no. 397/2021*[123]**

Objective: The project is geared towards creating a financial instrument necessary for the energy rehabilitation of the real estate fund of the Republic of Moldova, which includes public buildings owned by central and local public authorities, characterized by a low energy performance due to the age of the buildings, as well as the acute lack of investments in the consolidation and energy efficiency increasing works during exploitation.

In this regard, in order to implement the Energy Efficiency Project in the Republic of Moldova, the RoM shall contract a loan worth 30 million Euro from the EIB, another loan worth 30 million Euro from the EBRD, as well as a grant worth 15.5 million Euro from the European Commission's Neighborhood Investment Platform. Thus, the total budget of the Project is 75.5 million Euro, with an implementation period of 4 years (2022-2025).

The main category of Project beneficiaries will be public institutions, namely governmental public institutions of national importance (the socially important ones, such as republican/national hospitals) and public institutions of local/municipal importance (kindergartens, schools, hospitals).

The specific objectives of the Project are to improve the energy performance indicators of buildings, focusing on the improvement/rehabilitation of the building envelope, heating, ventilation and air conditioning systems, implementation of lighting systems, distribution of thermal energy and integration of renewable energy resources, when this is technically permissible.

These investments in energy efficiency measures will lead to smaller electricity/heat and natural gas consumption, which will result in GHG emissions reduction.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: economic

Status: in force since 10.12.2021

Start of implementation: 2022

Included in: With Additional Measures scenario

Responsible entity: MIRD

Monitoring and evaluation indicators: energy efficiency in buildings, electricity and heat savings in public buildings.

Mitigation impact: Not available;

Estimated costs and benefits: Investments through energy efficiency measures in public buildings worth 75.5 million Euro. Monetary savings estimated at 5.2 million Euro/year (which could be excluded from the budgets of public institutions or could be directed by the management of these institutions to cover other needs).

***The Government's Action Plan for 2021-2022, GD no. 235/2021*[124]**

Objective: The Government's Action Plan for 2021-2022 was developed to achieve the sustainable development objectives set out in the Governance Program "Moldova of Good Times", approved by the Parliament Decision no. 88/2021, as well as the international commitments of the RoM, in particular those deriving from the Association Agreement between the RoM, of the one part, and the European Union and the European Atomic Energy Community and their Member States, on the other part, and the 2030 Agenda for Sustainable Development.

[122] <//www.legis.md/cautare/getResults?doc_id=103972&lang=ro>.

[123] Government Decision no. 396 of 08-12-2021 on Ratification of the Financing Agreement between the Republic of Moldova and the European Investment Bank for the implementation of the "Energy Efficiency Project in the Republic of Moldova". Published: 10-12-2021 in the Official Gazette no. 302-306 art. 679. <https://www.legis.md/cautare/getResults?doc_id=128982&lang=ro>.

[124] Government Decision no. 235 of 13-10-2021 approving the Government's Action Plan for 2021-2022. Published: 05-11-2021 in the Official Gazette no. 266-272 Art. 541. <https://www.legis.md/cautare/getResults?doc_id=128407&lang=ro>.

The key energy objectives set out by the Government in this Action Plan are to create an efficient, sustainable and competitive energy sector that ensures the security of the country's energy supply. Policies promoted in the coming period in this area will focus on:

- development of the electricity sector;
- development of the thermal power sector;
- development of the natural gas and petroleum products sector;
- promoting energy efficiency and harnessing renewable energy sources.

The activities planned to achieve the objectives aim at: initiating the works related to construction of the overhead power line of 400 kV on the direction Vulcanesti – Chisinau and the back-to-back substation Vulcanesti; improving the efficiency of the district heating systems in the Chisinau and Balti municipalities; facilitating the transit of natural gas on the territory of the RoM; improving the support mechanisms for investments in renewable energy projects; launching the project "Energy efficiency in the Republic of Moldova"; development of the biomass sector, etc.

Product/result indicators:

- diversification of routes and sources of electricity supply in the RoM;
- diversification of the natural gas supply sources in the RoM;
- the number of final consumers connected to the natural gas networks and current level of access of the settlements in the RoM to the natural gas networks increasing by 1% by 2022 (compared to 61.6% in 2021);
- consumers connected/reconnected to district heating systems (SACET): 30 public buildings connected to SACET; 10 residential blocks connected to SACET; restoration of the domestic hot water delivery service in 150 residential blocks;
- energy rehabilitation of 12% of the heated area of public buildings (5 million m^2);
- 4% share of renewable resources in the final consumption of electricity by 2022 (compared to 1.95% in 2016).

One of the actions set in the field of natural gas sector development (Action 8.3.5) is the *carrying out a study on the feasibility of construction of underground natural gas storage on the territory of the Republic of Moldova*. Thus, in the long run, the current Government assesses the possibility of building an underground natural gas storage on the territory of the RoM, which will have a significant impact on the security of the country's continuous gas supply. At the same time, the existence of an underground natural gas storage facility on the territory of the RoM would directly lead to an increase of GHG emissions.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: planning

Status: in force since 05.11.2021

Start of implementation: 2022

Included in: With Additional Measures scenario

Responsible entity: Government of the Republic of Moldova, relevant Ministries

Monitoring and evaluation indicators: energy intensity; GHG emissions; energy consumption in buildings, the share of renewable resources in the final electricity consumption, consumers connected/reconnected to SACET, the number of final consumers connected to the natural gas networks and current level of access of localities in the RoM to the natural gas networks.

Mitigation impact: Not available

Estimated costs and benefits: Not available.

The Law on Electricity, no. 107/2016[125]

Objective: Establishes the conditions for priority access to the electricity grid of power plants, the conditions for the operation of interconnections as well as the liberalized electricity market

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory

Status: under implementation

Included in: With Existing Measures scenario

Start of implementation: 2016

Responsible entity: MIRD, license holders

Monitoring and evaluation indicators: approved regulatory acts; losses of electricity in electricity grids; GHG emissions; competition in the electricity market; electricity prices and tariffs; plans for the development of electricity grids; annual investments in power plants and grids.

Mitigation impact: not available

Estimated costs and benefits: not available.

The Draft Law amending the Law on Electricity no. 107/2016, adopted by the Parliament of the Republic of Moldova in plenary session of 21.01.2022[126] ***(extraordinary session)***

Objective: This project corrects an excessive and difficult to apply provision of the Law no.107/2016 on Electricity, Art. 84 para. (6), respectively, the amount of the financial guarantee to be submitted to S.E. "Moldelectrica" by the parties responsible for balancing. The proposal is detailed in Section 2.2. above and provides for the establishment of guarantees in a reasonable amount under the ANRE's control.

At the same time, this project provides for the transposition into national legislation of Art.13 of Directive 2009/72/EC. This takeover creates the possibility of certifying the electricity transmission operator S.E. "Moldelectrica" as ISO, the only separation model applicable under the conditions of maintaining the electricity transmission assets in the public domain of the state.

It also provides for the introduction of a mechanism to ensure the purchase of electricity from at least two sources, as a measure to increase security of electricity supply. As the general tendering rules provide for the designation of a single winner, in order to increase the security of electricity supply,

[125] <https://www.legis.md/cautare/getResults?doc_id=121988&lang=ro#>
[126] <https://www.parlament.md/SesiuniParlamentare/%c5%9eedin%c5%a3eplenare/tabid/128/SittingId/4510/language/ro-RO/Default.aspx>, item nr. 12.

a number of procedural elements have been imposed by the changes proposed in that project, which strike a balance between achieving the lowest costs and achieving a higher degree of security of electricity supply.

Thus, in Art. 68 paragraph (8), the single criterion of “minimum price” has been replaced by a cumulation of objectives pursued by the tender, including the objectives of supply security, thus creating the possibility of establishing multiple winners in the energy purchase tendering.

Art. 68 paragraph (81) stipulates the procedural elements which are in the competence of the National Agency for Energy Regulation. It will draw up an Instruction that will establish quantitative ratios to be purchased from the first two significant bidders, depending on the percentage difference between the offered prices (for example: if the difference in price between the first two bidders is below 5%, the contracted amounts will be at 70% - 30% ratio if the difference between the offered prices is 5 – 15%, the contracted amounts will be at 80% - 20% ratio, and if the difference is more than 30%, a single winner will be selected).

This change will reduce the amount of electricity produced by the MTPP (MGRES) Dnestrovsk by at least 20-30%, which will directly reduce the volume of natural gas used to produce this electricity by the largest consumer of natural gas in the Transnistrian region, and will also reduce GHG emissions in this region of the Republic of Moldova.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulation and competitiveness

Status: in force since 2022 (adopted on 21.01.2022)

Start of implementation: 2022

Included in: With Additional Measures scenario (WAM)

Responsible entity: MIRD and ANRE

Monitoring and evaluation indicators: energy intensity; energy losses in electricity grid, amount of electricity produced, purchased and consumed for the needs of the RoM.

Mitigation impact: The implementation of this Law will reduce greenhouse gas emissions in the Transnistrian region, due to the reduction of electricity produced by the MTPP (MGRES) by at least 20-30 %, which will reduce the amount of natural gas used to produce this volume of electricity by the largest consumer of natural gas in the Transnistrian region;

Estimated costs and benefits: Not available.

The Electricity Market Rules, approved by the Decision of the Board of Directors of ANRE no. 283/2020

Objective: Establishing the principles, conditions and deadlines for setting up and operation of the electricity market, the rights and obligations of the electricity market participants, the pricing rules and mechanisms and the relations between the electricity market participants, etc.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory

Status: under implementation

Included in: With Additional Measures scenario

Start of implementation: 2021

Responsible entity: ANRE, license holders

Monitoring and evaluation indicators: balancing electricity; import-export of electricity; GHG emissions; quantities of electricity traded on centralized markets; capacity of interconnections

Mitigation impact: not available

Estimated costs and benefits: not available.

Methodology for calculating, approving and applying the regulated prices and tariffs for electricity and thermal energy production, for heat distribution and supply services, approved by the ANRE's Board of Directors Decision no. 396/2019[127]

Objective: Establish the manner of calculation, approval and application of regulated prices and tariffs for the electricity and heat produced by district heating plants

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory and economic

Status: under implementation

Included in: With Existing Measures scenario

Start of implementation: 2019

Responsible entity: ANRE, license holders in the thermal energy sector

Monitoring and evaluation indicators: tariffs for electricity produced by district heating plants, tariffs for heat production; tariffs for heat distribution and supply service; tariffs for heat delivered to consumers; GHG emissions.

Mitigation impact: not available.

Estimated costs and benefits: not available.

The Law on Amendment of Certain Legislative Acts, no. 257 of 16.12.2020[128]

Objective: Removal of restrictions related to the operating age of the transport means imported into the Republic of Moldova, provided for in the Customs Code. At the same time, the excise duties for transport means with an operating age between 8-10 years were increased, and new excise duties were established for transport means with an operating age exceeding 10 years. Thus, according to the presented arguments, these amendments aimed at ensuring stimulation of imports of new vehicles with a shorter operating period. Before this amendment, the following limits related to the vehicles term of operation were in force:

a) 10 years – motor vehicles for transporting more than 20 persons, motor vehicles for transporting goods and those for special uses;
b) 12 years – for other types of tractors;
c) 20 years – for agricultural and forestry tractors;
d) 10 years – cars;
e) 7 years – vehicles for transportation of maximum 20 persons;
f) 10 years – motorcycles

[127] <https://www.legis.md/cautare/getResults?doc_id=119203&lang=ro>.
[128] <https://www.legis.md/cautare/getResults?doc_id=124566&lang=ro>

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory and economic

Status: under implementation

Start of implementation: 2021

Included in: With Additional Measures scenario

Responsible entity: Customs Service of the Republic of Moldova

Monitoring and evaluation indicators: number and age of vehicles imported into the country

Mitigation impact: not available

Estimated costs and benefits: not available.

The Transport and Logistics Strategy until 2022, GD no. 827 of 28.10.2013[129]

Objective: Creating an efficient transport and logistics system that supports the population's needs for mobility and facilitates trade on domestic and international markets.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory and economic

Status: under implementation

Start of implementation: 2013

Included in: With Existing Measures scenario

Responsible entity: MIRD

Monitoring indicators: average operating costs of vehicles on the road network reduced from current 2.88 lei/km (0.18 euro/km) to 2.72 lei/km (0.17 euro/km) for cars; from 12.8 lei/km (0.80 euro/km) to 11.2 lei/km (0.70 euro/km) for trucks. Good, mediocre, properly maintained roads.

Mitigation impact: not available

Estimated costs and benefits: the estimated cost of the Strategy implementation is 2,405.27 million Euro, including 2,047.00 million Euro in the road sector; benefits - reduction of the operating costs of the transport sector.

The Law on modification and completion of certain legislative acts, no. 171 of 19.12.2019[130]

Objective: Reduce excise duty from 50% to 25% for hybrid cars that do not have the capacity to load from the power grid. For micro hybrid and mid hybrid cars the reduced rate of excise duty of 25% is no longer applicable.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory and economic

Status: accomplished

Start of implementation: 2020

Included in: With Existing Measures scenario

Responsible entity: Customs Service

Monitoring indicators: number of imported hybrid vehicles

Mitigation impact: not available

Estimated costs and benefits: not available.

The Law on modification and completion of certain legislative acts, no. 170 of 19.12.2019[131]

Objective: Maintaining the reduced 50% rate only for hybrid vehicles that have the capacity to be charged from the electricity network; applying the VAT exemption to electric vehicles imported in the country

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory and economic

Status: accomplished

Start of implementation: 2020

Included in: With Existing Measures scenario

Responsible entity: Customs Service

Monitoring indicators: number of electric vehicles imported into the country

Mitigation impact: not available

Estimated costs and benefits: not available.

Regulation on measures to reduce emissions from air conditioning systems of motor vehicles, GD no. 1242 of 14.11.2016[132]

Objective: Partial transposition of Directive 2006/40/EC of the European Parliament and of the Council of 17 May 2006 relating to emissions from air-conditioning systems in motor vehicles and amending Council Directive 70/156/EEC; prohibition of the charging of motor vehicles with fluorinated gases with a GWP 100 greater than 150 except for the recharging of air-conditioning systems containing such gases which were fitted to vehicles before 1 January 2021.

GHGs targeted by the policy: SF_6

Category of measure: regulatory and economic

Status: under implementation

Start of implementation: 2017

Included in: With Existing Measures scenario

Responsible entry: Ministry of Environment

Monitoring indicators: import of F-gases with a GWP 100 greater than 150

Mitigation impact: not available

Estimated costs and benefits: not available.

The Program for promoting "green" economy in the Republic of Moldova for 2018-2020 and the Action Plan for its implementation, GD no. 160 of 21.02.2018[133]

Objective: to promote "green" economy, including by 2020: 17% of gross final energy consumption to come from RES, 8.2% from energy efficiency

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of the measure: economic

Status: under implementation

Start of implementation: 2019

Included in: With Existing Measures scenario

Responsible entity: MIRD, MM

Monitoring indicators: energy intensity, share of renewable energy in final energy consumption, greenhouse gas emissions, CO_2 emissions in relation to real GDP

[129] <http://lex.justice.md/viewdoc.php?action=view&view=doc&id=350111&lang=1>
[130] <https://www.legis.md/cautare/getResults?doc_id=121329&lang=ro>
[131] <https://www.legis.md/cautare/getResults?doc_id=119646&lang=ro>
[132] <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=367710>
[133] <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=374523>

Mitigation impact: reduce air pollution by 30% by 2020 through development of sustainable transport

Estimated costs and benefits: Implementation costs – 24.5 million lei, benefits - saving resources, reducing dependence on imports, reducing emissions, increasing the competitive capacity of domestic products, reducing the level of risk factors for the health of the population.

The Action Plan for implementation of the National Strategy for Regional Development for 2016-2020, GD no. 485 of 2017[134]

Objective: Increasing energy efficiency of public buildings through implementation of 11 projects

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: economic

Status: under implementation

Start of implementation: 2016

Included in: With Existing Measures scenario

Responsible entity: MIRD, MM

Monitoring indicators: number of buildings rehabilitated

Mitigation impact: not available

Estimated costs and benefits: 928.2 million lei.

The Draft Law on creation and maintenance of minimum stocks of petroleum products

Objective: the transposition of Directive no. 2009/119/EC imposing an obligation on Member States to maintain minimum stocks of crude oil and/or petroleum products and Directive 2018/1581/EU on methods of calculating stockholding obligations

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory and economic

Status: planned

Start of implementation: not determined

Included in: With Additional Measures scenario

Responsible entity: MIRD

Monitoring and evaluation indicators: level of crude oil and/or petroleum products reserves

Mitigation impact: Implementation of the Law will lead to increased GHG emissions due to increased stocks of petroleum products up to 217 thousand tons

Estimated costs and benefits: estimated 148 million dollars for the purchase of petroleum products necessary to maintain the minimum emergency stocks (217 thousand tons of petroleum products - petrol, diesel, LPG) and estimated 10.5 million Euro capital costs (investment sources) for the development of new capacity and/or reconstruction, renovation of existing storage capacities. Benefits – increasing the country's security of supply with petroleum products, ensuring minimum stocks of petroleum products that would ensure domestic consumption for a period of at least 61 days.

[134] The Law no. 239 of 13.10.2016 approving the National Strategy for Regional Development for 2016-2020. Published: 03.02.2017 in the Official Gazette no. 30-39 art. 65 <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=368696>

ANRE's Draft Decision on approval of the Methodology for determining the technological consumption and natural gas losses in the distribution networks[135]

Objective: to establish a method for calculating natural gas losses in distribution networks

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory

Status: planned

Start of implementation: not determined

Included in: With Additional Measures scenario

Responsible entity: ANRE

Monitoring and evaluation indicators: approved methodology

Mitigation impact: reduction of normative natural gas losses in natural gas distribution networks, with the allowable ceiling of 3.0%.

Estimated costs and benefits: costs not available; benefits: incentivizing the reduction of natural gas losses and lowering gas tariffs.

Regulation on the control of emissions of volatile organic compounds resulting from the storage and distribution of gasoline from terminals to filling stations with petroleum products, GD no. 587/2020[136]

Objective: Transposition of Directive 94/63/EC on control of volatile organic compound (VOC) emissions resulting from storage of petrol and its distribution from terminals to service stations; reduction of the total annual losses of petrol resulting from the loading and storage in each storage installation at terminals to a level below the target reference value of 0.01% by weight of the total annual throughput; for mobile containers at terminals - reduction of the total annual losses of petrol to levels below the target reference value of 0.005% by weight of the total throughput; for installations for the loading and storage of petrol at service stations for petroleum products - reduction of the total annual loss of petrol to levels below the reference value of 0.01% by weight of the total throughput.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory and economic

Status: under implementation

Start of implementation: 2021

Included in: With Additional Measures scenario

Responsible entity: Ministry of Environment and Environmental Protection Inspectorate

Monitoring and evaluation indicators: total annual losses of petrol at petrol storage facilities at terminals, mobile container loading and unloading facilities at terminals, mobile containers and petrol loading and storage facilities at petrol filling stations.

Mitigation impact: not available

Estimated costs and benefits: not available.

[135] <http://www.anre.md/consultari-publice-3-27>, item no. 137

[136] Government Decision no. 587 of 31-07-2020 approving the Regulation on control of emissions of volatile organic compounds resulting from the storage and distribution of gasoline from terminals to filling stations with petroleum products. Published: 07-08-2020 in the Official Gazette no. 199-204 art. 713. <https://www.legis.md/cautare/getResults?doc_id=122611&lang=ro>

Methodology for calculating the impact of biofuels and bioliquids on greenhouse gas emissions, GD no. 107 of 27.02.2019[137]

Objective: to establish how to calculate the impact of biofuels and bioliquids on GHG emissions

GHGs targeted by the policy: CO_2, CH_4

Category of measure: regulatory and economic

Status: under implementation

Start of implementation: 2019

Included in: With Existing Measures scenario

Responsible entity: Ministry of Environment

Monitoring and evaluation indicators: biofuels/bioliquids in total fuel consumed, impact of biofuels and bioliquids on GHG emissions

Mitigation impact: depending on the production pathway of biofuels and bioliquids (from wheat, sugar beet, rapeseed vegetable oil, etc.), the typical and default greenhouse gas emission reductions for each resulting from land use change are estimated.

Estimated costs and benefits: not available.

The Law on Petroleum Products Market, no. 461/2001, updated by the Law no. 168/2018[138]

Objective: creating an organizational, legal and economic framework to ensure the economic security of the country and regulate import, transport, storage and marketing of petroleum products on the internal market, as strategic products, with a special activity regime

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory and economic

Status: under implementation

Start of implementation: 2001

Included in: With Existing Measures scenario

Responsible entity: MIRD and ANRE

Monitoring and evaluation indicators: consumption of petroleum products and prices / profitability from trading of petroleum products

Mitigation impact: not available

Estimated costs and benefits: not available.

The Law on Natural Gas, no. 108/2016 updated by the Law no. 182/2018[139]

Objective: establishing a general legal framework for the organization, regulation, efficient functioning and monitoring of the natural gas sector

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory

Status: under implementation

Start of implementation: 2016

Included in: With Existing Measures scenario

Responsible entity: MIRD and ANRE

Monitoring and evaluation indicators: gas losses in transmission and distribution networks

Mitigation impact: not available

Estimated costs and benefits: not available.

The Draft Law amending and supplementing the Law on Natural Gas no. 108/2016 and related normative acts[140]

Objective: adoption of this draft law is expected to generate the following benefits:

- natural security of gas supply will grow due to creation of gas stocks;
- the tasks and powers of the authorities involved in management of exceptional situations in the natural gas sector will be clarified;
- the necessary legal framework to ensure transparency on the wholesale gas market will be put in place to exclude abuse and/or manipulation on the gas market;
- interpretation in relation to the actions that may be considered as market manipulation, in relation to the obligations incumbent on the participants in the natural gas market, who hold privileged information, will be excluded;
- ANRE will be able to ensure efficient monitoring of the wholesale gas market and will have the necessary means to intervene promptly to prevent and counteract market manipulation and abuse by some natural gas market participants, including by applying specific sanctions in this sense;
- the necessary legal prerequisites will be created to set and apply in a harmonized manner the entry/exit tariffs for the transmission service in the entry/exit systems in which several transmission system operators (TSOs) operate, and for implementing the inter-compensation mechanism between TSOs, respectively. Thus, the continuous operation of the natural gas transmission networks of the two transmission system operators and their viability will be ensured, and the use of all gas transmission networks by system users will be encouraged, following the harmonized setting and application of entry/exit tariffs, in order to encourage competition on the natural gas market and for the benefit of final customers;
- The RoM will fulfill the obligations assumed as a contracting party of the Energy Community Treaty regarding the transposition and implementation of EU Regulation no. 1227/2011 on the integrity and transparency of the wholesale energy market, as well as on ensuring the implementation of EU Regulation no. 2017/460 establishing a network code on harmonized gas transmission tariffs;
- The possibility to interpret some provisions of the Law on Natural Gas will be removed, including ANRE will be able to adopt the necessary acts for the implementation

[137] Government Decision no. 107 of 27-02-2019 on approval of the Methodology for calculating the impact of biofuels and bioliquids on greenhouse gas emissions. Published: 15-03-2019 in the Official Gazette no. 94-99 art. 189. <https://www.legis.md/cautare/getResults?doc_id=112852&lang=ro>

[138] The Law no. |461 of 30-07-2001 on petroleum products market. Published: 10-02-2017 in the Official Gazette no. 40-49 art. 82. Modified by PL168 of 26.07.18, OG333-335/24.08.18 art.549. <https://www.legis.md/cautare/getResults?doc_id=108148&lang=ro#>

[139] The Law on Natural Gas no. 108 of 27-05-2016. Published: 08-07-2016 in the Official Gazette no. 193-203 art. 415 Modified by the PL182 of 26.07.18, OG321-332/24.08.18 art.531; effective since 24.08.18. <https://www.legis.md/cautare/getResults?doc_id=121987&lang=ro>

[140] <https://particip.gov.md/ro/document/stages/proiect-hotararii-guvernului-cu-privire-la-aprobarea-proiectului-de-lege-pentru-modificarea-unor-acte-normative/8677>.

of the mandatory legislation at the level of the Energy Community, the necessary legal framework for carrying out the new activity on the natural gas market will be ensured: the "trading" activity will be excluded, the uncertainty regarding the status of the GNCV installations will be excluded, and, respectively, the application of the principles aimed to ensure the separation and the independence of the system operators in relation to this activity will be excluded.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulation and competitiveness

Status: in the process of promotion

Start of implementation: 2023

Included in: With Additional Measures scenario

Responsible entity: MIRD and ANRE

Monitoring and evaluation indicators: energy losses in gas networks.

Mitigation impact: Not available;

Estimated costs and benefits: Not available.

The Law no. 105/2017 on the declaration of public utility for the works of national interest for the construction of the natural gas transmission pipeline on the direction Ungheni-Chisinau and implementation of measures for the operation, exploitation and maintenance of the natural gas transmission pipeline Iasi-Ungheni-Chisinau[141]

Objective: Facilitate the construction of the Ungheni-Chisinau gas pipeline. In August 2020, the construction works of the Ungheni-Chisinau gas pipeline were completed.

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: economic

Status: in force since 2017

Start of implementation: 2017

Included in: With Existing Measures scenario

Responsible entity: MIRD

Monitoring and evaluation indicators: constructed gas network infrastructure

Mitigation impact: Not available

Estimated costs and benefits: about 80 million Euro; 120 km long pipeline will assure the energy security of the country, being able to provide about 75% of the average consumption of the RoM or about 60% of the average gas consumption of the country in the cold period of the year.

Methodology for calculating technological consumptions and technical losses of natural gas in distribution networks, ANRE's Decision no. 398/2010[142]

Objective: To establish a single method for calculating, determining, adjusting and approving technological consumption and technical losses of natural gas in natural gas distribution networks

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory

Status: under implementation

Start of implementation: 2011

Included in: With Existing Measures scenario

Responsible entity: ANRE

Monitoring and evaluation indicators: energy losses in natural gas networks

Mitigation impact: not available

Estimated costs and benefits: not available

Methodology for regulating technological consumption and technical losses in the transport of natural gas through the main pipelines of the Republic of Moldova, ANRE's Decision no. 24/2000[143]

Objective: Normalization of technological consumptions and technical losses in the natural gas transmission system/

GHGs targeted by the policy: CO_2, CH_4, N_2O

Category of measure: regulatory

Status: under implementation

Start of implementation: 2000

Included in: With Existing Measures scenario

Responsible entity: ANRE

Monitoring and evaluation indicators: gas losses in transmission networks

Mitigation impact: not available

Estimated costs and benefits: not available.

3.5.2. Industrial Processes and Other Products Use Sector

The policies approved in the RoM and expressly oriented towards reducing greenhouse gas emissions from the industrial sector are the Environmental Strategy for 2014-2023 and the Action Plan for its implementation, the LEDS until 2030 and the Action Plan for its implementation. The mitigation aspects of GHG emissions in this sector are also encountered in the National Energy Efficiency Program for 2011-2020 and the National Energy Efficiency Action Plans for the years 2013-2015, 2016-2018 and 2019-2021, the Law no. 139 of 19.07.2018 on Energy Efficiency, the Program for promoting "green" economy in the RoM for 2018-2020 and the Action Plan for its implementation, GD no. 160/2018[144], Regulation on measures to reduce emissions from air conditioning systems of motor vehicles, GD no. 1242/2016, etc. Since most of these have already been described in Chapter 3.5.1, they will be omitted further.

It should be mentioned that the legal framework associated with dealing with environmental protection problems in the industrial sector is also found - either episodic, tangential, in a general way or with a more focused footprint, in a number of legislative acts such as: the Law on Conformity

[141] The Law no. 105 of 09-06-2017 on the declaration of public utility for works of national interest for the construction of natural gas transmission pipeline for Ungheni – Chisinau Published: 30-06-2017 in Official Gazette no. 216-228 art. 351. <https://www.legis.md/cautare/getResults?doc_id=105691&lang=ro>

[142] ANRE's Decision no. 398 of 31-12-2010 on approval of the Methodology for calculating technological consumptions and technical losses of natural gas in distribution networks. Published: 21-01-2011 in the Official Gazette no. 16-17 art. 72. <https://www.legis.md/cautare/getResults?doc_id=49798&lang=ro>

[143] ANRE's Decision no. 24 of 28.07.2000 on the approval of the Methodology for regulating technological consumptions and technical losses in the transport of natural gas through the main pipelines of the Republic of Moldova. Published: 10-08-2000 in the Official Gazette no. 98 art. 290. <https://www.legis.md/cautare/getResults?doc_id=62716&lang=ro>

[144] Government Decision no. 160 of 21.02.2018 approving the "Green" Economy Promotion Program in the Republic of Moldova for 2018-2020 and the Action Plan for its implementation. Published: 02.03.2018 in the Official Gazette no. 68-76, art. 208. <https://www.legis.md/cautare/getResults?doc_id=102127&lang=ro>

Assessment of Products (2003)[145], the Law on Technical Regulation Activity (2006)[146], the Law on Accreditation and Conformity Assessment Activities (2011)[147], the Law on Industrial Security of Dangerous Industrial Objects (2012)[148] and the Law on National Standardization (2016)[149], the Law environment protection no. 1515 of 16.06.1993[150] (which is the core legal framework for development of special normative acts), the Law on Environmental Pollution Payments no. 1540 of 25.02.1998[151] (described in Chapter 3.5.1), the Law on approval of the Regulation on the trade regime and regulation of the use of ozone depleting layer halogenated hydrocarbons no. 852 of 14.02.2002[152] and the Law on accession of the RoM to the Amendment to the Montreal Protocol on ozone depleting layer substances no. 119 of 18.05.2006[153] (by which the ozone depleting layer substances are prohibited or have a strict regime of record and management in the RoM), the Law on Industrial Parks no. 182 of 15.07.2010,[154] the Law on Heat and Promotion of Cogeneration no. 92 of 29.05.2014[155] (described in Chapter 3.5.1), the Law on Eco-design Requirements for Energy-related Products no. 151 of 17.07.2014[156] (which establishes eco-design requirements for energy-related products to ensure the free movement of these products on the internal market), the Law on Waste no. 209 of 29.07.2016 [157] (described in Chapter 3.5.5), the Association Agreement between the RoM, of the one part, and the European Union and the European Atomic Energy Community and their Member States, of the other part, the Law no. 112/2014[158] (According to Annex XII (Chap. 17, Climate Action) of the Association Agreement, RoM undertook to progressively approximate its national legislation to the following EU legislation: by 2018 - Regulation (EU) 517/2014 (Art. 5, 6, 13); to 2019 - Regulation (EC) no. 1005/2009 (Art. 4, 5, 11, 22-23, 26-27 and Chapters III and IV); to 2022 - Directive 2003/87/EC (Annexes I and II, Art. 9, 14 - 17, 19 and 21), the Strategy of cooperation between the RoM and the Government of Sweden, through the Swedish Agency for International Development and Cooperation (SIDA), for the period 2014-2020[159] (which focuses on building a better environment, reducing the climate impact of human activities and strengthening the resilience of society and economy to extreme climatic phenomena and global climate changes), the Cooperation Agreement between the RoM and the US Agency for International Development (USAID) and the Government of Sweden, through the Swedish Agency for International Development and Cooperation (SIDA), for 2016-2020[160] (dedicated to the purpose of joint implementation of the USAID Moldova Competitiveness Project), etc.

The legal and policy framework for reducing greenhouse gas emissions from Industry sector is analyzed below.

The National Research and Innovation Program for 2020-2023 and the Action Plan for its implementation[161]

Objective: Increasing the efficiency of the national research and innovation system and ensuring optimal conditions for generating new knowledge obtained based on fundamental and applied research and their implementation to increase the competitiveness of the national economy and the general level of well-being. Research shall include the *Environment and Climate Change Directorate* that cover the themes "Secure, Clean and Efficient Energy" and "Waste, Plastics and Pollutants".

GHGs targeted by the policy: CO_2, CH_4, N_2O, HFC, PFC and SF_6

Category of measure: economic

Status: under implementation

Start of implementation: 2020

Included in: With Additional Measures scenario

Responsible entity: Ministry of Education and Research

Monitoring and evaluation indicators: number of projects financed and implemented; grant programs launched; number of grants awarded; number of grant beneficiaries; funding programs launched; number of researchers involved; number of innovative start-ups and/or spin-offs created annually; incentives developed and implemented, etc.

Mitigation impact: GHG emission reductions without indicative targets compared to 1990

Estimated costs and benefits: estimated costs for the implementation of competitively selected projects according to the priorities and strategic directions are 224.7 million lei for 2020 and, respectively, 238.9 million lei for 2021, 257.9 million lei for 2022, 276.3 million lei for 2023. The costs for institution building measures in research and innovation are estimated at 149.8 million lei for 2020 and 128.7 million lei for

[145] The Law on Assessment of Conformity of Products no. 186 of 24.04.2003. Published: 11-07-2003 in the Official Gazette no. 141-145 art. 566. <https://www.legis.md/cautare/getResults?doc_id=27997&lang=ro#>
[146] The Law on Technical Regulation Activity no. 420 of 22.12.2006. Published: 16-03-2007 in the Official Gazette no. 36-38 art. 141. <https://www.legis.md/cautare/getResults?doc_id=2609&lang=ro>
[147] The Law on Accreditation and Conformity Assessment Activities no. 235 of 01.12.2011. Published: 07-03-2012 in the Official Gazette no. 46-47, art. 136. <https://www.legis.md/cautare/getResults?doc_id=23162&lang=ro>
[148] The Law on Industrial Security of Dangerous Industrial Objects no. 116 of 18.05.2012. Published: 10-02-2017 in the Official Gazette no. 40-49 art. 83. <https://www.legis.md/cautare/getResults?doc_id=120652&lang=ro#>
[149] The Law on National Standardization no. 20 of 04.03.2016. Published: 08-04-2016 in the Official Gazette No. 90-99 art. 170. <https://www.legis.md/cautare/getResults?doc_id=91809&lang=ro>.
[150] The Law on Environment Protection no. 1515 of 16.06.1993. Published: 30.10.1993 in the Parliament Gazette no. 10. no: 283. <https://www.legis.md/cautare/getResults?doc_id=112032&lang=ro>.
[151] The Law on Environmental Pollution Payments no. 1540 of 25.02.1998. Published: 18.06.1998 in the Official Gazette no. 54-55, art. 378. <https://www.legis.md/cautare/getResults?doc_id=117159&lang=ro>.
[152] The Law on approval of the Regulation on trade regime and regulation of use of ozone-depleting halogenated hydrocarbons no. 852/2002; Published: 18.04.2002 in the Official Gazette no. 54-55, art. 383. <https://www.legis.md/cautare/getResults?doc_id=122851&lang=ro>. Subsequently amended by the Law no. 159 of 20.07.2020, OG 205-211 of 14.08.2020, art. 464; the Law no. 79 of 24.05.2018, OG 195-209 of 15.06.2018, art. 338; the Law no. 185 of 21.09.2017, OG 371-382 of 27.10.2017, art. 632; the Law no. 245 of 03.11.2016, OG 441-451 of 16.12.2016, art. 881; Law no. 228 of 10.10.2013, OG 258-261 of 15.11.2013, art. 715; the Law no. 109 of 04.06.2010, OG 131-134 of 30.07.2010, art. 443; the Law no.72 of 22.03.2007, OG 54-56 of 20.04.2007, art. 256.
[153] The Law on accession of the Republic of Moldova to the Amendment to the Montreal Protocol on ozone layer depleting substances no. 119 of 18.05.2006. Published: 09.06.2006 in the Official Gazette no. 87-90, art.391. <https://www.legis.md/cautare/getResults?doc_id=107184&lang=ro>
[154] The Law on Industrial Parks no. 182 of 15.07.2010. Published: 03-09-2010 in the Official Gazette No. 155-158 art. 561. <https://www.legis.md/cautare/getResults?doc_id=106588&lang=ro>.
[155] The Law no. 92 of 29.05.2014 on Heat and Promotion of Cogeneration. Published: 11-07-2014 in the Official Gazette no. 178-184 art. 415. <https://www.legis.md/cautare/getResults?doc_id=121989&lang=ro>.
[156] The Law no. 151 of 17.07.2014 on Eco-design Requirements for Energy-related Products. Published: 10-10-2014 in the Official Gazette no. 310-312 art. 616. <https://www.legis.md/cautare/getResults?doc_id=106031&lang=ro>.
[157] The Law on Waste no. 209 of 29.07.2016. Published: 23.12.2016 in the Official Gazette No. 459-471, art. 916. Date of entry into force: 23.12.2017. <https://www.legis.md/cautare/getResults?doc_id=118272&lang=ro>.
[158] The Law no. 112 of 02.07.2014 for the ratification of the Association Agreement between the Republic of Moldova, on the one hand, and the European Union and the European Atomic Energy Community and their Member States, on the other hand. Published: 18.07.2014 in the Official Gazette No. 185-199, art. 442. <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=353829>.

[159] Cooperation strategy between the Republic of Moldova and the Government of Sweden, through the Swedish Agency for International Development and Cooperation (SIDA) for 2014-2020. <http://www.infoeuropa.md/suedia/>.
[160] Cooperation agreement between the Republic of Moldova and the US Agency for International Development (USAID) and the Government of Sweden, through the Swedish Agency for International Development and Cooperation (SIDA). <http://agora.md/stiri/26138/video--agentia-sua-pentru-development-international-si-government-swedish-signed-a-cooperationagreement>
[161] Government Decision no. 381 of 01.08.2019 approving the National Program on Research and Innovation for s 2020-2023 and the Action Plan on its implementation. Published: 16.08.2019 in the Official Gazette no. 256-259 art. 506. <https://www.legis.md/cautare/getResults?doc_id=115747&lang=ro>.

2021, 110.5 million lei for 2022, 92.1 million lei for 2023. The implementation of the Program will result in development of solutions, technologies and materials with GHG emissions reduction impact, as well as sustainable development of society.

"Zero Net Carbon Emissions, Science-Based Target" Commitment signed by LafargeHolcim Group on 21 September 2020 at the New York Climate Conference[162]

Objective: aiming at implementation of the "Zero net carbon emissions, science-based objective" commitment towards 2030, according to the LafargeHolcim Group Investment Roadmap, launched in 2019, the LafargeHolcim Group states its ambition to increase the CO_2 mitigation targets by reducing the intensity of emissions from cement production, up to 475 kg CO_2 net emissions per ton of cement produced, including:

- accelerate the use of its low or neutral carbon footprint products, such as ECOPact, which allows for carbon-neutral construction and Susteno, the basic circular cement;
- recover 100 million tons of waste and by-products as sources of energy and raw materials;
- intensify the use of calcined clay and develop cements with new binders;
- double the capacity to use waste-derived fuels in the production process to reach a 37% substitution rate;
- reach 550 kg CO_2 net emissions per ton of cement by 2022, respectively 457 kg CO_2 net emissions per ton of cement produced by 2030 (compared to the level of about 800 kg CO_2 net emissions per ton of cement in 1990; 576 kg CO_2 net emissions per ton of cement in 2018 and 561 kg CO_2 net emissions per ton of cement in 2019);
- operate its first zero-carbon production unit;
- reduce transport-related emissions and fuel consumption by 20%;
- reduce the clinker content to 68%;
- make greater use of waste-derived fuels to achieve a 37% substitution rate;
- use alternative raw materials;
- capture and store carbon;
- reduce the intensity of emissions from electricity procurement up to 13 kg CO_2 per ton of cement produced (or by 65% compared to 2018), by recovering waste heat and using renewable energy;
- reduce level 3 emissions, or those from transportation of finished production, by optimizing transport networks, routes and loads through better logistics and distribution to the fleet to reduce traditional fuel consumption

GHGs targeted by the policy: CO_2

Category of the measure: economic

Status: under implementation

Start of implementation: 2020

Included in: With Additional Measures scenario

Responsible entity: Lafarge Ciment (Moldova) S.A. (member of LafargeHolcim Group)

Monitoring and evaluation indicators: clinker content in the produced cement types and reduced CO_2 emissions

Mitigation impact: the target to mitigate net CO_2 emissions per ton of cement by 2030 is 40% compared to 1990[163]

Estimated costs and benefits: CHF 160 million by 2030.

The Business Plan for 2016-2020 of SE Chisinau Glass Factory, approved by the Decision of the Board of Directors, Minutes no. 29 of 24.11.2016[164]

Objective: To ensure further development of the enterprise based on increasing efficiency by: growing export of competitively produced glass products; increasing the efficiency of production following the partial repair of the glass melting furnace, the capital repair of glass forming machines, upgrading the electricity transmission line.

GHGs targeted by the policy: CO_2

Category of the measure: economic

Status: under implementation

Start of implementation: 2016

Included in: With Existing Measures scenario

Responsible entity: SE Chisinau Glass Factory

Monitoring and evaluation indicators: amount of melted glass; share of broken glass in the batch; consumption of natural gas used to melt glass; specific consumption of natural gas per ton of melted glass; consumption of electricity used to melt glass; reduced CO_2 emissions

Mitigation impact: not available

Estimated costs and benefits: about 5.5 million Euro, according to the investment roadmap of the State Enterprise Chisinau Glass Factory.

Government Decision no. 561 of 31.07.2020 approving the Regulation on Packaging and Packaging Waste[165]

Objective: Partial transposition of Directive 94/62/EC of the European Parliament and of the Council of 20 December 1994 on packaging and packaging waste. The regulation establishes priority measures aimed at preventing production of packaging waste and the principles for reducing the final disposal of packaging waste through reuse, recycling and recovery. The objectives of recovery and recovery by recycling, global and by type of packaging material, at national level, for the period 2023-2029 are the following:

[162] <https://www.lafarge.md/ro/lafargeholcim-semneaza-employment-net-zero-emisii-de-carbon-cu-obiective-base-pe-stiinta>

[163] Lafarge Holcim <https://www.lafargeholcim.com/our-climate-pledge>

[164] The Business Plan for 2016-2020 of the State Enterprise Chisinau Glass Factory , approved by the Decision of the Board of Directors, Minutes no. 29 of 24.11.2016. <http://www.glass.md/>

[165] Government Decision no. 561 of 31.07.2020 approving the Regulation on Packaging and Packaging Waste. Published: 21-08-2020 in the Official Gazette no. 212-220 art. 743. <https://www.legis.md/cautare/getResults?doc_id=122773&lang=ro>

Year	Minimum recovery target by recycling/type of material (%)					Global recovery by recycling target *) (%)	Overall recovery target **) (%)
	Paper and cardboard	Plastics	Glass	Metal	Wood		
2023	15	10	15	10	5	15	17
2024	20	11	20	20	5	20	22
2025	25	12	25	25	5	25	27
2026	30	14	30	30	5	30	32
2027	40	16	40	35	10	35	37
2028	45	18	45	40	10	40	42
2029	50	20	50	45	10	45	50

Note: Composite packaging according to the prevailing material. *) Minimum percentage of the total mass of packaging materials contained in packaging waste; **) Minimum percentage of the mass of packaging waste.

GHGs targeted by the policy: CO_2

Category of the measure: economic

Status: under implementation

Start of implementation: 2021

Included in: With Additional Measures scenario

Responsible entity: Ministry of Environment, through the Environmental Agency and the Environmental Protection Inspectorate

Monitoring and evaluation indicators: weight of packaging waste; weight of recycled packaging materials including glass, paper/ cardboard, metal, wood, plastic

Mitigation impact: not available

Estimated costs and benefits: costs paid by producers per ton of materials put on the market ranging from 14 Euro/ tone (UK) to 200 Euro/tone (Austria), with an average of 92 Euro/tone; for the RM the costs are to be estimated based on the respective feasibility studies.

Kigali Amendment to the Montreal Protocol on progressive reduction of the use of hydrofluorocarbons worldwide, signed on 15.10.2016[166]

Objective: Incremental reduction of hydrofluorocarbons in CO_2 equivalence; by 2048, all countries will reach the target of 15–20% of their current HFC consumption, expressed in CO_2 equivalent.

The Republic of Moldova, classified according to the Montreal Protocol in group 1 of developing countries (country of Art. 5), has the following schedule for suppressing HFCs:

- estimating the base level (HFC production/ consumption) as an average of the years 2020-2022 + 65% of the base level (production/ consumption) of HCFC (*in the RoM* the *consumption of the base level of HCFC was about 17 metric tons or 30,770 kt of CO_2 equivalent; 65% of the consumption of the base level represents about 20,001 kt of CO_2 equivalent*);
- 2024-2028 – freezing of consumption at the basic consumption level;
- 2029-2034 (stage I) – reducing consumption by 10%;
- 2035-2039 (stage II) – reducing consumption by 30%;
- 2040-2044 (stage III) – reducing consumption by 50%;
- 2045 and later (stage IV) – reducing consumption by 80% (versus the basic level).

By Government Decision no. 536 of 20.07.2020 the Government of the RoM approved the draft Law on the Accession of the RoM and the Kigali Amendment to the Montreal Protocol on Substances that Destroy the Ozone Layer, adopted on 15 October 2016[167] (ratification is planned for 2021). By adhering to the Kigali Amendment, the RoM will demonstrate the commitment made by our country to contribute to the reduction of greenhouse gas emissions and to the achievement of the objectives set out in the Paris Agreement (2015). In the RoM, the sectors that use hydrofluorocarbons are stationary and mobile air conditioning, commercial and industrial refrigeration, refrigerated transport of food products, production and use of expanded foams and aerosols.

GHGs targeted by the policy: HFC

Category of measure: regulatory

Status: planned for approval by the end of 2022

Start of implementation: 2023

Included in: With Additional Measures scenario (WAM)

Responsible entity: Ministry of Environment

Monitoring and evaluation indicators: annual consumption of hydrofluorocarbons expressed in metric tons and thousand tones CO_2 equivalent

Mitigation impact: approved HFC suppression schedule, frozen HFC consumption, reduction of HFC consumption

Estimated costs and benefits: cost is not available; ratification of the Kigali Amendment will help reduce the consumption of HFCs, eliminating the environmental consequences of their use in RoM.

3.5.3. Agriculture Sector

By 2020, the policies approved in the RoM and expressly oriented towards reducing greenhouse gas emissions from the agriculture (*includes both the plant and soil resources, as well as animal husbandry)* are the Environmental Strategy for 2014-2023 and the Action Plan for its implementation, and the LEDS until 2030 and the Action Plan for its implementation. Both have already been described in Chapter 3.5.1.

It should be mentioned that the legal framework associated with environmental protection problems in agriculture is also reflected, either episodically, tangentially, in a general way, or with a more focused footprint, in a series of legislative acts such as: the Land Code no. 828/1991**[168]**, the Law Environment

[166] Kigali amendment to the Montreal Protocol to progressively reduce the use of hydrofluorocarbons worldwide, < http://conf.montreal-protocol.org/meeting/oewg/oewg-39/presession/briefingnotes/ratification_kigali.pdf>, <https://europa.eu/capacity4dev/unep/document/full-text-kigali-amendment-pt-1>

[167] Government Decision no. 536 of 20.07.2020 approving the Draft Law on the accession of the Republic of Moldova to the Amendment to the Montreal Protocol on Substances that Destroy the Ozone Layer, adopted on 15 October 2016. Published: 24-07-2020 in the Official Gazette no. 188-192 art. 649. <https://www.legis.md/cautare/getResults?doc_id=122328&lang=en>

[168] Code no. 828 of 25.12.1991 Land Code. Published: 04.09.2001 in the Official Gazette no. 107, art. 817.

Protection no. 1515 of 16.06.1993[169], the Law on Selection and Breeding in Animal Husbandry no. 371 of 15.02.1995 [170], the Law on Nut Crops no. 658 of 29.10.1999 [171], the Law on Fruit Growing no. 728 of 06.02.1996, the Law on Farms no. 1353 of 03.11.2000, the Law on Plant Protection Products and Fertilizers no. 119 of 22.06.2004[172], the Law on Organic Agri-food Production no. 115 of 09.06.2005[173], the Law on Sanitary-Veterinary Activity no. 221 of 19.10.2007[174], the Law on Protection of Plant Varieties no. 39 of 29.02.2008[175], the NDS "Moldova 2020", the Law no. 166/2012[176], the Strategy for the development of rural extension services for the years 2012-2022, GD no. 486/2012[177], the Rural Inclusive Economic – Climate Resilience Program (IFAD VI) for 2014-2020[178], the National Regional Development Strategy for 2016-2022, the Law no. 239/2016[179], the Strategy on Food Safety for 2018-2022, GD no. 1150/2017[180], GD no. 455 of 21.06.2017 on allocation of funds from the National Agriculture and Rural Environment Development Fund[181], the Law on the principles of subsidization in agriculture and rural areas development no. 276 of 16.12.2016[182], Rural Resilience Program (IFAD VII) for the period 2017-2023[183], GD no. 381 of 01.08.2019 approving the National Program on research and innovation for 2020-2023 and the Action Plan on its implementation[184], the Law on subsidized insurance in agriculture no. 183 of 11.09.2020[185], the Law on Animal Husbandry (draft)[186], the Dairy Cattle Breeding Program for 2014-2020[187], the Sheep and Goats Breeding Program for 2014-2020[188], the FAO Project "Development of the National Strategy and Action Plan for implementing the Livestock Genetic Resources and Dairy Cows Genetic Improvement Program"[189], the Waste Management Strategy for 2013-2027, GD no. 248/2013[190], the Regulation on conditions and procedure for granting advance grants for investment projects for land improvement for the implementation of the Land Improvement Program aimed at ensuring sustainable management of soil resources for 2021-2025, approved at the meeting of the Government on 22 December 2020[191], Talent Retention and Rural Transformation Project (IFAD VIII) for 2021-2026[192].

The following normative acts make part of the legal framework that can be regarded as having an impact on the level of GHG emissions in the agricultural sector.

National Agriculture and Rural Development Strategy for 2014-2020, GD no. 409/2014[193] and the Action Plan for the implementation of the National Agricultural and Rural Development Strategy for 2014-2020, GD no. 742/2015[194], the updated National Agricultural and Rural Development Strategy for 2014-2020 and the Action Plan for the implementation of the National Agricultural and Rural Development Strategy for 2018-2020, GD no. 785/2018

Objective: Increasing the competitiveness of the agri-food sector, by restructuring and modernizing the market; ensuring the sustainable management of natural resources in agriculture; improving the standard of living in rural areas, increasing the production output by at least 20% more versus the reference period 2013 by creating/ modernizing by 2020 of at least 50 livestock farms, of which at least 10 cattle farms; optimizing the number of livestock to ensure the genetic fund with biological material, a total of 600 heads of cattle and 1800 heads of pure-bred swine or at least 200 heads of cattle purchased annually, respectively at least 600 heads of swine purchased annually.

GHGs targeted by the policy: CH_4 and N_2O

Category of measure: regulatory and economic

Status: under implementation

Start of implementation: 2014

Included in: With Existing Measures scenario

<https://www.legis.md/cautare/getResults?doc_id=122075&lang=ro>.

[169] The Law on environment protection no. 1515 of 16.06.1993. Published: 30.10.1993 in the Parliament Gazette no. 10, art. no.: 283. <https://www.legis.md/cautare/getResults?doc_id=112032&lang=ro>

[170] The Law no. 371 of 15.02.1995 on breeding and reproduction in animal husbandry. Published: 06.04.1995 in the Official Gazette no. 20. no: 182. <https://www.legis.md/cautare/getResults?doc_id=109449&lang=ro>

[171] The Law on Nut Crops no. 658 of 29.10.1999. Published: 29.12.1999 in the Official Gazette no. 153-155, art. 749. <https://www.legis.md/cautare/getResults?doc_id=108460&lang=ro>.

[172] The Law on Plant Protection Products and Fertilizers no. 119 of 22.06.2004. Published: 25.06.2004 in the Official Gazette no. 100-103, art. 510. <https://www.legis.md/cautare/getResults?doc_id=107644&lang=ro>

[173] The Law on Organic Agri-food Production no. 115 of 09.06.2005. Published: 15.07.2005 in the Official Gazette no. 95-97, art. 446. <https://www.legis.md/cautare/getResults?doc_id=115169&lang=ro>

[174] The Law on Sanitary-veterinary Activity no. 221 of 19.10.2007. Published: 19.10.2007 in the Official Gazette no. 51-54, art. 153. <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=327196>

[175] The Law on plant varieties protection no. 39 of 29.02.2008. Published: 06.06.2008 in the Official Gazette no. 99-101, art. 364. <https://www.legis.md/cautare/getResults?doc_id=93465&lang=ro>

[176] The Law no. 166 of 11.07.2012 on approval of the National Development Strategy "Moldova 2020". Published: 30.11.2012 in the Official Gazette No. 245-247, art. 791. <https://www.legis.md/cautare/getResults?doc_id=48697&lang=ro>. Amended by the Law no. 121 of 03.07.2014 on amending and supplementing the annex to Law no. 166 of 11 July 2012 approving the National Development Strategy "Moldova 2020" Published: 03.10.2014 in the Official Gazette no. 293-296, art. 603. <https://www.legis.md/cautare/getResults?doc_id=48684&lang=ro/>

[177] Government Decision no. 486 of 04.07.2012 approving the Strategy for rural extension services development for 2012-2022. Published: 13.07.2012 in the Official Gazette no. 143-148, art. 537. <https://www.legis.md/cautare/getResults?doc_id=114376&lang=ro>

[178] Rural of Economic Resilience – Inclusive Climate Program (IFAD VI) 2014-2020. <https://www.ucipifad.md/programe/programe-in-derulare/proiect-de-rezilienta-rurala-ifad-vii/>

[179] The Law no. 239 of 13.10.2016 on approval of the National Strategy for Regional Development for 2016-2020. Published: 03.02.2017 in the Official Gazette no. 30-39, art. 65. <https://www.legis.md/cautare/getResults?doc_id=105791&lang=ro>

[180] Government Decision no. 1150 of 20.12.2017 approving the Food Safety Strategy for 2018-2022. Published: 19.01.2018 in the Official Gazette no. 18-26, art. 06. <https://www.legis.md/cautare/getResults?doc_id=111638&lang=ro>

[181] Government Decision no. 455 of 21.06.2017 on Allocation of Funds from the National Agriculture and Rural Environment Development Fund. Published: 23.06.2017 in the Official Gazette no. 201-213, art. 537. <https://www.legis.md/cautare/getResults?doc_id=123859&lang=ro>. Amended by Government Decision no. 772 of 21.10.2020 on amendment of certain Government Decisions no. 772 of 21.10.2020. Published: 24.10.2020 in the Official Gazette no. 278, art. 909. <https://www.legis.md/cautare/getResults?doc_id=123697&lang=ro>

[182] The Law on the principles of subsidization in agriculture and rural areas development no. 276 of 16.12.2016. Published: 03.03.2017 in the Official Gazette no. 67-71, art. 93. <https://www.legis.md/cautare/getResults?doc_id=122915&lang=ro>

[183] Rural Resilience Program (IFAD VII) 2017-2023. <https://www.ucipifad.md/programe/programe-in-derulare/programul-rural-de-rezilienta-economico-climatica-incluziva-ifad-vi/>

[184] Government Decision no. 381 of 01.08.2019 approving the National Program in research and innovation for 2020-2023 and the Action Plan for its implementation. Published: 16.08.2019 in the Official Gazette no. 256-259 art. 506. <https://www.legis.md/cautare/getResults?doc_id=115747&lang=ro>

[185] The Law on Subsidized Insurance in Agriculture no. 183 of 11.09.2020. Published: 16.10.2020 in the Official Gazette no. 267-271, art. 572. <https://www.legis.md/cautare/getResults?doc_id=123554&lang=ro>

[186] The Draft Law on Animal Husbandry (new edition). Published for consultation by the State Chancellery on March 18, 2020: <https://cancelaria.gov.md/ro/content/cu-privire-la-aprobarea-proiectului-de-lege-zootehniei-238madrm2020>

[187] Dairy Cattle Breeding Program of the Republic of Moldova for 2014-2020, approved for implementation by the Zooveterinary Commission of the Technical and Scientific Council of the Ministry of Agriculture and Food Industry of the Republic of Moldova, Minutes no.2 of 17.10.2013. Focsa, V., Constandoglo, A. Chisinau, Tipogr. "Prince-Caro". 2013, 22 pp., ISBN 978-9975-56-122-8.

[188] Sheep and Goats Breeding Program of the Republic of Moldova for 2014-2020, approved for implementation by the Zooveterinary Commission of the Technical and Scientific Council of the Ministry of Agriculture and Food Industry of the Republic of Moldova, Minutes no.3 of 18.12.2013. Masner, O., Liuțcanov, P., Evtodienco, S., Dănuță, A. Chisinau, Tipogr. "Prince-Caro". 2014, 34 pp. ISBN 978-9975-56-197-6.

[189] FAO Project "Development of the National Strategy and the Action Plan for Livestock Genetic Resources and the Dairy Cows Genetic Improvement Program", < http://www.madrm.gov.md/en/content/moldova-%C3%AE%C8 -consolideaz%99i %C4%83-creation-sector%C8%99ter-vacilor-de-lapte-cu-suportul-fao>, <http://maia.gov.md/en/categorii/proiecte-de-asistenta-externa-sector-agroalimentar>

[190] Government Decision no. 248 of 10.04.2013 on approval of the Waste Management Strategy of the Republic of Moldova for 2013-2027. Published: 12.04.2013 in the Official Gazette no. 82 art. 306. <https://www.legis.md/cautare/getResults?doc_id=114412&lang=ro>

[191] Government Decision on approval of the Regulation on conditions and procedure for granting advance subsidies for land improvement investment projects for the implementation of the Land Improvement Program aimed at ensuring sustainable management of soil resources for 2021-2025, approved at the Government meeting of 22.12.2020 (subject of discussion no. 66). <https://gov.md/ro/content/sedinta-guvernului-din-22-decembrie-2020-ora-1600>

[192] Talent Retention and Rural Transformation Project (IFAD VIII) 2021-2026, < https://www.ucipifad.md/noutati/parlamentul-a-ratificat-un-nou-acord-de-finantare-cu-fondul-international-pentru-developarea-agricola/>, ratified by the Law no. 194 of November 19, 2020 on ratification of the Financing Agreement between the Republic of Moldova and the International Fund for Agricultural Development aimed at implementing the Talent Retention and Rural Transformation Project (IFAD VIII)", published on 18.12.2020 in the Official Gazette no. 329-331, art. 199 <https://www.legis.md/cautare/getResults?doc_id=124253&lang=ro>

[193] Government Decision no. 409 of 04.06.2014 approving the National Agricultural and Rural Development Strategy for 2014-2020. Published: 10.06.2014 in the Official Gazette no. 152, art. 451. <https://www.legis.md/cautare/getResults?doc_id=110039&lang=ro>

[194] Government Decision no. 742 of 21.10.2015 approving the Action Plan on implementation of the National Agricultural and Rural Development Strategy for 2014-2020. Published: 30.10.2015 in the Official Gazette no. 297-300, art. 835. <https://www.legis.md/cautare/getResults?doc_id=110254&lang=ro>

Responsible entity: MAFI

Monitoring and evaluation indicators: number of farms created/ upgraded; number of animals with highly improved productivity; number of insured animals extended

Mitigation impact: not available

Estimated costs and benefits: about 8,318 billion lei was spent during 2014-2017; allocation of another 19,384 billion lei was planned for the period 2018-2020.

Government Decision no. 455 of 21.06.2017 on allocation of funds to the National Agriculture and Rural Environment Development Fund[195]

Objective: Establishing the support measures, as well as conditions, order and procedure for granting the financing to the Fund; achieving the general and specific objectives set out in the National Agricultural and Rural Development Strategy for 2014-2020, approved by the Government Decision no. 409 of 04.06.2014, as well as in the Financing Agreement between the Government of the Republic of Moldova and the European Commission on the implementation of the ENPARD Moldova Program – support for agriculture and rural development.

GHGs targeted by the policy: CH_4 and N_2O

Category of measure: economic

Status: under implementation

Start of implementation: 2017

Included in: With Existing Measures Scenario

Responsible entity: Public Institution "Agency for Intervention and Payments in Agriculture"

Monitoring and evaluation indicators: number of farms created/ upgraded; number of livestock with highly improved productivity; number of insured livestock extended

Mitigation impact: not available

Estimated costs and benefits: about 1 billion lei in 2020, 950 million lei in 2019, 900 million lei in 2017 and 2018. As a result of the requested subsidies, it was possible to attract about 4.0 billion lei of agri-business investments, and the investments made in 2019 generated 2553 new jobs, of which 1251 seasonal jobs.

Government Decision no. 836 of 18.11.2020 on approval of the Regulation on granting direct payments per head of livestock[196]

Objective: Establishes the conditions, order and procedure for granting direct payments to livestock farmers with a view to: revitalize the livestock sector; increase the average productivity per agricultural holding; rear, breed, improve the breeds in livestock farming; adapt to climate change and mitigate its effects on agricultural production. Direct payments will be available to holders of registered livestock hold outside the built-up area – female animals at least 12 months old, kept in a herd of at least 10 heads of cows and heifers, 50 heads of ewes and ewe lambs used for milk production, 30 heads of ewes and ewe lambs used for meat production, 30 heads of goats and young female goats.

GHGs targeted by the policy: CH_4 and N_2O

Category of measure: economic

Status: under implementation

Start of implementation: 2021

Included in: With Additional Measures scenario

Responsible entity: MAFI, through the PI "Agency for Intervention and Payments in Agriculture"

Monitoring and evaluation indicators: number of farms created/ upgraded; number of animals with highly improved productivity.

Mitigation impact: not available

Estimated costs and benefits: The amount of direct payment granted to an agricultural producer for each head of livestock is established according to the species and category of animal: milk cows breeds and mixed breeds – 7000 lei; meat cows breeds– 7000 lei; heifers over 12 months – 5000 lei; milk sheep breeds and mixed breeds – 500 lei; meat sheep breeds– 500 lei; ewes over 12 months – 300 lei; goats – 500 lei; goats over 12 months – 300 lei. In case of pure-bred animals, when properly exploited, the amount of the direct payment shall be increased by 50%. As a result, the pollution in villages will be reduced, the environment improved and the specific GHG emissions per livestock production unit will be reduced.

The Draft National Milk Sector Development Program of the Republic of Moldova for 2020-2025 and the Action Plan for its implementation for 2020-2022[197]

Objective: Creating conditions for sector development by improving the legal regulatory framework, endowment with modern equipment and machinery, implementation of modern technologies for maintenance, nutrition and exploitation of animals, genetic improvement and creation of a sufficient feed base, with an impact of increasing the number of cattle, sheep and goats, as well as increasing the productivity of animals and competitiveness of animal products. The targets towards 2025 are:

- harmonization of relevant legislation to EU requirements;
- redirecting cattle from households to farms located outside the built-up area and increasing the number of milk cows in farms from 5.1 thousand heads in 2020 to about 21.8 thousand heads by 2025;
- increasing production of bovine, ovine and caprine meat as a by-product of the milk sector to 40%;
- increasing cow's milk production by up to 60% (from 3700 liters to 6200 liters);
- construction of new dairy farms of various capacities, (at least 150 farms by 2025);
- genetic improvement of livestock; modernization of dairies.

[195] Government Decision no. 455 of 21.06.2017 on allocation of funds to the National Agriculture and Rural Environment Development Fund. Published: 23.06.2017 in the Official Gazette no. 201-213, art. 537. <https://www.legis.md/cautare/getResults?doc_id=123859&lang=ro>. Amended by Government Decision no. 772 of 21.10.2020 on the amendment of certain Government Decisions no. 772 of 21.10.2020. Published: 24.10.2020 in the Official Gazette no. 278, art. 909. <https://www.legis.md/cautare/getResults?doc_id=123697&lang=ro>

[196] Government Decision no. 836 of 18.11.2020 on approval of the Regulation on granting direct payments per head of animal. Published: 02.12.2020 in the Official Gazette no. 318, art. 992. <https://www.legis.md/cautare/getResults?doc_id=124163&lang=ro>

[197] Draft National Milk Sector Development Program of the Republic of Moldova for 2020-2025 and the Action Plan on its implementation for 2020-2022. <http://particip.gov.md/proiectview.php?l=ro&idd=7741>

GHGs targeted by the policy: CH_4 and N_2O

Category of measure: economic

Status: under implementation

Start of implementation: 2022

Included in: With Additional Measures scenario

Responsible entity: MAFI

Monitoring and evaluation indicators: number of farms created/upgraded; number of animals with highly improved productivity

Mitigation impact: not available

Estimated costs and benefits: the Program implementation cost by 2022 is 383,273 million lei, of which 374,585 million lei from the state budget and 8,688 million lei from other sources, including the MAC-P World Bank project (5,163 million lei). Expected impact: revitalization of the livestock sector; at the same time, however, the GHG emissions from that sector will increase, especially as a result of livestock and poultry farming. However, specific emissions per production site are expected to have a downward trend.

Plant Growing and Land Resources Sector

Environmental Strategy for 2014-2023 and Action Plan for its implementation, GD no. 301/2014[198]

Objective: To guarantee the population of the RoM the right to an unpolluted and healthy sustainable environment, in harmony with the economic development and social welfare; to develop "environment-friendly" agricultural techniques and infrastructure; to develop and implement systems of complex regional measures, adapted to the specifics of the natural conditions of each region, based on the concept of productive resource technologies; to improve 880 thousand ha of eroded land and 21.57 thousand ha of lands subject to landslides; to plant forest strips on about 33 thousand ha; to reduce GHG by at least 20% by 2020, compared to the baseline scenario

GHGs targeted by the policy: CO_2, CH_4 and N_2O

Category of measure: regulatory

Status: under implementation

Start of implementation: 2014

Included in: With Existing Measures scenario

Responsible entity: MAFI, MoE

Monitoring and evaluation indicators: area of degraded lands in thousands of ha rehabilitated or forested; surface of lands subject to landslides in thousands of ha reconstructed; number of rehabilitated and extended irrigation systems; surface in thousands of ha of the restored and created riparian strips; thousands of ha of forest plantations and green spaces with protection function created; thousands of ha of roads protection strips, including agricultural fields protection belts

Mitigation impact: reduction of GHG emissions from agriculture by at least 20% by 2020 compared to baseline scenario

Estimated costs and benefits: about 383 million lei for the implementation of mitigation measures with a direct or indirect impact on GHG emissions generated by the plant growing sector.

The Low-Emission Development Strategy until 2030 and the Action Plan for its implementation, GD no. 1470/2016[199]

Objective: 37% unconditional reduction of greenhouse gas emissions from agriculture by 2030 and 41% conditional reduction of greenhouse gases compared to 1990

GHGs targeted by the policy: CO_2, CH_4 and N_2O

Category of measure: regulatory

Status: under implementation

Start of implementation: 2017

Included in: WEM and WAM scenarios

Responsible entity: MAFI, MoE

Monitoring and evaluation indicators: area in ha covered by conservation agriculture (no-till and mini-till); amount of manure in thousands of tones stored in communal platforms or individual deposits; share of livestock covered by advanced feeding technologies

Mitigation impact: GHG emissions from agriculture reduced by 37% by 2030 compared to 1990, unconditionally, and by 41% - conditionally

Estimated costs and benefits: 15.995 million lei for implementing the scenario with unconditional measures (including 14.080 million lei for the plant growing sector), plus an additional 4.183 million lei for implementation of the with additional conditional measures scenario (including 3.520 million lei for the plant growing sector).

The Soil Fertility Conservation and Enhancement Program for 2011-2020, GD no. 626/2011[200], the Action Plan for the implementation of the Soil Fertility Conservation and Enhancement Program for 2014-2016, GD no. 138/2014[201] and the Action Plan for the implementation of the Soil Fertility Conservation and Enhancement Program for 2017-2020, GD no. 554/2017[202]

Objective: Long-term maintenance of the quality and production capacity of soils to ensure the food security of the country; stopping the active degradation of soil on 877 thousand ha of arable land by the end of 2020; implementing measures to preserve and increase soil fertility on 1.7 million ha by 2020; implementing zonal crops; use of soil conservation cultivation system; compensation of humus losses in soil by production and application of manure, composts, incorporation of secondary agricultural production (straw, other organic residues) with the application of 10 kg of nitrogen to 1 t of organic residues; growing leguminous crops

[198] Government Decision no. 301 of 24.04.2014 approving the Environmental Strategy for 2014-2023 and the Action Plan for its implementation. Published: 06.05.2014 in the Official Gazette no. 104-109, art 328. <https://www.legis.md/cautare/getResults?doc_id=114539&lang=ro>

[199] Government Decision no. 1470 of 30.12.2016 approving the Low Emission Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation. Published: 24.03.2017 in the Official Gazette no. 85-91, art. 222. <https://www.legis.md/cautare/getResults?doc_id=114408&lang=ro>

[200] Government Decision no. 626 of 20.08.2011 approving the Soil Conservation and Fertility Enhancement Program for the years 2011-2020. Published: 26.08.2011 in the Official Gazette no. 139-145, art. 696. <https://www.legis.md/cautare/getResults?doc_id=110149&lang=ro>

[201] Government Decision no. 138 of 24.02.2014 approving the Action Plan on the implementation of the Program for the soil fertility conservation and enhancement for 2014-2016. Published: 28.02.2014 in the Official Gazette no. 49-52, art. 154. <https://www.legis.md/cautare/getResults?doc_id=13424&lang=ro>

[202] Government Decision no. 554 of 14.07.2017 approving the Action Plan on the implementation of the Soil Fertility Conservation and Enhancement Program for 2017-2020. Published: 21.07.2017 in the Official Gazette no. 253-264, art. 650. <https://www.legis.md/cautare/getResults?doc_id=113349&lang=ro>

on 20-25% of arable lands for the accumulation of biological nitrogen; application of mineral fertilizers to prevent soil drying in nutrients and achieve the expected yields, etc.

GHGs targeted by the policy: CO_2 and N_2O

Category of measure: regulatory and economic

Status: under implementation

Start of implementation: 2011

Included in: With Existing Measures scenario

Responsible entity: MAFI

Monitoring and evaluation indicators: the area of the lands on which: active degradation of the top soil cover was stopped; soil fertility preservation and increasing measures were applied; the zonal soils were implemented; the humus losses were compensated by production and application of manure, composts, by incorporating the secondary agricultural production; cultivation of leguminous crops; mineral fertilizers were applied to prevent the drying of the soils in nutrients and to achieve the expected yields, etc.

Mitigation impact: not available

Estimated costs and benefits: The allocation of 140 million lei was planned for the implementation of the Program from the state budget.

The Land Improvement Program aimed at ensuring sustainable management of soil resources for 2021-2025 and the Action Plan for its implementation for 2021-2023, GD no. 864/2020[203]

Objective: Achieving the objectives set until 2025 regarding the prevention, stopping the degradation of soils and enhancing fertility, erosion control on 482 hectares; deep erosion control on 1900 hectares; wind erosion (deflation) control on 170 hectares; soil improvement on 68.5 thousand hectares; chemical improvement on 500 hectares; water improvement (irrigation facilities), and expanding irrigated areas by 68 thousand hectares; preserving and increasing soil fertility on 5 thousand hectares

GHGs targeted by the policy: CO_2 and N_2O

Category of measure: economic

Status: under implementation

Start of implementation: 2021

Included in: With Additional Measures scenario

Responsible entity: MAFI

Monitoring and evaluation indicators: rehabilitated grass cover, improved pastures, degraded lands, rehabilitated filter stripes, decontaminated polluted lands, grassy terraces, in ha; afforestation on agricultural lands subject to landslides; ha of hydrotechnical and phytoameliorative anti-erosion plannings; ha of windshield forest stripes set up/ rehabilitated; ha of created agroforestry plantations; riparian stripes for protection of the created waters; forest stripes in the created ravines and valleys; ha of amended soils; ha occupied by sidereal crops and ha occupied by vegetable crops.

[203] Government Decision no. 864 of 09.12.2020 approving the Land Improvement Program aimed at ensuring sustainable management of soil resources for 2021-2025 and the Action Plan for its implementation for 2021-2023. Published: 22.01.2021 in the Official Gazette no. 13-20, art. 22. <https://www.legis.md/cautare/getResults?doc_id=125027&lang=ro>.

Mitigation impact: not available

Estimated costs and benefits: financial means amounting to 4,278 billion lei were planned, including 59,626 million lei from the state budget, respectively 4,219 billion lei from external sources; the benefits correspond to the objectives set out above.

Summarizing the information presented above in the sectoral policies related to the plant growing and soil resources sector, it can be concluded that measures contributing the most efficient way to achieving the objective of reducing greenhouse gas emissions in the plant growing and soil resources sector would be the following:

- *use of lands in accordance with their natural destination for different agricultural use*, as assessed on the basis of the pedological study and local relief and climate conditions;
- *introduction of the conservation agriculture system,* based on implementation of the soil conservation technologies (SLCs): "mini-till" and "no-till" system based on scientifically substantiated measures; on a harmless system of fertilization and crops protection;
- *use of sidereal (green) fertilizers (annual leguminous crops mixed with grasses)*: introduction of carbon from intermediate vegetation into the soil between the growing periods of the basic agricultural crops;
- *incorporation of plant residues into the soil*: increased carbon content in soil is ensured by incorporation of agricultural residues remaining in the field after the main harvest;
- *optimized fertilizer application*: reducing the amount of nitrogen fertilizers and replacing them with green fertilizers in particular will reduce GHG emissions;
- *crop rotation*: using crop rotation on slopes, planting predominantly dense sown crops can significantly increase the retention of carbon in the soil and control erosion;
- *the inclusion of leguminous crops in the crop rotation*: the inclusion in the crop rotation of nitrogen-fixing leguminous crops such as beans, peas, soybeans, vetches, alfalfa, asparagus contributes to reducing the need for nitrogen fertilizers, respectively reduction of the related GHG emissions, ensure increased organic carbon content in the soil and restoration of the arable layer structure and general quality.

3.5.4. Land Use, Land Use Change and Forestry Sector

The legislative and normative framework, underpinning the state policy promoted in the "Land Use, Land Use Change and Forestry" (LULUCF) Sector, includes the Constitution of the RoM, over 30 laws and a set of Government Decisions that refer, directly or indirectly, to the forestry and land use.

Forest Code[204] (no. 887/1996, the last update – 2017) is the basic document regulating the relations of forest use, land and water protection, as well as the use and conservation of the vegetal and animal kingdom within the forest fund. Considering the major changes produced in our country,

[204] Forest Code no.887/1996, Published: 16-01-1997 in the Official Gazette no. 4-5 art. 36. Version effective as of 27.10.2017.
< https://www.legis.md/cautare/getResults?doc_id=118482&lang=ro>

the need for new instruments for protection and sustainable management of the forest and hunting funds, as well as for the purpose of harmonizing the national forestry legislation with the European legislation, the new version of the Forest Code is being developed, with subsequent examination in legislative techniques and approval by the Parliament. Another important document related to LULUCF Sector is the Land Code[205] (no. 828/1991, the last update – 2020), which regulates the land relations, establishes the modalities of assigning and changing the destination categories and the categories of land use, regulates the land ownership regime, protection and improvement of the lands.

At the same time, the contents of the legislative and normative framework associated with the LULUCF sector also finds its reflection - either episodically, tangentially, in a general way, or with a more focused footprint - in a series of legislative and normative acts, such as: the Law on Environmental Protection, no. 1515/1993[206]; the Law on Rivers and Water Basins Protection areas and Stripes, no. 440/1995[207]; GD no. 595/1996 on improving the forestry management and forest vegetation protection[208]; the Law on Natural Resources, no. 1102/1997[209]; the Law on improving degraded lands by afforestation, no. 1041/2000[210]; the National Strategy and Action Plan for Biological Diversity Conservation, PD no. 112/2001[211]; the Law on Nut Crops, no. 658/1999[212]; GD 740/2003 on approval of the normative acts on forestry management[213]; the Regulation on the authorization of logging in the forest fund and forest vegetation outside the forest fund, GD 27/2004[214]; the Law on Vegetal Kingdom, no. 239/2007[215]; Regulation on grazing and mowing, GD no. 667/2010[216]; the National Program on establishing the national ecological network for 2011-2018, GD no. 593/2011[217]; the Strategy on rural extension services development for 2012-2022, GD no. 486/2012[218]; the National Strategy for Agricultural and Rural Development for 2014-2020, GD no. 409/2014[219]; Regulation on the afforestation of publicly owned degraded lands of administrative-territorial units and privately owned degraded lands, GD 1186/2016[220]; the “Green” Economy Promotion Program for 2018-2020 and the Action Plan for its implementation, GD no. 160/2018[221]; Regulation on conditions and procedures for carrying out the land improvement and soil fertility protection, conservation and enhancing activities, GD 691/2018[222] etc.

The following normative acts can be regarded as part of the legislative framework as having a direct impact on the level of GHG sinks in the LULUCF sector.

GD no. 106/1996 on measures ensuring protection of forests, protective forest belts and other forest plantations[223]

Objective: To stop illicit logging of forests, forest protection curtains, other forest plantations and other violations of forest legislation

GHGs targeted by the policy: CO_2 (indirect)

Category of measure: regulatory

Status: under implementation

Start of implementation: 1996

Included in: With Existing Measures scenario

Responsible entity: the Ministry of Environment, “Moldsilva” Agency, District Executive Committees, Town Halls of Communes and Municipalities

Monitoring and evaluation indicators: Prevention and sanctioning measures against infringements of forestry legislation enforced; amount of illicit logging detected and documented

Mitigation impact: not available

Estimated costs and benefits: not available

GD no. 32/2001 on measures for the establishment of riparian zones and stripes for protection of rivers waters and water catchments[224]

Objective: Establishing the size of riparian areas and stripes for protection of rivers and water basins in the Republic of Moldova (84 thousand ha), as well as carrying out afforestation

[205] Land Code. no. 828/1991. Published: 04-09-2001 in the Official Gazette no. 107 art. 817, Modified LP96 of 11.06.20, OG161-164/03.07.20 art. 311; effective since 03.08.2020, <https://www.legis.md/cautare/getResults?doc_id=122075&lang=ro>

[206] The LAW on Environment Protection no.1515/1993 Published: 30-10-1993 in the Official Gazette no. 10. 283 amended by PL253 of 22.11.18, OG1-5/04.01.19 art. 4; effective since 04.02.2019, <https://www.legis.md/cautare/getResults?doc_id=112032&lang=ro>

[207] The LAW no.440/1995 on Rivers and Water Basins Protection Areas and Stripes. Published: 03-08-1995 in the Official Gazette no. 43, art. 482, Modified by the LP64 of 23.04.20, OG115-117/15.05.20 art.203; effective since 15.05.2020, <https://www.legis.md/cautare/getResults?doc_id=121475&lang=ro>

[208] GD no.595/1996 on forestry management improvement and protection of the forest vegetation. Published: 05-12-1996 in the Official Gazette no. 78-79 art. 635, <https://www.legis.md/cautare/getResults?doc_id=47442&lang=ro>

[209] The LAW on Natural Resources no.1102/1997. Published: 19-06-1997 in the Official Gazette no. 40. 337 Modified by the LP185 of 21.09.17, OG371-382/27.10.17 art. 632; effective since 27.10.2017, <https://www.legis.md/cautare/getResults?doc_id=109389&lang=ro>

[210] The LAW on improving degraded lands by afforestation no.1041/2000, Published: 09-11-2000 in the Official Gazette no. 141-143 art. 1015 Version effective since 01.01.2004 based on the amendments by the LP482/04.12.03, OG6-12/01.01.04 art.48, <https://www.legis.md/cautare/getResults?doc_id=64409&lang=ro>

[211] PD no.112/2001 on approval of the National Biological Diversity Strategy and Action Plan. Published: 02-08-2001 in the Official Gazette no. 90 art. 700 Version in force from 04.05.07 based on the amendments by PD80-XVI of 29.03.07, OG60-63/04.05.07 art. 288. <https://www.legis.md/cautare/getResults?doc_id=77328&lang=ro>

[212] The LAW on Nut Crops no. 658/1999. Published: 29-12-1999 in the Official Gazette no. 153-155 art. 749, Version effective since 15.06.2018 based on the amendments by the LP79 as of 24.05.2018,OG 195–209/338 as of 15.06.2018, <https://www.legis.md/cautare/getResults?doc_id=108460&lang=ro>

[213] GD no.740/2003 on approval of the normative acts on forestry management. Published: 27-06-2003 in the Official Gazette no. 126-131 art. 778 Modified by the GD1143 of 21.11.18, OG13-21/18.01.19 art.7; effective since 18.01.2019, <https://www.legis.md/cautare/getResults?doc_id=112873&lang=ro>

[214] GD no. 27/2004 approving the Regulation regarding the authorization of felling in the forest fund and forest vegetation areas outside the forest fund. Published: 30-01-2004 in the Official Gazette no. 19-21 art. 155 Modified by the GD1143 of 21.11.18, OG13-21/18.01.19 art.7; effective since 18.01.2019, <https://www.legis.md/cautare/getResults?doc_id=113236&lang=ro>

[215] The LAW on Plant Kingdom no.239/2007. Published: 26-02-2008 in the Official Gazette no. 40-41 art. 114 Version effective since 24.08.18 based on the amendments by the LP172 of 27.07.18, OG321-332/24.08.18 art. 529; <https://www.legis.md/cautare/getResults?doc_id=107020&lang=ro>

[216] GD no. 667/2010 approving the Regulation on grazing and mowing. Published: 30-07-2010 in the Official Gazette no. 131-134 art. 748, <https://www.legis.md/cautare/getResults?doc_id=19561&lang=ro>

[217] GD no. 593/2011 approving the National Program on the establishment of the national ecological network for 2011-2018. Published: 12-08-2011 in the Official Gazette no. 131-133 art. 664, amended HG1143 of 21.11.18, MO13-21/18.01.19 art. 7; in force since 18.01.19, <https://www.legis.md/cautare/getResults?doc_id=114335&lang=ro>

[218] GD no. 486/2012 regarding the approval of the Strategy for the development of rural extension services for 2012-2022. Published: 13-07-2012 in the Official Gazette no. 143-148 art. 537 Modified by the HG1143 of 21.11.18, OG13-21/18.01.19 art. 7; effective since 18.01.2019, <https://www.legis.md/cautare/getResults?doc_id=114376&lang=ro>

[219] GD no. 409/2014 approving the National Agricultural and Rural Development Strategy for 2014-2020. Published: 10-06-2014 in the Official Gazette no. 152 art. 451. Version effective since 28.09.18 based on the amendments by the GD785 of 01.08.18, OG366-376/28.08.18 art. 962. <https://www.legis.md/cautare/getResults?doc_id=110039&lang=ro>

[220] GD no. 1186/2016 approving the Regulation on afforestation of publicly owned degraded lands of administrative-territorial units and privately owned degraded lands. Published: 04-11-2016 in the Official Gazette no. 379-386 art. 1283, amended by the GD1143 of 21.11.18, OG13-21/18.01.19 art.7; effective since 18.01.19, <https://www.legis.md/cautare/getResults?doc_id=114853&lang=ro>

[221] GD no. 1186/2016 approving the Regulation on afforestation of publicly owned degraded lands of administrative-territorial units and privately owned degraded lands. Published: 04-11-2016 in the Official Gazette no. 379-386 art. 1283, amended by the HG1143 of 21.11.18, OG13-21/18.01.19 art.7, effective since 18.01.19, <https://www.legis.md/cautare/getResults?doc_id=114853&lang=ro>

[222] GD no. 691/2018 approving the Regulation on conditions and procedures for carrying out the land improvement and soil fertility protection, conservation and enhancing activities. Published: 10-08-2018 in the Official Gazette no. 295-308 art. n.a. Repealed by the GD 985 of 22.12.20, OG22-32/29.01.21 art. 33; effective since 29.01.21, <https://www.legis.md/cautare/getResults?doc_id=125431&lang=ro>

[223] GD no. 106/1996 on measures ensuring protection of forests, protective forest belts and other forest plantations. Published: 30-05-1996 in the Official Gazette no. 32-33 art. 222, <https://www.legis.md/cautare/getResults?doc_id=112777&lang=ro>

[224] GD no. 32/2001 on measures for the establishment of riparian zones and strips for the protection of the waters of rivers and water basins. Published: 31-05-2001 in the Official Gazette no. 57-58 art. 366. <https://www.legis.md/cautare/getResults?doc_id=48658&lang=ro>

of riparian areas and water protection stripes on a total area of 23 thousand ha

GHGs targeted by the policy: CO_2

Category of measure: regulatory

Status: under implementation

Start of implementation: 2001

Included in: With Existing Measures scenario (WEM)

Responsible entity: Local public administrations, Land Relations and Cadaster Agency (LRCA), "Apele Moldovei" Agency, MAFI, MoE, "Moldsilva" Agency

Monitoring and evaluation indicators: Forest belts and plantations planted in riparian water protection areas

Mitigation impact: removed greenhouse gas estimated at 210 kt CO_2 annually

Estimated costs and benefits: 2300 thousand lei

The Forestry Sector Sustainable Development Strategy, PD no. 350/2001[225]

Objective: Covering at least 130 thousand ha (15% of the country's territory) with forest vegetation; creation of new forest bodies, green islands of trees and shrubs, interconnection corridors between forested massifs, protective curtains along rivers, roads and around industrial sites.

GHGs targeted by the policy: CO_2

Category of measure: regulatory

Status: under implementation

Start of implementation: 2001

Included in: With Existing Measures scenario

Responsible entity: "Moldsilva" Agency, Ministry of Environment

Monitoring and evaluation indicators: wooded areas

Mitigation impact: removal of greenhouse gas estimated at 1180 kt CO_2 annually

Estimated costs and benefits: according to GD 739/2003, 345.9 million lei (US $25.5 million).

State program for regeneration and afforestation of forest land areas for 2003-2020, GD no. 737/2003[226]

Objective: Planting Forest crops on 24.7 thousand ha (26%), aiding natural regeneration on 39.0 thousand ha (41%) and natural regeneration on 31.4 thousand ha (33%). In total, the regeneration and afforestation works in the forest fund until 2020 will take place on a total area of 95.1 thousand ha

GHGs targeted by the policy: CO_2

Category of measure: regulatory

Status: under implementation

Start of implementation: 2003

Included in: With Existing Measures scenario

Responsible entity: Ministry of Environment, 'Moldsilva' Agency

Monitoring and evaluation indicators: afforested and regenerated areas of the forest fund

Mitigation impact: removed greenhouse gas estimated at 225 kt CO_2 annually

Estimation of costs and benefits: 588.1 million lei or 42.6 million US dollars, including annual expenses of about 32.7 million lei or 2.4 million US dollars.

The possibility of harvesting wood mass in the process of main products cutting during 2016-2020, GD no. 890/2015[227]

Objective: Timber harvesting in the process of main products cutting (regeneration cuts), conservation and ecological reconstruction in total amount of 1871.5 thousand m^3 or 374.3 thousand m^3 annually during 2016-2020

GHGs targeted by the policy: CO_2

Category of measure: regulatory

Status: achieved

Start of implementation: 2016

Included in: With Existing Measures scenario

Responsible entity: Ministry of Environment, "Moldsilva" Agency, IPM, Environmental Agency

Monitoring and evaluation indicators: amount of wood harvested annually in the process of main products felling, conservation and ecological reconstruction

Mitigation impact: not available

Estimated costs and benefits: not available.

Environmental Strategy for 2014-2023 and the Action Plan for its implementation, GD no. 301/2014[228]

Objective: The extension of the forest areas up to 15% of the country's territory, of the natural areas protected by the state up to 8% of the territory

GHGs targeted by the policy: CO_2

Category of measure: regulatory

Status: under implementation

Start of implementation: 2014

Included in: With Existing Measures scenario

Responsible entity: Ministry of Environment, 'Moldsilva' Agency

Monitoring and evaluation indicators: the area of wooded lands; the area of forest belts for protection of restored agricultural lands; the area of wooded riparian stripes; the area of forest plantations, green spaces created

Mitigation impact: greenhouse gas emissions reduced by 20%

Estimated costs and benefits: 83 million lei

[225] HP no. 350/2001 for the approval of the Sustainable Development Strategy of the Forestry Sector of the Republic of Moldova, Published: 08-11-2001 in the Official Gazette no. 133-135 art. 1021, < https://www.legis.md/cautare/getResults?doc_id=63247&lang=ro>

[226] GD no. 737/2003 regarding the approval of the State Program for regeneration and afforestation of forest land for the years 2003-2020, Published: 01-07-2003 in the Official Gazette no. 132-133 Art. 788, <https://www.legis.md/cautare/getResults?doc_id=112869&lang=ro>

[227] GD no. 890/2015 approving the possibility of harvesting wood in the process of main products cutting during 2016-2020, Published: 31-12-2015 in the Official Gazette no. 370-376 art. 996, <https://www.legis.md/cautare/getResults?doc_id=114820&lang=ro>

[228] GD no. 301/2014 approving the Environmental Strategy for 2014-2023 and of the Action Plan for its implementation. Published: 06-05-2014 in the Official Gazette no. 104-109 art. 328, <https://www.legis.md/cautare/getResults?doc_id=114539&lang=ro>

The Action Plan on implementation of the National Agricultural and Rural Development Strategy for 2014-2020, GD no.742/2015[229]

Objective: Establishment of 4.5 thousand ha of modern vineyards by 2020; planting 7.5 thousand ha of energy crops; rehabilitation of 2199 ha of forest belts

GHGs targeted by the policy: CO_2, CH_4 and N_2O

Category of measure: regulatory

Status: under implementation

Start of implementation: 2014

Included in: With Existing Measures scenario

Responsible person: MAIA, MoE

Monitoring and evaluation indicators: area of newly established vineyards; rehabilitated forest belts

Mitigation impact: removed greenhouse gas estimated at 30 kt CO_2 annually

Estimated costs and benefits: 225.7 million lei for vineyards; 15.2 million lei for the rehabilitation of forest belts for protection of agricultural fields

The Climate Change Adaptation Strategy until 2020 and the Action Plan for its implementation, GD no. 1009/2014[230]

Objective: Afforestation of 20 thousand ha of land and creation of green islands, creation/restoration of 3000 ha of forest curtains and creation of energy plantations on an area of 5 thousand ha by 2020

GHGs targeted by the policy: CO_2, CH_4 and N_2O

Category of measure: regulatory

Status: under implementation

Start of implementation: 2014

Included in: With Existing Measures scenario

Responsible entity: Ministry of Environment, 'Moldsilva' Agency

Monitoring and evaluation indicators: area of wooded lands, green islands, forest belts, energy plantations

Mitigation impact: removed greenhouse gas estimated at 210 kt CO_2 annually

Estimated costs and benefits: 500 million lei for afforestation of lands; 66 million lei for restoration/ creation of forest curtains; 380 million lei for creation of energy plantations

The Low Emission Development Strategy until 2030 and the Action Plan for its implementation, GD no. 1470/2016[231]

Objective: 3.8 thousand hectares afforested annually; 5.9% of the total area (860,000 ha) of degraded land improved by afforestation; 3.6% of the total area of degraded land planted with forest vegetation; 12,000 ha of planted protection forest belts, 10 thousand ha of planted forest energy crops

GHGs targeted by the policy: CO_2, CH_4 and N_2O

Category of measure: regulatory

Status: under implementation

Start of implementation: 2016

Included in: With Existing Measures scenario

Responsible entity: Ministry of Environment, 'Moldsilva' Agency

Monitoring and evaluation indicators: number of hectares afforested annually, including on degraded land, with protection forest belts, energy forestry crops

Mitigation impact: unconditional increase, by 2030, of carbon sequestration capacity up to 62% and greenhouse gas sequestration up to 76% compared to 1990

Estimated costs and benefits: 2597 million lei from the state budget, 1621.4 million lei from external assistance.

Biological Diversity Strategy for 2015-2020 and the Action Plan for its implementation, GD no. 274/2015[232]

Objective: rehabilitation of forest belts for protection of agricultural fields on an area of 3000 ha; restoration of riparian forest belts for protection of rivers and water basins on an area of 3000 ha; creation of forest plantations on degraded land, with the promotion of native species on an area of 500 ha (Central and Northern area) etc.

GHGs targeted by the policy: CO_2, CH_4 and N_2O

Category of measure: regulatory

Status: under implementation

Year of start of implementation: 2015

Included in: With Existing Measures scenario

Responsible: Ministry of Environment, Agency "Apele Moldovei", Agency "Moldsilva"

Monitoring and evaluation indicators: forested riparian strips, protection strips of rehabilitated agricultural fields; forest plantations created on degraded lands

Mitigation impact: greenhouse gas sequestration – estimated 100 kt CO_2 annually

Estimation of costs and benefits: 379.2 million lei for the afforestation of riparian stretches for the protection of rivers and water basins; 376.2 million lei for the rehabilitation of forest belts for the protection of agricultural fields; 338.0 million lei for the creation of forest plantations on degraded lands, with the promotion of native species

The possibility of harvesting the wood mass in the process of cutting the main products during 2021-2025, GD no.958/2020[233]

Objective: Harvesting in the process of cutting the main products (regeneration cuts), conservation and ecological reconstruction of 1601.5 thousand m^3 of wood or about 320.3 thousand m^3 annually

[229] GD no. 742/2015 approving the Action Plan on the National Agricultural and Rural Development Strategy implementation for 2014-2020. Published: 30-10-2015 in the Official Gazette no. 297-300 art. 835, <https://www.legis.md/cautare/getResults?doc_id=110254&lang=en>

[230] GD no. 1009/2014 approving the Climate Change Adaptation Strategy of the Republic of Moldova until 2020 and the Action Plan for its implementation. Published: 19-12-2014 in the Official Gazette no. 372-384 art. 1089, <https://www.legis.md/cautare/getResults?doc_id=114739&lang=ro>

[231] GD no. 1470/2016 approving the Low Emission Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation. Published: 24-03-2017 in the Official Gazette no. 85-91 art. 1470, <https://www.legis.md/cautare/getResults?doc_id=114408&lang=ro>

[232] GD no. 274/2015 approving the Biological Diversity Strategy of the Republic of Moldova for 2015-2020 and the Action Plan for its implementation Published: 05/29/2015 in the Official Gazette no. 131-138 art. 321, <https://www.legis.md/cautare/getResults?doc_id=114746&lang=ro>

[233] GD 958/2020 on approving the possibility of harvesting the wood mass in the process of cutting the main products during 2021–2025 Published: 31-12-2020 in the Official Gazette no. 372-382 art. 1143, <https://www.legis.md/cautare/getResults?doc_id=124767&lang=ro>

GHGs targeted by the policy: CO_2, CH_4 and N_2O

Category of measure: regulatory

Status: under implementation

Start of implementation: 2021

Included in: With Existing Measures scenario

Responsible entity: Ministry of Environment, 'Moldsilva' Agency

Monitoring and evaluation indicators: quantity of harvested wood

Mitigation impact: not available

Estimated costs and benefits: not available

The Horticulture Development Program for 2021-2025 and the Action Plan for its implementation, GD no. 840 of 18.11.2020[234]

Objective: The document will contribute to the achievement of the objective "Targeting investments towards strengthening the value chain and the agricultural production processing infrastructure and modernization of the processing industry by creating a system of small and medium enterprises for processing, storage and packaging agri-food products", established by the above Plan for the agricultural sector and food industry. The specific LULUCF related objectives - stimulate the establishment of intensive multiannual plantations with the assortment range required on regional markets and stimulate the deforestation of aging multiannual plantations to prevent the spread of diseases and pests.

GHGs targeted by the policy: CO_2

Category of measure: regulatory

Status: under implementation

Start of implementation: 2021

Included in: With Additional Measures scenario

Responsible entity: MAFI

Monitoring and evaluation indicators: 21.8 kha of established plantations and implemented investments; estimated 21 kha of deforested areas, including orchards and vineyards with exceeded exploitation term.

Mitigation impact: removed greenhouse gas estimated at 26 kt CO_2 annually

Estimated costs and benefits: 3026 million lei for establishment of multiannual plantations and 391 million lei for deforestation of aging multiannual plantations.

Draft Strategy on Adaptation of the Forestry Sector to Climate Change for 2018-2025 and Action Plan for its implementation

Objective: extending areas covered with forest vegetation outside the forest fund by 13.5 thousand ha; creation of rural and urban green spaces on 5 thousand ha; planting energy forest crops on an area of about 10.0 thousand ha

GHGs targeted by the policy: CO_2, CH_4 and N_2O

Category of measure: regulatory

Status: planned

Start of implementation: not determined

Included in: With Additional Measures scenario

Responsible entity: Ministry of Environment, 'Moldsilva' Agency

Monitoring and evaluation indicators: area covered with forest vegetation outside the forest fund; rural and urban green spaces; forest energy crops plantations

Mitigation impact: removed greenhouse gas estimated at 165 kt CO_2 annually

Estimated costs and benefits: 160.3 million lei for all activities

Draft National Plan on Extension of Areas Covered with Forest Vegetation for 2019-2024

Objective: Expansion of forest vegetation on the total area of 13.0 thousand ha on the account of degraded lands, as well as providing 71.5 million pieces of planting material for the extension works

GHGs targeted by the policy: CO_2

Category of measure: regulatory

Status: planned

Start of implementation: not determined

Included in: With Additional Measures scenario

Responsible entity: Ministry of Environment, 'Moldsilva' Agency

Monitoring and evaluation indicators: area of wooded degraded land, wooded protection areas of river waters and water basins, planted forest curtains for protection of the agricultural lands

Mitigation impact: removed greenhouse gas estimated at 120 kt CO_2 annually

Estimated costs and benefits: 545.8 million lei for the implementation of all activities.

Concept of the National Reforestation Campaign for 2022-2031 (project)

Objective: Extension of forest vegetation on the total area of 76 thousand ha of new land, including 66 thousand ha of forest plantations (forests) and 10 thousand ha of riparian forest and agricultural fields protection belts. The structure by the type of ownership is the following: state owned – 9.12 thousand ha or 12.0%, owned by ATU– 46.2 thousand ha (60.8%), private ownership – 20.68 thousand ha (27.2%). The planting needs under the Campaign will require about 48 million seedlings annually (40 million for planting; 8 million additions for repairs), cumulatively for the entire period – 450 million seedlings.

GHGs targeted by the policy: CO_2

Category of measure: regulatory

Status: planned

Start of implementation: not determined

Included in: With Additional Measures scenario

Responsible entity: Ministry of Environment, 'Moldsilva' Agency

[234] GD 840/2020 approving the Horticulture Development Program for 2021-2025 and the Action Plan on its implementation <https://www.legis.md/cautare/getResults?doc_id=124291&lang=ro>

Monitoring and evaluation indicators: area of wooded degraded land, wooded protection areas of river waters and water basins, planted forest curtains for protection of agricultural land

Mitigation impact: estimated 585 kt CO_2 annually or an increase by about 30% of the amount removed annually by the current forests in the Republic of Moldova

Estimated costs and benefits: 192 mil. Euro for implementation of all activities, including 9 mil. Euro for capacity building activities.

3.5.5. Waste Sector

In the Republic of Moldova, the legal framework in the field of environmental protection is being updated, in accordance with the National Action Plan for the implementation of Moldova-EU Association Agreement. Thus, in recent years, new regulations have been introduced in the field of waste management, including on GHG emissions reduction, which contain provisions providing for endowment of SWD landfills with biogas recovery facilities. Policies aimed at GHG emission reduction in the waste sector are reflected in a series of pieces of legislation.

The Law on Waste no. 209 of 29.07.2016 transposed into national legislation the Directive 2008/98/EC and other 9 European acts, for which the secondary framework had to be developed. Thus, in 2018-2020, a number of legislative acts were adopted for coherent application of the Law on Waste no. 209/2016, which by the GD no. 99/2018 approving the List of wastes, transposed the Commission Decision 2000/532/EC on the list of waste, including hazardous waste. At the same time the GD no. 501/2018 on the Instruction on keeping record and transmission of data on waste and waste management and the GD no. 682/2018 on the Concept of the Automated Waste Management Information System by which the www.siamd.gov.md reporting system was developed, were approved. Other regulations have also recently been approved, such as the following:

- GD no. 212/2018 approving the Regulation on electrical and electronic equipment waste.
- GD no. 373/2018 on the National Pollutant Release and Transfer Register, in particular the Regulation on the National Pollutant Release and Transfer Register.
- GD 561/2020 approving the Regulation on packaging and packaging waste.

The policy documents and recently approved new ones, which specify emission reduction issues in this sector more evidently, are listed below:

The Environmental Strategy for 2014-2023 and Action Plan for its implementation, GD no. 301/2014[235]

The overall objective of the Strategy is to create an effective environmental management system, including (Specific Objective 7) "Creation of an integrated air quality management system, a 30% reduction of pollutant emissions into the atmosphere by 2023 and at least 20% of greenhouse gases by 2020, compared to the baseline scenario". In the Waste sector, a reduction of about 15% of GHG emissions compared to the baseline scenario is expected by 2020.

GHGs targeted by the policy: CH_4 and N_2O

Measure category: regulatory

Status: under implementation between 2014 and 2023

Start of implementation: 2014

Included in: With Existing Measures scenario (WEM)

Responsible entity: Ministry of Environment

Monitoring and implementation indicators: pollutant emissions, GHG emissions, number of approved normative acts aimed at regulating emissions

Mitigation impact: 30% reduction in air pollutant emissions by 2023 and at least 20% reduction in greenhouse gas emissions by 2020 compared to the baseline scenario, about 15% reduction in GHG emissions compared to the baseline scenario for the waste sector.

Estimation of costs and benefits: about 110 million lei are planned for implementation of actions and measures to achieve these objectives. The Action Plan also includes other legislative measures for which the allocated budget is not indicated.

Waste Management Strategy for 2013-2027, GD no. 248/2013[236]

The Waste Management Strategy for 2013-2027 promotes a new way of collecting municipal waste, recovery of reusable materials, environment protection and implementation of a unitary street sanitation program, which contributes to reduction of the amount of waste deposited in those areas, by establishing an appropriate treatment system for each type of waste, aimed at environment protection. The general objectives of the Strategy are to develop the integrated municipal waste management systems by harmonizing the regulatory acts; territorial division of the country into 8 waste management regions; to increase the amount of recycled and capitalized waste by 20-30% by 2025; to reduce the amount of deposited biodegradable waste; to develop regional waste disposal infrastructure by building 7 SWD landfills and 2 mechanical-biological treatment plants (MBT) in Chisinau and Balti municipalities; to recultivate at least 50% of the number of non-compliant landfills by 2027.

GHGs targeted by the policy: CH_4 and N_2O

Measure category: regulatory

Status: under implementation 2013-2027

Start of implementation: 2013

Included in: With Additional Measures scenario (WAM).

Note: *Although previously within BUR1 and BUR2, the Waste Management Strategy for 2013-2027 was considered under the WEM as a policy framework containing measures approved and published at the time of BUR1 and BUR2 development, in BUR3 it has been decided to consider this document under the WAM, as its implementation (development of integrated waste management*

[235] GD no.301/2014 approving the Environmental Strategy for 2014-2023 and the Action Plan for its implementation, Published: 06-05-2014 in the Official Gazette no. 104-109 art. 328 <https://www.legis.md/cautare/getResults?doc_id=114539&lang=ro>

[236] GD no. 248/2013 regarding the approval of the Waste Management Strategy of the Republic of Moldova for 2013-2027, Published: 12-04-2013 in the Official Gazette no. 82 art. 306, <https://www.legis.md/cautare/getResults?doc_id=114412&lang=ro>

systems) is totally conditioned by the external donor's financial support.

Responsible: Ministry of Environment

Monitoring and implementation indicators: number of approved acts; number of waste management; percentage of the population benefiting from continuous waste collection services; geographical coverage and number of compliant environmentally sound waste treatment and disposal capacities; amount of waste collected separately and recycled (including special waste streams such as packaging and electrical and electronic equipment, end-of-life vehicles, etc.); amount of waste subject to recovery (including energy recovery); amount of landfilled waste; number of non-compliant landfills closed and recycled;

Mitigation impacts: The development of waste management infrastructure would help to reduce GHG emissions in the waste sector, but the strategy does not quantify these reductions.

Estimated costs and benefits: the cost of implementing the strategy provisions regarding development of the municipal waste management infrastructure indicates 145,168,000 Euro with the support of internal and external financing attracted and implemented for the development of the waste management institutional capacity, infrastructure and services.

***The Law on Waste no. 209 of 29.07.2016*[237]**

Establishing the legal basis, the state policy and the necessary measures for protection of the environment and the health of the population by preventing or reducing the effects of waste generation and management. The law transposes Directive 2008/98 / EC of the European Parliament and a number of provisions from about nine regulatory acts of the European Union, creating a platform for taking over or transposing into national law the provisions of these Community acts, provided by the Association Agreement, as well as the Agreement for the creation of the Deep and Comprehensive Free Trade Area (DCFTA), which is an integral part of the Association Agreement. The law imposes new regulations, including ensuring separate collection of bio-waste for composting and fermentation purposes; treating bio-waste in a way that ensures a high level of environmental protection; using environmentally safe materials produced from bio-waste. At the same time, biodegradable waste from parks and gardens must be collected separately and transported to composting stations or individual composting platforms.

GHGs targeted by the policy: CH_4 and N_2O

Measure category: regulatory

Status: approved 29.07.2016

Start of implementation: effective as of 23.12.2017

Included in: With Existing Measures scenario

Responsible entity: Ministry of Environment

Monitoring and implementation indicators: amount of biodegradable waste collected separately for composting and fermentation; number of composting stations, individual composting platforms and bio-digesters.

Mitigation impacts: The development of waste management infrastructure through composting or fermentation would help to reduce GHG emissions for the waste sector, but the strategy does not quantify these reductions.

Estimated costs and benefits: the Law no. 209/2016 does not provide for costs for its implementation, including the development of composting stations, individual composting platforms and biodigesters. These costs will be estimated in the feasibility studies for the development of the integrated waste management system at regional level.

***The LEDS until 2030 and the Action Plan for its implementation, GD no. 1470 of 30.12.2016*[238]**

The strategy presents a vision of changing the long-term development paradigm of the RoM towards green economic development, based on the low-carbon development constraints assessment. The overall objective of the Strategy is in line to the one set out in the Intended Nationally Determined Contribution and is oriented towards the unconditional reduction, by 2030, of the total national emissions of net greenhouse gases by no less than 64% compared to 1990, in support of the global effort to maintain the trend of increasing the global average temperature, by 2100, within the limit of up to 2°C. The emission reduction target could be increased to 78% conditionally – in line with a global agreement that would address important issues such as low-cost financial resources, technology transfer and technical cooperation, access to all to the extent appropriate to the challenges of global climate change.

Specific objective 7 on waste management provides for an unconditional reduction of greenhouse gas emissions from the waste sector by 38% by 2030 and a conditional reduction of greenhouse gas emissions by 47% compared to 1990.

GHGs targeted by the policy: CH_4 and N_2O

Measure category: regulatory

Status: under implementation since 24.03.2017

Included in: WEM and WAM scenarios

Responsible entity: Ministry of Environment

Monitoring and implementation indicators:

- 38% of GHGs unconditionally reduced from the waste sector by 2030 compared to 1990.
- 47% of GHGs from the sector reduced conditionally by 2030 compared to 1990.

Mitigation impact: development of regional waste disposal infrastructure by building seven municipal solid waste disposal sites and two mechanical-biological treatment plants in Chisinau and Balti municipalities. The implementation of credible mitigation actions in the waste sector is possible through projects focusing on recovery of biogas from managed municipal solid waste disposal sites, which will contribute to the expected reduction of GHG emissions from the waste sector.

[237] Law on Waste no. 209, of 29.07.2016, Official Gazette no. 459-471/916 of 23.12.2016 <https://www.legis.md/cautare/getResults?doc_id=118272&lang=ro>

[238] GD no. 1470 of 30-12-2016 approving the Low Emission Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation Published: 03/24/2017 in the Official Gazette no. 85-91 art. 1470, <https://www.legis.md/cautare/getResults?doc_id=114408&lang=ro>

Estimated costs and benefits: the Law no. 209/2016 does not provide for costs for its application, including the development of composting stations, individual composting platforms and biodigesters. These costs will be estimated in the feasibility studies for the development of the integrated waste management system at regional level.

Draft Waste Management Program for 2022-2027 and the Action Plan for its implementation

Objective: The National Waste Management Program for 2022-2027 is developed in order to implement the Government's Action Plan for 2020-2023, approved by the GD no. 636/2019 and will contribute to the achievement of the objective aimed at developing by 2027 of an economically efficient integrated waste management system which ensures the fundamental right to a healthy and safe environment and achievement of the main indicators of sustainable development, included in the country's sustainable development strategic framework.

The Program contains specific objectives regarding the management of each type of waste and the achievement of the general objectives. In the context of municipal waste and climate change mitigation, it includes measures to promote and implement selective waste collection systems in all urban and rural areas where feasible, both in the domestic and production sectors, as well as in sorting, composting and recycling facilities. It is also planned to develop municipal waste disposal capacities (construction of 8 regional deposit sites and 2 mechanical-biological treatment stations) endowed with methane recovery facilities.

The Program provides for measures to reduce the amount of municipal biodegradable waste by 15% of the total amount of municipal waste, by developing the biodegradable waste collection system at source for residents and other entities, including implementation of selective food/kitchen waste collection and development of capacities for separate treatment of food/kitchen waste. The aerobic and anaerobic enhancement and construction of waste composting and fermentation capacities can indirectly contribute to minimizing waste generation as well as its sustainable disposal, and therefore to reducing GHG emissions.

GHGs targeted by the policy: CH_4 and N_2O

Measure category: regulatory

Status: in preparation

Start of implementation: planned for 2023-2027

Included in: With Additional Measures scenario (WAM)

Responsible entity: Ministry of Environment

Monitoring and implementation indicators: In order to monitor the actions and to assess the level to which the results were achieved, a set of indicators will be applied, such as the amount of municipal waste subject to recycling and composting, the number of municipal waste deposit sites equipped with biogas recovery system, the amount of GHG recovered from landfills, etc.

Mitigation impact: Starting with 2025, it is planned to launch the construction of integrated waste management systems for regions 2, 3, 6, 7, so that by 2027, the amount of municipal waste collected and stored will increase by 11.2% compared to 2020, on the background of full coverage with sanitation services of the entire country. At the same time, by 2027, the amount of separately collected and recovered waste will increase by 239%, of composted waste - by 337% compared to 2020, these being deviated from the flow of municipal waste by promoting separate collection. In addition, once all non-compliant landfills are closed and recultivated, and regional landfill are established, the number of landfills will decrease by 99.3% to 2027, and the areas occupied by landfills will decrease by 87% until 2027.

Estimated costs and benefits: Modernization of municipal waste integrated management infrastructure during 2026-2030, will require approximately 200 million euro financed from the EIB/EBRD loan, and the compensation of about 25% of investments will be covered by the contribution from the State Budget.

Regulation on packaging and packaging waste, GD no.561/2020[239]

Objective: The Regulation on packaging and packaging waste will regulate the management of packaging and packaging waste in order to prevent or reduce its impact on the environment, ensuring a high level of environmental protection, ensure market operation and avoid obstacles to trade, as well as distortion and limitation of competition.

The Regulation will establish the priority measures aimed at preventing production of packaging waste and the principles regarding reduction of the final disposal of packaging waste by reuse, recycling and recovery thereof. All packaging placed on the market, regardless of the material from which they were made, whether they are used or come from industry, offices, shops, services, households or any other activities, as well as all packaging waste, regardless of the way of generation shall be covered by the provisions of the Regulation.

GHGs targeted by the policy: CH_4 and N_2O

Measure category: regulatory

Statutes: effective since the expiry of 12 months after publication.

Start of implementation: 21.08.2021

Included in: With Additional Measures scenario

Responsible entity: Ministry of Environment

Monitoring and implementation indicators: In order to monitor and assess the level at which the objectives set out in the Regulation were achieved, the Environmental Agency will be responsible for developing the reporting framework for the Automated System Waste Management Information on the quantities of packaging placed on the market and of the quantities of waste collected and recovered, therefore the recycling and recovery objectives are the key indicators for this Regulation.

Mitigation impact: The Regulation sets the objectives for the recovery and recycling of packaging waste, which must be

[239] GD no. 561 of July 31, 2020 approving the Regulation on packaging and packaging waste, Published: August 21, 2020 in the Official Gazette no. 212-220 art. 743, <https://www.legis.md/cautare/getResults?doc_id=122773&lang=ro>

achieved at national level, in stages, but no later than 2027, are the following:

1) capitalization of at least 50% of the packaging waste by weight;

2) recycling at least 45% of the total weight of packaging materials contained in packaging waste, achieving the following minimum values for recycling of each type of material contained in packaging waste:

a) 45% by weight for glass,
b) 50% by weight for paper/paperboard,
c) 40% by weight for metal,
d) 10% by weight for wood,
e) 20% by weight for plastic, taking into account only the recycled material in the form of plastic.

Promotion of the principle of extended producer responsibility and separate collection and recovery of paper packaging would reduce the amount of deposited biodegradable waste. As a result, these activities would contribute to reducing the amounts of disposable municipal waste and thus, also GHG emissions for the waste sector.

Draft Waste Disposal Regulation

The draft of the Regulation on waste disposal aims to establish the legal framework for waste storing activities, for the design, construction, operation, monitoring, closure and post-closure follow-up of new and existing landfills, under conditions of environment and public health protection. The Regulation on waste disposal aims to prevent or reduce adverse effects on the environment, in particular pollution of surface water, groundwater, soil, air, including greenhouse effect, as well as any risk to public health, throughout the term of use of the waste deposit site, and after.

The Regulation lays down operational and technical requirements and measures for the depositing of waste to prevent or reduce as far as possible the negative effects on the environment and human health arising from the waste landfilling, throughout the service life of a landfill. It also requires the development of the technical norms regarding the waste depositing, which includes the requirements towards the design, construction, operation, closure and post-closure monitoring stages of a waste deposit.

GHGs targeted by the policy: CH_4 and N_2O

Policy type: regulatory

Status: draft

Start of implementation:

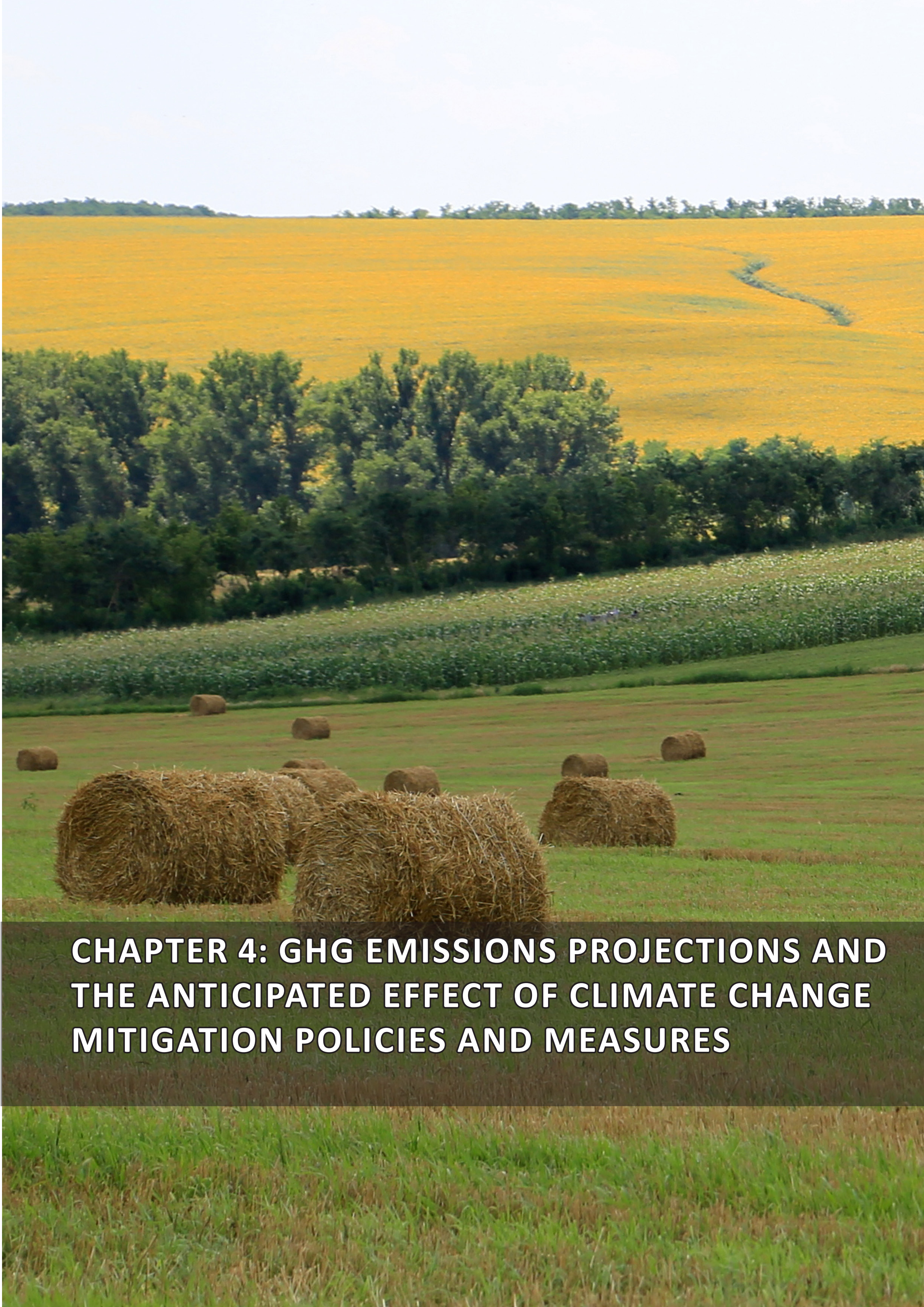
Included in: With Additional Measures scenario

Responsible entity: Ministry of Environment

Monitoring and implementation indicators: Although the draft Regulation on Waste Disposal was developed in 2018, its finalization, promotion and approval are delayed. Also, the Regulation does not provide for the transition phase from the current waste storage/ dumps to regional deposits built and operated according to the provisions of this Regulation. As a monitoring indicator would be the number of closed and recultivated landfills, the number of built deposits.

Mitigation impact: Activities are focused on liquidation, closure and recultivation of existing waste dumps, along with construction of new regional deposits equipped with biogas recovery systems, would contribute to reduction of GHG emissions in the waste sector.

CHAPTER 4: GHG EMISSIONS PROJECTIONS AND THE ANTICIPATED EFFECT OF CLIMATE CHANGE MITIGATION POLICIES AND MEASURES



CHAPTER 4. GHG EMISSIONS PROJECTIONS AND THE ANTICIPATED EFFECT OF CLIMATE CHANGE MITIGATION POLICIES AND MEASURES

4.1. Assumptions and Tools Used

4.1.1. Introduction

GHG emissions projections were made for two scenarios: (1) scenario with existing measures (WEM) and (2) scenario with additional measures (WAM). The need to develop the Business as Usual (BAU) scenario has been dropped due to the fact that when identifying the mitigation targets in the context of the Nationally Determined Contribution (2015), the RoM chose the emissions target relative to the 1990 reference year. Thus, GHG emissions in the WEM and WAM are compared to emissions recorded in 1990, and not to emissions under the BAU scenario.

The GHG mitigation scenarios were generated for the following sectors: Energy, IPPU, Agriculture, LULUCF and Waste.

The mitigation scenarios mentioned above considered the following direct GHG emissions: CO_2, CH_4, N_2O and F-gases.

GHG emissions projections are also expressed in aggregate form (CO_2 equivalent). Projections were made for years 2025, 2030 and 2035. The GHG emissions for years 1990-2020 corresponds to the actual emissions referred to as GHG emissions inventory results for the period 1990-2020, as reflected in Chapter 2 of the "*National GHG Inventory*" of the NC5 and its technical annex "*National Inventory Report: 1990-2020. GHG Sources and Sinks in the Republic of Moldova" (2022).*

Emissions from combustion of fuels in international transport are also presented in this chapter, but they are not accounted in total national emissions.

4.1.2. Scenarios Considered

As already mentioned above, the GHG emissions projections were developed for the years 2025, 2030 and 2035 for the following scenarios, which also reflect the actual emissions of 1990, 1995, 2000, 2005, 2010, 2015 and 2020: (1) WEM scenario – reflects the projections complying with the policies and measures implemented or adopted before 01.01.2022; (2) WAM scenario – reflects policies and measures adopted or under development since 01.01.2022.

4.1.3. Methodologies and Tools

The content of this chapter is based on the Guidelines on Reporting to the UNFCCC for signatory Parties not included in Annex I (Decision 17/CP.8)[240].

Computer based tools as well as top-down and bottom-up methodology were used to measure the GHG emissions mitigation potential. Mitigation scenarios were developed for each individual sector (Energy, Transport, Industry, Agriculture, Forestry and Waste), and GHG emissions were estimated separately for CO_2, CH_4, N_2O and F-gases. The list of tools considered, and tools selected to be used, along with a brief argument to support the selection, is presented in Table 4-1.

[240] UNFCCC Guidelines for the preparation of national communications from Parties not included in Annex I to the Convention (Decision 17/CP.8).

Table 4-1: Tools used to assess the GHG emission reduction potential in RoM

Sector	Recommended Tools	Tools used	Observations
Energy	MESSAGE MARKAL ENPEP-BALANCE LEAP	ENPEP, in complex with sub-programs: WASP, IMPACT Standard Calculation Tool (IPCC, 2006)	1) For the electricity subsector the electricity sources development scenarios were calculated using WASP module, while the GHG emissions mitigation potential - using the IMPACT module; 2) For the thermal power and transport sub-sectors, the GHG emission mitigation potential was assessed using Excel–based calculation tools developed by sectoral experts.
Industry	LEAP	Standard Calculation Tool (IPCC, 2006)	For the Industry, Agriculture and LULUCF subsectors, the GHG emissions mitigation potential was assessed using the Excel-based calculation tools developed by sectoral experts, and the 2006 IPCC Guidelines. To simulate the evolution of GHG emissions/removals in LULUCF, the Land Use, Land Use Change Matrix for the period 1970-2020 extended for the period 2021-2035, was used;
Agriculture	STAIR		
LUUCF	COPATH		
Waste	LEAP	Standard calculation tool (IPCC, 2006) for the Tier 3 Assessment Methodology (IPCC First Order Decay Method)	The potential for mitigation of methane emissions from solid waste deposits was assessed using the Excel based calculation tool developed by sectoral expert, and the Tier 3 Assessment Methodology (IPCC First Order Decay Methodology) from the 2006 IPCC Guidelines; The potential for mitigation of methane and nitrous oxide emissions from wastewater treatment was assessed by using the 2006 IPCC Guidelines methodologies, and the Excel-based calculation tools developed by the sectoral experts.

4.1.4. Key Parameters and Assumptions

Table 4-2 shows the projected key parameters for the national economy, and Table 4-3 shows the specific key parameters used for projections made by sectors.

Table 4-2: Key parameters used in scenarios

Parameters	UM	2000	2005	2010	2015	2020	2025	2030	2035
Real GDP	mil $ SUA	1,289.0	2,988.0	6,977.0	7,746.0	11,916.0	17,435.0	24,577.0	33,902.0
Annual GDP growth	%	-2.2	18.3	18.5	2.1	-0.5	7.5	6.9	6.5
Stable population, annual average	thousand persons	3,640.0	3,595.0	3,562.0	3,554.0	No data			
Population with habitual residence, annual average	thousand persons	No data			2,835.0	2,643.0	2,886.0	2,683.0	2,459.0
Population growth	%	0.2	-0.3	-0.2	-1.4	-1.4	-1.4	-1.4	-1.4
Price of imported natural gas	$/1000m^3	NA	67.0	273.0	224.4	208.4	228.5	208.4	228.5
Price of imported electricity	cents $/kWh	2.8	2.4	5.8	5.9	5.5	6.1	5.5	6.1

Table 4-3: Key parameters used in projections for relevant sectors

Parameters	MU	2000	2005	2010	2015	2020	2025	2030	2035
Power sector									
Electricity demand under WEM and WAM	bill kWh	5.3	6.6	6.0	5.6	5.9	6.3	6.9	7.4
Annual increase in electricity demand	%	NA	4.5	-1.9	-1.4	1.0	1.3	1.8	1.4
Transport									
Number of private vehicles	thous units	NA	NA	NA	637.0	796.0	915.0	1,048.0	1,184.0
Fuel consumption in under WEM	PJ	NA	NA	NA	29.8	34.0	33.1	34.7	38.2
Fuel consumption in under WAM	PJ	NA	NA	NA	29.8	34.0	32.1	33.2	36.3
Buildings (residential, commercial and tertiary)									
Area of buildings	mil m^2	88.0	89.6	92.2	94.2	102.4	108.2	114.0	119.8
Increased ambient temperature in the cold season caused by global warming, admitted	K						0.5	1.1	1.3
Industrial Processes and Product Use									
Cement production, WEM	kt	431.9	772.8	861.4	1,122.8	1,164.1	1,400.0	1,600.0	1,800.0
Cement production, WAM	kt	431.9	772.8	861.4	1,122.8	1,164.1	1,350.0	1,550.0	1,750.0
Steel production, WEM	kt	908.1	1,049.4	242.4	431.8	467.1	502.3	602.8	703.3
Steel production, WAM	kt	908.1	1,049.4	242.4	431.8	467.1	527.5	628.0	728.5
Agriculture									
Areas where the conservation agriculture practices will be employed, WEM	kha	NO	NO	NO	54.0	100.0	100.0	150.0	200.0
Areas where the conservation agriculture practices will be employed, WAM	kha	NO	NO	NO	54.0	100.0	150.0	200.0	250.0
Land Use, Land Use Change and Forestry									
Area of annual successful afforestation, WEM	ha	NA	NA	NA	578.9	715.0	3,795.1	5,060.2	6,072.2
Area of annual successful afforestation, WAM	ha	NA	NA	NA	578.9	715.0	4,746.4	5,222.0	10,476.4
Waste									
Municipal solid waste, WEM	kt	523.8	602.5	1,075.1	1,270.7	1,417.9	1,522.5	1,634.4	1,622.6
Municipal solid waste, WAM	kt	523.8	602.5	1,075.1	1,270.7	1,417.9	1,141.7	1,212.0	1,290.2

4.2. Aggregate Direct GHG Emissions Projections

4.2.1. Aggregate Direct GHG Emissions Projections by Sector

Following the promotion of GHG emissions mitigation policies and measures described in Chapter 3 and underlying the WEM and WAM scenarios concepts, the assumed impact was calculated for the defined IPCC sectors, expressed in CO_2 equivalent. The results apply to the entire country, including ATULBD, and are shown in Table 4-4 and Figure 4-1.

Table 4-4: Aggregate Direct GHG Emissions Projections by Sector in the RoM, kt CO_2 equivalent

	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
WEM										
Energy	36,992.9	12,391.3	6,940.9	8,836.5	9,496.4	9,119.6	9,549.9	8,502.6	8,490.3	9,083.2
IPPU	1,605.2	456.7	315.8	573.1	561.2	765.1	998.8	1,134.9	1,173.0	1,205.7
Agriculture	5,076.7	3,173.4	2,136.2	2,063.2	1,803.7	1,701.2	1,546.4	1,784.0	1,806.5	1,829.1
LULUCF	-1,657.5	-2,031.1	-2,123.3	-1,667.5	-1,228.2	-1,181.9	-3.5	-886.2	-1,779.7	-3,291.9
Waste	1,573.5	1,637.3	1,573.9	1,478.5	1,501.5	1,423.2	1,566.6	1,504.4	1,473.7	1,434.5
Total (with LULUCF)	**43,590.9**	**15,627.6**	**8,843.4**	**11,283.7**	**12,134.7**	**11,827.3**	**13,658.2**	**12,039.7**	**11,163.8**	**10,260.7**
Total (without LULUCF)	**45,248.4**	**17,658.7**	**10,966.7**	**12,951.3**	**13,362.8**	**13,009.2**	**13,661.7**	**12,925.9**	**12,943.5**	**13,552.5**
WAM										
Energy	36,992.9	12,391.3	6,940.9	8,836.5	9,496.4	9,119.6	9,549.9	8,109.1	7,724.5	8,476.3
IPPU	1,605.2	456.7	315.8	573.1	561.2	765.1	998.8	1,053.1	1,063.4	1,064.7
Agriculture	5,076.7	3,173.4	2,136.2	2,063.2	1,803.7	1,701.2	1,546.4	1,743.1	1,754.6	1,762.3
LULUCF	-1,657.5	-2,031.1	-2,123.3	-1,667.5	-1,228.2	-1,181.9	-3.5	-921.1	-2,793.5	-5,540.4
Waste	1,573.5	1,637.3	1,573.9	1,478.5	1,501.5	1,423.2	1,566.6	1,464.8	1,129.3	939.4
Total (with LULUCF)	**43,590.9**	**15,627.6**	**8,843.4**	**11,283.7**	**12,134.7**	**11,827.3**	**13,658.2**	**11,449.1**	**8,878.4**	**6,702.4**
Total (without LULUCF)	**45,248.4**	**17,658.7**	**10,966.7**	**12,951.3**	**13,362.8**	**13,009.2**	**13,661.7**	**12,370.2**	**11,671.8**	**12,242.8**

As can be seen in Figure 4-1, GHG emissions under the WEM are lower than the commitments made by the RoM in the updated NDC (2020). Thus, by 2030 GHG emissions are expected to be lower than in 1990 by 74.4%, compared to 70% according to the unconditional updated NDC (2020). By 2035, net GHG emissions will continue to decrease, reaching a 76.5% reduction versus 1990. Under the WAM, GHG emissions reductions by 2030 will be lower than those set up in the updated conditional NDC, for sector-specific reasons, considered separately in the following chapters dedicated to GHG emissions by sector.

The most significant contribution towards achieving these objectives comes from the energy and the LULUCF sectors, as seen in Figure 4-2.

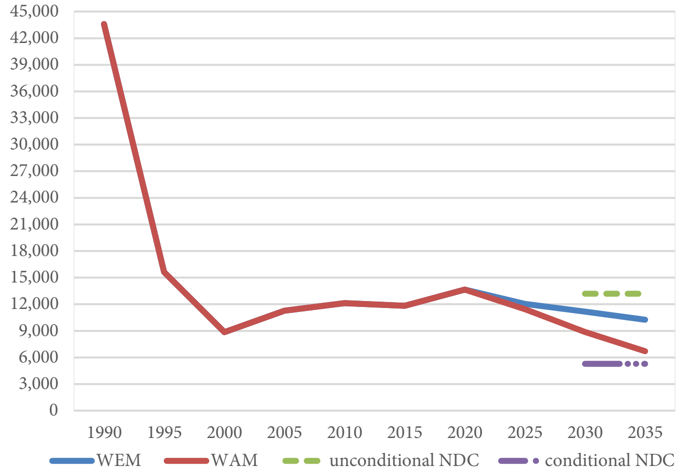


Figure 4-1: Projected net total GHG emissions (with LULUCF), kt CO_2 equivalent

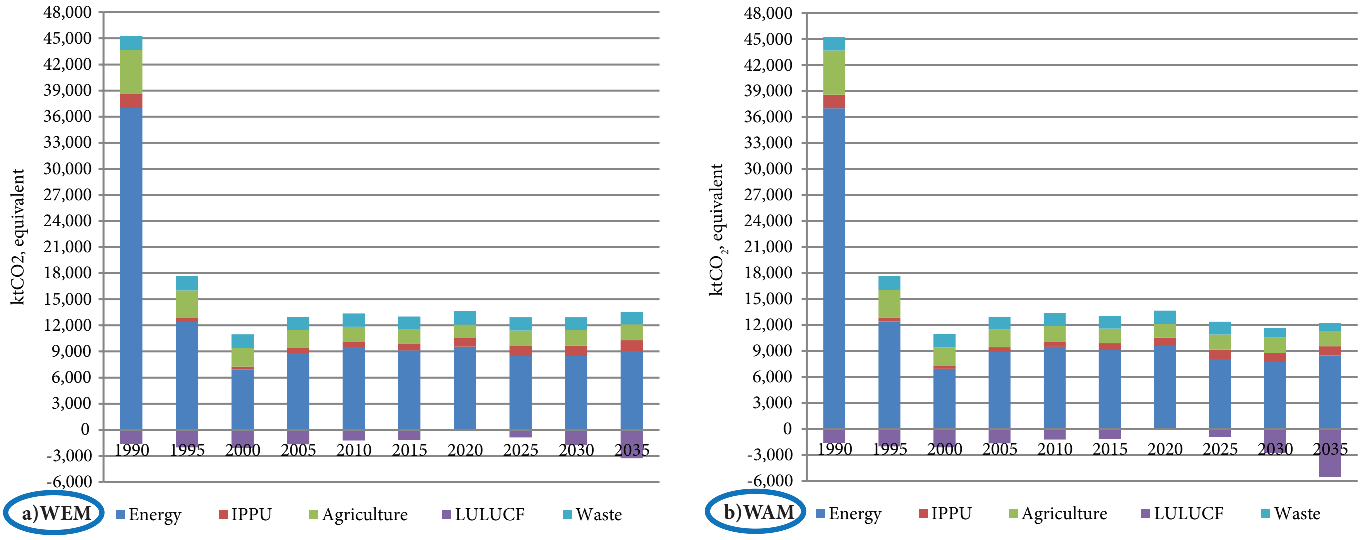


Figure 4-2: Sectors share in total GHG emissions under WEM and WAM scenarios.

Due to promotion of energy efficiency and attraction of renewable energy sources in the country's energy balance, the GHG emissions from the energy sector tends to maintain their level compared to 2015 under both WEM and WAM scenarios, while the real GDP of the country is expected to grow by 333% by 2035 compared to 2015. The same trend is observed in agriculture sector, due to use of conservation agriculture methods, with effects of increased yields on cultivated land. On the other hand, in LULUCF sector, expansion of wooded areas, meadows and implementation of sustainable agricultural practices will result in gradual increase of GHG removals, especially under the WAM scenario. These findings are supported by Table 4-5 which show the projected GHG emissions reductions for 2025, 2030 and 2035 compared to the reference year (1990), according to the WEM and WAM scenarios.

Table 4-5: GHG emission reductions anticipated for 2025, 2030 and 2035 compared to 1990, according to WEM and WAM scenarios, kt CO_2 equivalent

Sectors	WEM			WAM		
	2025	2030	2035	2025	2030	2035
Energy	-28,490	-28,503	-27,910	-28,884	-29,268	-28,517
IPPU	-470	-432	-399	-552	-542	-541
Agriculture	-3,293	-3,270	-3,248	-3,334	-3,322	-3,314
LULUCF	771	-122	-1,634	736	-1,136	-3,883
Waste	-69	-100	-139	-109	-444	-634
Total (with LULUCF)	**-33,209**	**-34,085**	**-34,988**	**-32,142**	**-34,713**	**-36,889**
Total (without LULUCF)	**-30,665**	**-30,647**	**-30,038**	**-32,878**	**-33,577**	**-33,006**

Figure 4-3 shows the evolution of individual net GHG emissions under the WEM and WAM scenarios, compared to the 1990 emissions level. F-gas projections are not shown in this figure because such emissions were not recorded in 1990. F-gases should not require significant attention, as their share in the total emissions at national level does not exceed 4% during the period under review in both scenarios.

As revealed, in the post-2015 period the amounts of CO_2 and CH_4 emissions tend to decrease, while the N_2O, conversely, increase, under both WEM and WAM. This evolution is explained by the gradual increase of the amounts of nitrogenous fertilizer over the years up to 2035, as well as carbon loss through the mineralization process due to the change in land use and soil management practices over the years up to 2035, which increases N_2O emissions (in particular, from the 3D category "Agricultural Soils"). It should be noted that the share of N_2O in the total GHG emissions during 2020-2035 is expected around 10-15% under the WEM, and around 10-22% under the WAM scenarios. It should also be noted that the WAM shows net CO_2 level of almost zero by 2035, mainly due to the extensive promotion of conservation agriculture, afforestation, and significant increase of grasslands.

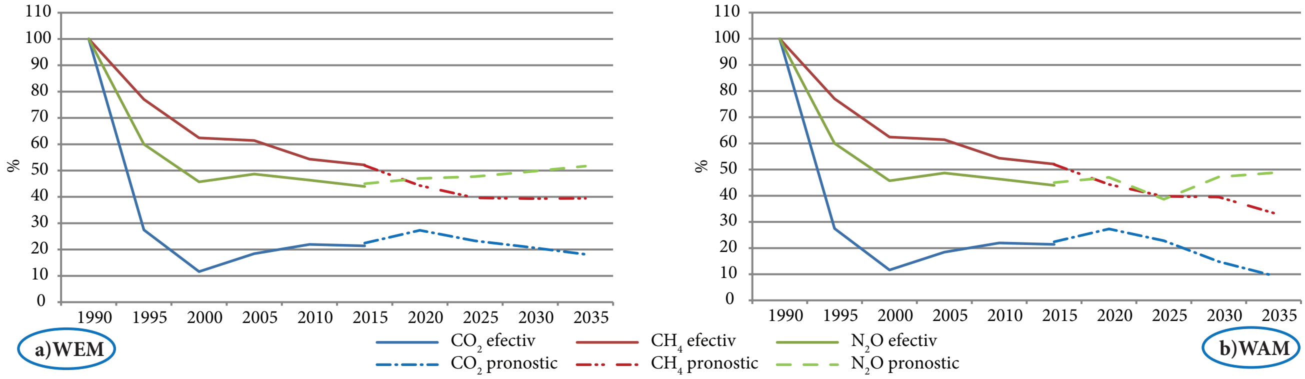


Figure 4-3: GHG emissions by type, according to WEM (a) and WAM (b), compared to 1990,%.

The absolute values of the GHG quantities for the years under review are also shown in Table 4-6.

Table 4-6: Projected direct GHG emissions (with LULUCF) under the considered scenarios up to 2035, kt CO_2 equivalent

	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
WEM										
Total CO_2 emissions	35,191.4	9,664.5	4,096.3	6,485.0	7,729.5	7,536.3	9,608.0	8,199.5	7,337.1	6,412.6
Total CH_4 emissions	5,401.4	4,162.7	3,371.4	3,316.9	2,935.7	2,814.9	2,392.9	2,140.8	2,124.3	2,130.5
Total N_2O emissions	2,998.2	1,799.4	1,370.6	1,459.3	1,390.6	1,317.9	1,410.3	1,431.5	1,487.9	1,548.9
Total F-gas emissions	NO	1.0	5.1	22.6	78.9	158.1	246.9	267.9	214.5	168.7
Total national emissions (with LULUCF)	**43,590.9**	**15,627.6**	**8,843.4**	**11,283.7**	**12,134.7**	**11,827.3**	**13,658.2**	**12,039.7**	**11,163.8**	**10,260.7**
WAM										
Total CO_2 emissions	35,191.4	9,664.5	4,096.3	6,485.0	7,729.5	7,536.3	9,608.0	8,025.6	5,214.8	3,324.2
Total CH_4 emissions	5,401.4	4,162.7	3,371.4	3,316.9	2,935.7	2,814.9	2,392.9	2,147.2	2,134.7	1,802.4
Total N_2O emissions	2,998.2	1,799.4	1,370.6	1,459.3	1,390.6	1,317.9	1,410.3	1,159.3	1,414.4	1,463.4
Total F-gas emissions	NO	1.0	5.1	22.6	78.9	158.1	246.9	252.7	194.2	145.7
Total national emissions (with LULUCF)	**43,590.9**	**15,627.6**	**8,843.4**	**11,283.7**	**12,134.7**	**11,827.3**	**13,658.2**	**11,584.8**	**8,958.1**	**6,735.7**

4.2.2. Comparison of GHG Emissions Projections from BUR3 and NC5

Table 4-7 shows the difference between GHG emissions projections (without LULUCF) made in NC5 and BUR3, as well as the parameters that have undergone the most important change with the respective impact on emissions. The difference between the projected GHG removals/emissions for the LULUCF sector, as described in NC5 and BUR3, is shown in Chapter 4.3.4. As seen from Table 4-7, both WEM and WAM show an increase in GHG emissions in NC5 compared to BUR3. Such change is mainly due to the underestimation of the electricity demand projected in BUR3.

Table 4-7: Comparison of projections made in NC5 and BUR3

Indicators	Units of measure	2020	2025	2030	2035
Annual GDP growth in NC5	%	-0.5	7.5	6.9	6.5
Annual GDP growth in BUR3	%	-2.0	6.7	6.1	5.6
NC5-BUR3 difference	%	1.5	0.8	0.7	0.9
Electricity demand in NC5 WEM	bill. kWh	5.9	6.3	6.9	7.4
Electricity demand in BUR3, WEM	bill. kWh	5.9	6.3	6.9	6.9
NC5-BUR3 difference, WEM	%	0.0	0.0	0.0	6.8
Electricity demand in NC5, WAM	bill. kWh	5.9	4.9	6.2	7.5
Electricity demand in BUR3, WAM	bill kWh	5.9	6.3	6.9	6.9
NC5-BUR3 difference, WAM	%	0.0	-28.0	-10.6	7.6
Total emissions in WEM, NC5 (without LULUCF)	kt CO_2 echivalent	13,662	12,926	12,944	13,553
Total emissions in WEM, BUR3 (without LULUCF)	kt CO_2 echivalent	12,440	12,639	12,829	12,830
NC5-BUR3 difference, WEM	%	9.8	2.3	0.9	5.6
Total emissions in WAM, NC5 (without LULUCF)	kt CO_2 echivalent	13,662	12,370	11,672	12,243
Total emissions in WAM, BUR3 (without LULUCF)	kt CO_2 echivalent	12,195	11,996	11,697	11,575
NC5-BUR3 difference, WAM	%	12.0	3.1	-0.2	5.8
Total emissions in WEM, NC5 (with LULUCF)	kt CO_2 echivalent	13,658	12,040	11,164	10,261
Total emissions in WEM, BUR3 (with LULUCF)	kt CO_2 echivalent	12,106	12,144	12,187	11,588

Indicators	Units of measure	2020	2025	2030	2035
NC5-BUR3 difference, WEM	%	12.8	-0.9	-8.4	-11.5
Total emissions in WAM, NC5 (with LULUCF)	kt CO_2 echivalent	13,658	11,449	8,878	6,702
Total emissions in WAM, BUR3 (with LULUCF)	kt CO_2 echivalent	11,861	9,825	7,656	4,128
NC5-BUR3 difference, WAM	%	15.2	16.5	16.0	62.4

4.3. Projections of Direct GHG Emissions by Sector

4.3.1. Energy Sector

The energy sector generates GHG emissions by combusting and transforming fossil fuels. Fugitive emissions are mainly generated as methane in the process of extracting, transportation and processing natural gas. The WASP calculation tool was used to develop scenarios for the energy sector, and GHG emissions from this sector were calculated by using the emission factors reported in the "*National Inventory Report: 1990-2020. GHG Sources and Sinks in the Republic of Moldova*". The Standard calculation tool (IPCC, 2006) was used for the other sectors.

The WEM and WAM scenarios cover the measures set out in Chapter 3.5.1. Additionally, the WAM included measures contained in draft documents and studies, as well as those approved after 01.01.2020, including:

1. The new draft Energy Strategy of the Republic of Moldova until 2030;
2. Draft amendment to Government Decision no. 689/2018 on approval of capacity limits, maximum quotas and capacity categories for electricity from renewable sources until 2020 (782/MEI/2020)[241];
3. ANRE's draft Decision on approval of the Methodology for calculating technological consumption and natural gas losses in the distribution networks[242];
4. Evaluation of electricity sources development options in the RoM. USAID, August 2020[243];
5. Environmental and social impact assessment for Component 1 and environmental and social management framework for Component 2. World Bank, April, 2020[244];

Measures to mitigate GHG emissions mainly include energy efficiency, efficient power generation technologies, and use of energy from renewable energy sources.

CO_2 emissions projections

In the energy sector the share of CO_2 emissions in the total GHG emissions in 2020 accounted for about 93.9%. The assessment of CO_2 emissions projections for the energy sector are shown in Table 4-8 and Figure 4-4.

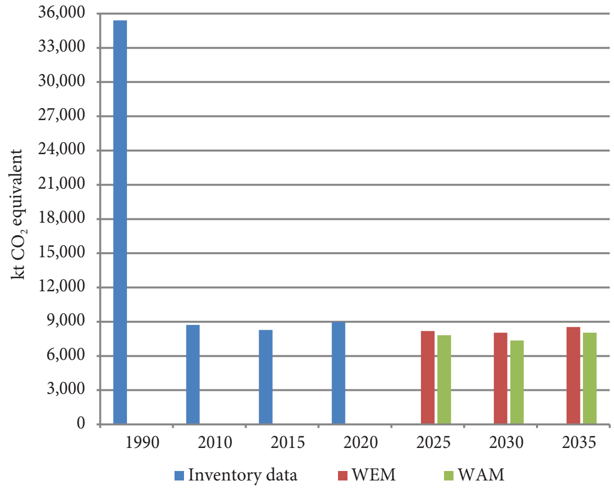


Figure 4-4: Projected CO_2 emissions from the energy sector until 2035, kt CO_2 equivalent.

[241] <https://cancelaria.gov.md/ro/content/pentru-modificarea-hotararii-guvernului-nr-6892018-cu-privire-la-aprobarea-limitelor-de>

[242] <http://www.anre.md/consultari-publice-3-27 project no. 137>

[243] <https://pdf.usaid.gov/pdf_docs/PA00X1TX.pdf>

[244] Second project to improve the efficiency of the centralized heat supply system. World Bank, Consolidated Unit for the Implementation and Monitoring of Projects in the Field of Energy. <https://mepiu.md/dheip-ii-esia-esmf-april-12-2020-final.docx>

Table 4-8: Projected CO_2 emissions from the energy sector until 2035, kt CO_2

	1990	2010	2015	2020	2025	2030	2035
WEM							
1. Energy	**35,401.1**	**8,719.1**	**8,277.6**	**8,972.1**	**8,185.7**	**8,040.3**	**8,536.3**
1A. Fuel Combustion	**35,400.4**	**8,717.8**	**8,275.9**	**8,970.5**	**8,184.2**	**8,039.2**	**8,535.2**
1A.1. Energy Industries	21,300.3	4,047.8	3,684.5	3,634.4	3,252.3	2,872.8	2,718.6
1A.2. Manufacturing Industries and Construction	1,915.7	516.1	517.1	801.4	735.5	774.7	843.1
1A.3. Transport	4,698.2	2,140.5	2,261.4	2,462.2	2,171.0	2,281.8	2,516.8
1A.4. Other Sectors	7,372.3	1,986.0	1,790.2	2,050.1	2,002.6	2,087.3	2,434.1
1A.5. Other	114.0	27.3	22.7	22.4	22.7	22.7	22.7
1B. Fugitive Emissions from Fuels	**0.7**	**1.3**	**1.7**	**1.6**	**1.5**	**1.1**	**1.1**
1B.2. Oil and Natural Gas	0.7	1.3	1.7	1.6	1.5	1.1	1.1
WAM							
1. Energy	**35,401.1**	**8,719.1**	**8,277.6**	**8,972.1**	**7,816.3**	**7,355.3**	**8,032.2**
1A. Fuel Combustion	**35,400.4**	**8,717.8**	**8,275.9**	**8,970.5**	**7,814.9**	**7,354.3**	**8,031.2**
1A.1. Energy Industries	21,300.3	4,047.8	3,684.5	3,634.4	3,116.8	2,690.1	2,654.7
1A.2. Manufacturing Industries and Construction	1,915.7	516.1	517.1	801.4	683.8	720.2	756.6
1A.3. Transport	4,698.2	2,140.5	2,261.4	2,462.2	2,097.6	2,170.6	2,371.7
1A.4. Other Sectors	7,372.3	1,986.0	1,790.2	2,050.1	1,894.0	1,750.7	2,225.5
1A.5. Other	114.0	27.3	22.7	22.4	22.7	22.7	22.7
1B. Fugitive Emissions from Fuels	**0.7**	**1.3**	**1.7**	**1.6**	**1.5**	**1.0**	**1.0**
1B.2. Oil and Natural Gas	0.7	1.3	1.7	1.6	1.5	1.0	1.0

As seen, CO_2 emissions under WEM and WAM slightly decrease after 2020, even if the GDP has an upward trend, above 6.7% annual growth, which should normally lead to an increase in the amount of CO_2. By 2035, the CO_2 emissions will decrease under WEM and WAM by 4.9% and, respectively, 10.5% compared to 2020. The reason for such evolution is mainly the widespread promotion of energy efficiency and renewable energy sources.

CH_4 emissions projections

In the energy sector the share of CH_4 emissions in the total GHG emissions at sector level in 2020 amounted to about 4.9%, of which 51.5% are fugitive emissions from oil and gas operations. Projections of CH_4 emissions resulting from burning and transformation of fossil fuels were made based on the assumed fossil fuel consumption using calculation methods available in the 2006 IPCC Guidelines, as well as emission factors reported in the "*National Inventory Report:1990-2020. GHG Sources and Sinks in the Republic of Moldova*". The calculations results are shown in Table 4-9.

Table 4-9: Projections of CH_4 emissions from the energy sector until 2035, kt CO_2 equivalent

	1990	2010	2015	2020	2025	2030	2035
WEM							
1. Energy	**1,246.2**	**714.6**	**762.8**	**466.9**	**277.2**	**405.7**	**494.5**
1A. Fuel Combustion	**335.5**	**53.4**	**121.2**	**226.6**	**29.0**	**28.0**	**29.8**
1A.1. Energy Industries	12.3	2.2	1.6	1.6	1.3	1.1	1.1
1A.2. Manufacturing Industries and Construction	1.7	0.2	0.2	0.7	0.9	1.0	1.0
1A.3. Transport	33.7	11.8	10.7	10.9	8.9	8.6	8.8
1A.4. Other Sectors	287.5	39.1	108.6	213.4	17.9	17.3	18.9
1A.5. Other	0.3	0.1	0.0	0.0	0.0	0.0	0.0
1B. Fugitive Emissions from Fuels	**910.7**	**661.2**	**641.6**	**240.2**	**248.2**	**377.7**	**464.7**
1B.2. Oil and Natural Gas	910.7	661.2	641.6	240.2	248.2	377.7	464.7
WAM							
1. Energy	**1,246.2**	**714.6**	**762.8**	**466.9**	**252.9**	**325.7**	**393.1**
1A. Fuel Combustion	**335.5**	**53.4**	**121.2**	**226.6**	**27.3**	**23.6**	**26.5**
1A.1. Energy Industries	12.3	2.2	1.6	1.6	1.2	1.1	1.1
1A.2. Manufacturing Industries and Construction	1.7	0.2	0.2	0.7	0.9	0.9	0.9
1A.3. Transport	33.7	11.8	10.7	10.9	8.8	8.4	8.4
1A.4. Other Sectors	287.5	39.1	108.6	213.4	16.4	13.2	16.1
1A.5. Other	0.3	0.1	0.0	0.0	0.0	0.0	0.0
1B. Fugitive Emissions from Fuels	**910.7**	**661.2**	**641.6**	**240.2**	**225.6**	**302.2**	**366.5**
1B.2. Oil and Natural Gas	910.7	661.2	641.6	240.2	225.6	302.2	366.5

N_2O emissions projections

The share of N_2O emissions in the total GHG emissions at sector level is modest, accounting for only 1.2% of the total (2020). Similarly with CH_4 emissions, the N_2O emissions resulting from combusting and transformation of fossil fuels were calculated on the basis of assumed fossil fuel consumption using the calculation methods available in the 2006 IPCC Guidelines. The calculations results are shown in Table 4-10.

Table 4-10: Projections of N_2O from the energy sector until 2035, kt CO_2 equivalent

	1990	2010	2015	2020	2025	2030	2035
WEM							
1. Energy	**345.6**	**62.7**	**79.3**	**110.9**	**42.8**	**47.0**	**54.9**
1A. Fuel Combustion	**345.6**	**62.7**	**79.3**	**110.9**	**42.8**	**47.0**	**54.9**
1A.1. Energy Industries	51.7	2.9	2.0	2.0	1.9	1.7	1.5
1A.2. Manufacturing Industries and Construction	4.3	0.9	1.0	1.5	2.2	2.3	2.5
1A.3. Transport	106.7	36.5	35.7	38.8	35.8	39.7	46.7
1A.4. Other Sectors	181.5	22.2	40.4	68.6	3.0	3.3	4.2
1A.5. Other	1.3	0.2	0.1	0.1	0.0	0.0	0.0
1B. Fugitive Emissions from Fuels	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
1B.2. Oil and Natural Gas	NA	NA	NA	NA	NA	NA	NA
WAM							
1. Energy	**345.6**	**62.7**	**79.3**	**110.9**	**41.3**	**44.5**	**52.1**
1A. Fuel Combustion	**345.6**	**62.7**	**79.3**	**110.9**	**41.3**	**44.5**	**52.1**
1A.1. Energy Industries	51.7	2.9	2.0	2.0	1.8	1.5	1.5
1A.2. Manufacturing Industries and Construction	4.3	0.9	1.0	1.5	2.0	2.2	2.3
1A.3. Transport	106.7	36.5	35.7	38.8	34.7	37.9	44.4
1A.4. Other Sectors	181.5	22.2	40.4	68.6	2.8	2.9	3.9
1A.5. Other	1.3	0.2	0.1	0.1	0.0	0.0	0.0
1B. Fugitive Emissions from Fuels	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
1B.2. Oil and Natural Gas	NA	NA	NA	NA	NA	NA	NA

Total aggregated GHG emission projections

Table 4-11 and Figure 4-5 show the aggregate GHG emissions projections in the energy sector, including transport, which can be compared with emissions reported in 1990, the IPCC base year, and the national updated NDC reference year. The analysis of these data shows that the energy sector, distinguished by the largest contribution to GHG emissions in the RoM (69.9%, 2020), will significantly contribute to achieving the country's commitments towards reducing GHG emissions. Thus, by 2035 the level of GHG emissions under WEM and WAM compared to 1990 will be 24.6% and 22.9%, respectively.

Table 4-11: Projections of aggregated GHG emissions from the energy sector, kt CO_2 equivalent

	1990	2010	2015	2020	2025	2030	2035
WEM							
1. Energy	**36,992.9**	**9,496.4**	**9,119.6**	**9,549.9**	**8,502.6**	**8,490.3**	**9,083.2**
1A. Fuel Combustion	**36,081.5**	**8,833.9**	**8,476.4**	**9,308.1**	**8,252.9**	**8,111.6**	**8,617.4**
1A.1. Energy Industries	21,364.2	4,053.0	3,688.1	3,638.0	3,252.3	2,872.8	2,718.6
1A.2. Manufacturing Industries and Construction	1,921.8	517.3	518.4	803.6	738.6	777.9	846.6
1A.3. Transport	4,838.6	2,188.8	2,307.8	2,511.9	2,215.8	2,330.2	2,572.4
1A.4. Other Sectors	7,841.3	2,047.4	1,939.2	2,332.1	2,023.4	2,107.9	2,457.1
1A.5. Other	115.6	27.5	22.9	22.5	22.7	22.7	22.7
1B. Fugitive Emissions from Fuels	**911.4**	**662.5**	**643.3**	**241.8**	**249.7**	**378.8**	**465.8**
1B.2. Oil and Natural Gas	911.4	662.5	643.3	241.8	249.7	378.8	465.8
WAM							
1. Energy	**36,992.9**	**9,496.4**	**9,119.6**	**9,549.9**	**8,109.1**	**7,724.5**	**8,476.3**

	1990	2010	2015	2020	2025	2030	2035
1A. Fuel Combustion	**36,081.5**	**8,833.9**	**8,476.4**	**9,308.1**	**7,883.5**	**7,422.3**	**8,109.8**
1A.1. Energy Industries	21,364.2	4,053.0	3,688.1	3,638.0	3,119.8	2,692.7	2,657.3
1A.2. Manufacturing Industries and Construction	1,921.8	517.3	518.4	803.6	686.7	723.3	759.8
1A.3. Transport	4,838.6	2,188.8	2,307.8	2,511.9	2,141.1	2,216.9	2,424.5
1A.4. Other Sectors	7,841.3	2,047.4	1,939.2	2,332.1	1,913.2	1,766.7	2,245.5
1A.5. Other	115.6	27.5	22.9	22.5	22.7	22.7	22.7
1B. Fugitive Emissions from Fuels	**911.4**	**662.5**	**643.3**	**241.8**	**225.6**	**302.2**	**366.5**
1B.2. Oil and Natural Gas	911.4	662.5	643.3	241.8	225.6	302.2	366.5

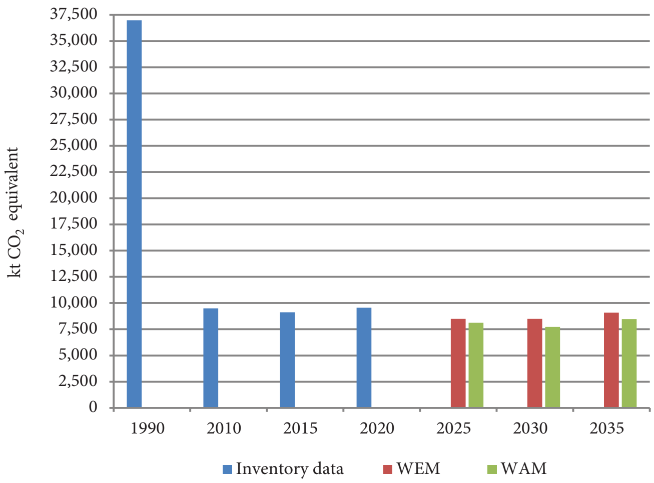


Figure 4-5: Projected aggregate GHG emissions from the energy sector, kt CO_2 equivalent.

Sensitivity analysis

Sensitivity analysis (SA) in the energy sector was undertaken for two categories, 1A.1. Energy industries and 1A.3. Transport, that together produce 64.4% (38.1% and 26.3%, respectively, 2020) of the total GHG emissions of the energy sector. Given that the most important sensitivity parameters for these categories are not common, the analysis was carried out separately for each of them.

1A.1. Energy industries

The study on electricity sources development in NC5 was carried out based on the WASP Model. The optimal economic solution is determined by several parameters, of which the most influential and with a higher probability of change over time are:

- The specific value of investment in construction of district heating power plants based on internal combustion engines that will run on natural gas. Instead of 700, the SA uses 1,062 US$ / kWh, a value found in a thematic study carried out by USAID in 2020[5].
- The discount rate value. Instead of the 10% discount rate, the SA uses the value of 8.3%, taking into account ANRE's decision in this regard, which uses this rate when approving fixed tariffs and ceiling prices for electricity produced from renewable sources by eligible producers.

Calculations have shown that solutions for the development of electricity sources remain unchanged, i.e. all power plants produce the same amounts of electricity and consume the same type and amount of fuel, without changing the amounts of emitted GHGs.

1A.3. Transport

For the purpose of the sensitivity analysis, two key indicators were considered: evolution of the real GDP (expressed in US dollars updated to 2015) and population numbers, key factors influencing the evolution of the Transport sector and, respectively, fuel consumption. A +1% variation of the two key indicators was used. The results are presented in Table 4-12, which shows that the used variation insignificantly affected GHG emissions.

Table 4-12: Sensitivity analysis (SA) of GHG emissions in the 1A.3. 'Transport' source category

	2020	2025	2030	2035
Impact of real GDP variation				
GHG emissions under WEM, kt CO_2 equivalent	2,382.9	2,215.8	2,330.2	2,572.4
GHG emissions under SA, kt CO_2 equivalent	2,382.9	1,955.6	2,142.5	2,373.2
Difference WEM-SA, %	0.0%	-11.7%	-8.1%	-7.7%
Impact of population numbers				
GHG emissions under WEM, kt CO_2 equivalent	2,382.9	2,215.8	2,330.2	2,572.4
GHG emissions under SA, kt CO_2 equivalent	2,382.9	1,959.9	2,146.3	2,376.7
Difference WEM-SA, %	0.0%	-11.5%	-7.9%	-7.6%
Impact of the combined variation of GDP and population numbers				
GHG emissions under WEM, kt CO_2 equivalent	2,382.9	2,215.8	2,330.2	2,572.4
GHG emissions under SA, kt CO_2 equivalent	2,382.9	1,959.7	2,146.2	2,376.7
Difference WEM-SA, %	0.0%	-11.6%	-7.9%	-7.6%

4.3.2. Industrial Processes and Product Use Sector

In 2020, the Industrial Processes and Product Use (IPPU) sector contributed by about 7.3% of total GHG emissions, of which 75.4% related to CO_2 emissions, respectively 24.6% to F-gases. The GHG emissions reduction measures taken into account for this sector are described in Chapter 3.5.2. CO_2, HFCs, PFCs and SF_6 emissions were considered under the WEM and WAM scenarios for the IPPU sector.

CO_2 emissions projections

In the IPPU sector, CO_2 emissions are generated by source categories 2A "Mineral Industry", 2C "Metal Industry", 2D "Non-Energy Products from Fuels and Solvent Use" and 2G "Other Product Manufacture and Use". Category 2A accounts for about 53.7% of total sectoral emissions, of which about 87% come from cement production.

Both scenarios show a continuous growth of cement production, which however, will not reach the level of the reference year (by 2035, the cement production in the RoM will be 21.3% below the level of 1990 under WEM, respectively by 23.5 % under WAM). Continuous reduction of clinker content in cement brands in the RoM is expected (by 10.5% below 1990 levels – WEM and by 23.8% below the reference year – WAM). Compared to the reference year, CO_2 emissions reduction from cement production in 2030 is anticipated by about 31.7% under WEM and by about 44.0% under WAM. Results of CO_2 emissions calculations are shown in Table 4-13.

Table 4-13: Projections of CO_2 emissions in the IPPU sector until 2035, kt

	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
WEM										
2. Industrial Processes and Product Use	**1,605.2**	**455.6**	**310.6**	**550.5**	**482.4**	**607.0**	**751.9**	**865.1**	**956.5**	**1,034.8**
A. Mineral Industry	1,339.0	351.7	240.8	439.2	405.4	504.2	536.9	636.2	705.0	760.2
C. Metal Industry	28.5	26.2	36.3	41.9	9.7	17.3	18.7	19.9	23.5	27.1
D. Non-Energy Products from Fuels and Solvents Use	234.4	76.6	32.6	68.2	66.2	84.6	195.4	208.0	226.9	246.4
G. Other Products Manufacture and Use	3.4	1.2	1.0	1.2	1.0	0.9	0.9	1.0	1.1	1.2
WAM										
2. Industrial Processes and Product Use	**1,605.2**	**455.6**	**310.6**	**550.5**	**482.4**	**607.0**	**751.9**	**798.7**	**867.3**	**916.9**
A. Mineral Industry	1,339.0	351.7	240.8	439.2	405.4	504.2	536.9	562.8	609.1	637.8
C. Metal Industry	28.5	26.2	36.3	41.9	9.7	17.3	18.7	19.8	21.8	22.8
D. Non-Energy Products from Fuels and Solvents Use	234.4	76.6	32.6	68.2	66.2	84.6	195.4	215.0	235.3	255.2
G. Other Products Manufacture and Use	3.4	1.2	1.0	1.2	1.0	0.9	0.9	1.0	1.1	1.2

F-gases emissions projections

In the RoM, the most important sources of F-gases emissions come from category 2F1 “Refrigeration and air conditioning equipment” (approx. 62.4%, 2020) and 2F2 “Expanded foams” (approx. 36.4%). A significant increase in HFC emissions is expected for category 2F “Product Uses as Substitutes for ODS” – about 200 times under WEM and about 175 times under WAM, compared to the 1995 level. (Table 4-14). At the same time, compared to the historical level of emissions recorded in 2020, the reduction of HFC emissions by 31.2% in the case of WEM is expected by 2035, respectively by 40.6% in the case of WAM.

Table 4-14: Projections of F-gases emissions in the IPPU sector until 2035, kt CO_2 equivalent

	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
	WEM									
2F. Product Uses as Substitutes for ODS	**NO**	**1.0**	**5.1**	**22.5**	**78.1**	**157.0**	**245.3**	**267.9**	**214.5**	**168.7**
2F1. Refrigeration and Air Conditioning Equipment	NO	0.8	3.8	10.2	23.5	74.4	153.1	181.5	168.7	151.2
2F2. Expanded Foams	NO	0.3	1.3	12.3	54.6	82.6	89.3	83.7	43.2	14.9
2F3. Fire Protection	NO	NO	NO	NO	NO	NO	3.0	2.7	2.6	2.5
2F4. Aerosols	NO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	WAM									
2F. Product Uses as Substitutes for ODS	**NO**	**1.0**	**5.1**	**22.5**	**78.1**	**157.0**	**245.3**	**252.7**	**194.2**	**145.7**
2F1. Refrigeration and Air Conditioning Equipment	NO	0.8	3.8	10.2	23.5	74.4	153.1	168.0	151.6	131.6
2F2. Expanded Foams	NO	0.3	1.3	12.3	54.6	82.6	89.3	81.7	39.8	11.5
2F3. Fire Protection	NO	NO	NO	NO	NO	NO	3.0	2.9	2.8	2.7
2F4. Aerosols	NO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Aggregated GHG Emissions Projections

Table 4-15 and Figure 4-6 show projections of aggregated total GHG emissions from the IPPU sector that can be compared with GHG emissions reported in 1990. The comparison results show that by 2035 the respective emissions will account for about 75.1% of the reference 1990 year under WEM and for about 66.3% of the 1990 under WAM. The trend towards a slight increase in GHG emissions in this sector will be maintained until 2035. Implementation of mitigation policies in this sector will allow to temper the growth under the WAM scenario.

Table 4-15: Projections of aggregated GHG emissions from IPPU sector by 2035, kt CO_2 equivalent

	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
WEM										
2. Industrial Processes and Product Use	**1,605.2**	**456.7**	**315.8**	**573.1**	**561.2**	**765.1**	**998.4**	**1,134.9**	**1,173.0**	**1,205.7**
2A. Mineral Industry	1,339.0	351.7	240.8	439.2	405.4	504.2	536.4	636.2	705.0	760.2
2C. Metal Industry	28.5	26.2	36.3	41.9	9.7	17.3	18.7	19.9	23.5	27.1
2D. Non-Energy Products from Fuels and Solvents Use	234.4	76.6	32.6	68.2	66.2	84.6	195.4	208.0	226.9	246.4
2F. Product Uses as Substitutes for ODS	NO	1.0	5.1	22.5	78.2	157.0	245.3	267.9	214.5	168.7
2G Other Products Manufacture and Use	3.4	1.2	1.0	1.2	1.7	2.0	2.6	2.8	3.1	3.4
WAM										
2. Industrial Processes and Product Use	**1,605.2**	**456.7**	**315.8**	**573.1**	**561.2**	**765.1**	**998.4**	**1,053.1**	**1,063.4**	**1,064.7**
2A. Mineral Industry	1,339.0	351.7	240.8	439.2	405.4	504.2	536.4	562.8	609.1	637.8
2C. Metal Industry	28.5	26.2	36.3	41.9	9.7	17.3	18.7	19.8	21.8	22.8
2D. Non-Energy Products from Fuels and Solvents Use	234.4	76.6	32.6	68.2	66.2	84.6	195.4	215.0	235.3	255.2
2F. Product Uses as Substitutes for ODS	NO	1.0	5.1	22.5	78.2	157.0	245.3	252.7	194.2	145.7
2G Other Products Manufacture and Use	3.4	1.2	1.0	1.2	1.7	2.0	2.6	2.8	3.0	3.3

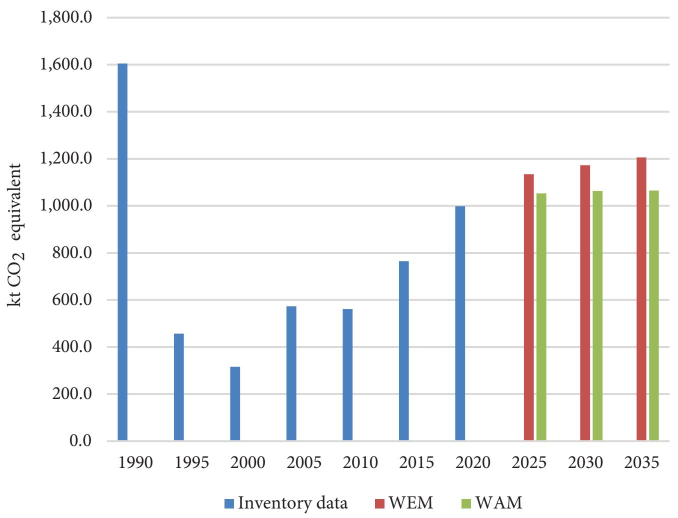


Figure 4-6: Projections of aggregated GHG emissions from the IPPU sector until 2035.

Given that the source category 2A1 "Cement production" had a maximum share of 63.7% and a minimum share of 46.8% in the structure of total GHG emissions from IPPU sector (2005, 2020), the amount of cement produced, respectively, the ratio of tones of clinker produced relative to one tone of cement produced, are the main indicators that could potentially affect the trend of GHG emissions from IPPU sector.

The sensitivity analysis is based on the scenario in which the amount of cement produced would be 5% higher, and the ratio of tons of clinker produced to one ton of cement, respectively 2.5% higher than the values expected in the WEM during years 2020-2035.

Given the increase of the amount of cement produced by 5%, respectively of the ratio of tons of clinker produced to one ton of cement produced by about 2.5% during the years 2020-2035, an increase in GHG emissions from IPPU sector by about 3.9-4.3% can be anticipated, compared to the values calculated for the WEM scenario (Table 4-16).

Sensitivity Analysis

Table 4-16: Sensitivity analysis (SA) for GHG emissions in IPPU sector compared to those included in the WEM scenario

	2020	2025	2030	2035
Cement production, WEM, kt	1,164.1	1,400.0	1,600.0	1,800.0
Cement production, SA, kt	1,164.1	1,470.0	1,680.0	1,890.0
WEM-SA difference,%	**0.0**	**5.0**	**5.0**	**5.0**
Clinker production, WEM, kt	876.4	1,042.8	1,171.9	1,269.0
Clinker production, SA, kt	876.4	1,122.3	1,261.2	1,365.8
WEM-SA difference,%	**0.0**	**7.6**	**7.6**	**7.6**
Clinker / cement ratio, WEM	0.753	0.745	0.732	0.705
Clinker / cement ratio, SA	0.753	0.763	0.751	0.723
WEM-SA difference,%	**0.0**	**2.5**	**2.5**	**2.5**
CO_2 emissions from cement production, kt, WEM	467.1	554.3	617.7	663.2
CO_2 emissions from cement production, kt, SA	467.1	596.6	664.8	713.8
WEM-SA difference,%	**0.0**	**7.6**	**7.6**	**7.6**
CO_2 emissions from mineral products industry, kt, WEM	536.4	636.2	705.0	760.2
CO_2 emissions from mineral products industry, kt, SA	536.4	678.5	752.1	810.7
WEM-SA difference,%	**0.0**	**6.6**	**6.7**	**6.7**
Total GHG emissions from IPPU sector, WEM, kt	998.4	1,134.9	1,173.0	1,205.7
Total GHG emissions from IPPU sector, SA, kt	998.4	1,177.1	1,220.1	1,256.3
WEM-SA difference, %	**0.0**	**3.7**	**4.0**	**4.2**

4.3.3. Agriculture Sector

Within the agriculture sector, CH_4 emissions are monitored from the animal husbandry sector, in particular from source categories 3A "Enteric Fermentation" and 3B "Manure Management", N_2O emissions from the source categories 3B "Manure Management" and 3D "Agricultural Soils", and CO_2 emissions from the source category 3H "Urea Application".

The key indicators and the main working assumptions used for projecting GHG emissions in Agriculture are provided below for the two scenarios, taking into account the sectoral policies set out in Chapter 3.5.3.

Table 4-17 shows the projections of livestock and poultry numbers, and Table 4-18 shows the share of different manure management systems (MS%) until 2035.

Table 4-17: Projections of livestock and poultry numbers over1990-2035, thousands of heads

	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
	WEM									
Total cattle	1,060.7	729.5	445.4	339.8	236.4	204.5	125.8	110.0	95.0	80.0
Dairy cows	395.2	380.8	298.5	233.1	165.8	137.7	80.3	70.0	60.0	50.0
Other cattle	665.5	348.7	146.9	106.7	70.5	66.9	45.5	40.0	35.0	30.0
Sheep	1,244.8	1,326.6	846.3	827.0	793.1	722.2	479.3	460.0	450.0	440.0
Goats	37.1	96.4	115.8	127.3	127.5	158.6	149.7	145.0	135.0	125.0
Horses	47.2	61.6	76.0	72.0	53.6	40.2	23.0	21.0	19.0	17.0
Asses	1.7	3.2	3.8	3.7	2.8	2.0	1.2	1.1	1.0	0.9
Swine	1,850.1	1,016.4	492.7	493.0	511.7	484.5	366.9	350.0	330.0	310.0
Rabbits	283.0	209.3	161.3	278.9	277.0	350.2	319.2	315.0	310.0	305.0
Poultry	24,625.0	13,746.4	13,624.9	22,773.6	23,782.5	12,590.6	9,492.0	9,250.0	8,925.0	8,600.0

	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
	WAM									
Total cattle	1,060.7	729.5	445.4	339.8	236.4	204.5	125.8	100.0	85.0	70.0
Dairy cows	395.2	380.8	298.5	233.1	165.8	137.7	80.3	65.0	55.0	45.0
Other cattle	665.5	348.7	146.9	106.7	70.5	66.9	45.5	35.0	30.0	25.0
Sheep	1,244.8	1,326.6	846.3	827.0	793.1	722.2	479.3	450.0	440.0	430.0
Goats	37.1	96.4	115.8	127.3	127.5	158.6	149.7	135.0	125.0	115.0
Horses	47.2	61.6	76.0	72.0	53.6	40.2	23.0	20.0	17.0	15.0
Asses	1.7	3.2	3.8	3.7	2.8	2.0	1.2	1.0	0.9	0.8
Swine	1,850.1	1,016.4	492.7	493.0	511.7	484.5	366.9	340.0	320.0	300.0
Rabbits	283.0	209.3	161.3	278.9	277.0	350.2	319.2	310.0	305.0	300.0
Poultry	24,625.0	13,746.4	13,624.9	22,773.6	23,782.5	12,590.6	9,492.0	8,935.0	8,630.0	8,325.0

Table 4-18: Share of different manure management systems (MS%) used in the period up to 2035,%

Animal categories (T) and manure management systems (MS)	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020	2025	2030	2035
	MS values $_{(T, S)}$													
	WEM													
Dairy cows														
Pasture/Range/Paddock	6.0	20.0	24.0	24.5	24.5	25.0	25.0	25.0	24.9	24.9	24.9	24.7	24.5	24.3
Liquid/Slurry	24.0	7.0	1.0	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.3	1.2	1.1	1.0
Anaerobic digestion	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.5	0.7	0.9
Solid Storage	70.0	73.0	75.0	74.0	74.0	73.5	73.5	73.5	73.5	73.5	73.5	73.6	73.7	73.8
Other cattle														
Pasture/Range/Paddock	4.0	16.0	22.0	22.0	22.0	21.5	20.0	20.0	18.0	18.0	17.0	16.0	15.0	14.0
Liquid/Slurry	34.0	10.0	4.0	6.0	6.0	6.1	6.4	6.4	6.8	6.8	7.1	9.0	12.0	15.0
Solid Storage	62.0	74.0	74.0	72.0	72.0	72.4	73.6	73.6	75.2	75.2	75.9	75.0	73.0	71.0
Swine														
Liquid/Slurry	73.0	55.0	30.0	32.0	35.0	37.0	31.0	31.0	25.0	25.0	19.0	17.0	15.0	13.0
Anaerobic digestion	0.0	0.0	0.0	0.0	0.0	0.0	3.0	3.0	6.0	6.0	9.0	10.0	12.0	15.0
Pit storage below animal confinements, less than 30 days	0.0	0.0	0.0	0.0	0.0	0.0	10.0	10.0	20.0	20.0	30.0	35.0	40.0	45.0
Solid Storage	27.0	45.0	70.0	68.0	65.0	63.0	56.0	56.0	49.0	49.0	42.0	38.0	33.0	27.0
Sheep and Goats														
Pasture/Range/Paddock	18.0	20.0	22.0	24.0	26.0	26.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Solid Storage	82.0	80.0	78.0	76.0	74.0	74.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0
Horses and Asses														
Pasture/Range/Paddock	18.0	20.0	22.0	24.0	26.0	26.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Solid Storage	82.0	80.0	78.0	76.0	74.0	74.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0
Rabbits														
Solid Storage	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Poultry														
Pasture/Range/Paddock	7.0	8.0	8.0	9.0	10.0	10.0	9.9	9.9	9.8	9.8	9.7	9.6	9.5	9.4
Anaerobic digestion	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.7	1.3	1.3	1.9	2.5	3.0	3.5
Solid Storage	93.0	92.0	92.0	91.0	90.0	90.0	89.4	89.4	88.9	88.9	88.4	87.9	87.5	87.1
	WAM													
Dairy cows														
Pasture/Range/Paddock	6.0	20.0	24.0	24.5	24.5	25.0	25.0	25.0	24.9	24.9	24.9	24.6	24.4	24.1
Liquid/Slurry	24.0	7.0	1.0	1.5	1.5	1.5	1.4	1.4	1.4	1.4	1.3	1.1	1.0	0.9
Anaerobic digestion	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.7	0.9	1.2
Solid Storage	70.0	73.0	75.0	74.0	74.0	73.5	73.5	73.5	73.5	73.5	73.5	73.6	73.7	73.8
Other cattle														
Pasture/Range/Paddock	4.0	16.0	22.0	22.0	22.0	21.5	20.0	20.0	18.0	18.0	17.0	15.0	14.0	13.0
Liquid/Slurry	34.0	10.0	4.0	6.0	6.0	6.1	6.4	6.4	6.8	6.8	7.1	10.0	15.0	18.0
Solid Storage	62.0	74.0	74.0	72.0	72.0	72.4	73.6	73.6	75.2	75.2	75.9	75.0	71.0	69.0
Swine														
Liquid/Slurry	73.0	55.0	30.0	32.0	35.0	37.0	31.0	31.0	25.0	25.0	19.0	16.0	14.0	12.0
Anaerobic digestion	0.0	0.0	0.0	0.0	0.0	0.0	3.0	3.0	6.0	6.0	9.0	12.0	15.0	18.0
Pit storage below animal confinements, less than 30 days	0.0	0.0	0.0	0.0	0.0	0.0	10.0	10.0	20.0	20.0	30.0	36.0	42.0	46.0
Solid Storage	27.0	45.0	70.0	68.0	65.0	63.0	56.0	56.0	49.0	49.0	42.0	36.0	29.0	24.0
Sheep and Goats														
Pasture/Range/Paddock	18.0	20.0	22.0	24.0	26.0	26.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
Solid Storage	82.0	80.0	78.0	76.0	74.0	74.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0
Horses and Asses														
Pasture/Range/Paddock	18.0	20.0	22.0	24.0	26.0	26.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0

Animal categories (T) and manure management systems (MS)	1990	1995	2000	2005	2010	2015	2016	2017	2018	2019	2020	2025	2030	2035
	MS values $_{(T,S)}$													
Solid Storage	82.0	80.0	78.0	76.0	74.0	74.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0
Rabbits														
Solid Storage	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Poultry														
Pasture/Range/Paddock	7.0	8.0	8.0	9.0	10.0	10.0	9.9	9.9	9.8	9.8	9.7	9.5	9.0	8.5
Anaerobic digestion	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.7	1.3	1.3	1.9	3.0	4.0	5.0
Solid Storage	93.0	92.0	92.0	91.0	90.0	90.0	89.4	89.4	88.9	88.9	88.4	87.5	87.0	86.5

Under the WEM scenario, the projections show a slow decrease rate in livestock and poultry. The WAM predicts a more alert decrease rate in livestock and poultry, focusing instead on increasing productivity and implementing the most effective measures to mitigate GHG emissions at sector level.

The more alert rate of animal productivity increase characteristic of WAM will contribute to the increase in emission factors value calculated according to Tier 2 calculation methodology (IPCC Guidelines 2006), used to assess CH_4 emissions from category 3A "Enteric fermentation". According to WAM, it is anticipated that the level of livestock sector productivity will be close to the current one reported for Eastern European countries with economies in transition included in Annex I, respectively country-specific EFs will have values close to default EFs used for assessment of CH_4 emissions from category 3A "Enteric Fermentation" specific to Eastern European countries. Under WEM and WAM, the EFs are expected to have values close to default EFs used for the assessment of methane emissions from category 3B "Manure Management" specific to Eastern European countries, respectively, values close to those reported in the RoM in the 90s of the XX century.

Regarding the agricultural crops and soil resources, the two scenarios considered CO_2 emissions, from urea application, and N_2O emissions from application of mineral fertilizers.

Table 4-19 shows the urea application projections, and Table 4-20 - application of chemical nitrogen and organic natural fertilizers until 2035. It is necessary to mention that urea application growth rate in the Republic of Moldova is quite impressive. Over the years 2010-2020, the applied quantities increased about by circa 24 times (from about 2.4 kt in 2010, to about 58.1 kt in 2020).

Table 4-19: Projections of urea application in the Republic of Moldova over 1990-2035, kt

	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
	WEM									
Application of urea	0.8	0.1	0.6	0.2	2.4	15.3	58.1	62.6	68.9	75.2
	WAM									
Application of urea	0.8	0.1	0.6	0.2	2.4	15.3	58.1	60.8	66.9	73.0

For projecting urea application in the Republic of Moldova until 2035 it was deemed appropriate to use the linear regression method based on 2010-2020 period trends.

Table 4-20: Projections for the application of chemical nitrogen and organic natural fertilizers in the Republic of Moldova over 1990-2035, kt N

	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
	WEM									
Chemical nitrogenous fertilizers, F_{SN}	92.1	10.5	10.2	16.1	20.6	38.7	75.2	87.5	93.5	99.9
Organic natural fertilizers, F_{ON}	54.5	33.4	20.8	20.5	18.3	15.6	10.3	14	17.4	20.7
	WAM									
Chemical nitrogenous fertilizers, F_{SN}	92.1	10.5	10.2	16.1	20.6	38.7	75.2	80.0	85.0	92.0
Organic natural fertilizers, F_{ON}	54.5	33.4	20.8	20.5	18.3	15.6	10.3	17.7	21.0	24.3

This evolution has been considered in line with the WEM. Under the WAM the emphasis has been put on optimizing urea application doses, taking into account the best practice recommendations for the sustainable development of the agricultural sector and the application of the most effective mitigation measures for the agricultural sector, as described in specialty literature. In the above context, it will contribute to reducing the quantities applied, on average by about 3% annually, compared to the values featured in the WEM.

In the case of WEM, projections were based on the information available in the New Land Reclamation and Soil Fertility Enhancement Program (Part II: Soil Fertility Enhancement), and based on the Soil Conservation and Fertility Enhancement Program for 2011-2020, the National Strategy for Agricultural and Rural Development for the years 2014-2020 and the Low Emissions Development Strategy until 2030 and the Action Plan for its implementation. The evolution of the demand for chemical nitrogen and natural organic fertilizers in the period 1990-2020 was also taken into account. In this context, it was deemed appropriate to transfer the targets initially envisaged in the New Land Reclamation and Soil Fertility Enhancement Program for 2020 to 2035.

Under the WAM scenario, particular emphasis was made on optimizing the doses of mineral and organic fertilizers, which will contribute to reducing the applied quantities, on average by about 3% per year, compared to the amounts applied used in the WEM scenario. This scenario also provides for increased application rates of organic fertilizers due to the increase of the share of crop residues incorporated in the soil and wider use of green fertilizers and conservation agriculture system.

Taking into account that the GHG emissions from agricultural soils depend on the annual flow of organic matter in the soil, incorporation of green fertilizer into the soil on a larger scale was considered. It is recommended that green mass of annual leguminous crops with highly developed semi-fasciculate radicular system should be used as fertilizer incorporated into the soil. The most suitable leguminous crops that can be used as green fertilizer are vetch and autumn and spring peas. Introducing intermediate crops as a green fertilizer will be carried out in parallel with the implementation of the "no-till" and "mini till" conservation tillage system.

Table 4-21 shows the prospects for the application of green (sidereal) fertilizers, and Table 4-22 - the information about the areas where currently applied, as well as the prospects for the application of the conservation agriculture system in the period up to year 2035.

Table 4-21: Projections for use of green fertilizer in the Republic of Moldova over 1990-2035

	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
	WEM									
Areas on which green fertilizer will be used - vetch, kha	0	0	0	0	0	0	0	25.0	50.0	75.0
Green vetch mass incorporated in the soil, kt	0	0	0	0	0	0	0	500	1000	1500
Green fertilizer, converted to equivalent organic fertilizer, kt	0	0	0	0	0	0	0	700	1400	2100
Green fertilizer - $F_{SIDEREAL}$, kt N	0	0	0	0	0	0	0	3.9	7.8	11.8
	WAM									
Areas on which green fertilizer will be used - vetch, kha	0	0	0	0	0	0	0	50.0	75.0	100.0
Green vetch mass incorporated in the soil, kt	0	0	0	0	0	0	0	1000	1500	2000
Green fertilizer, converted to equivalent organic fertilizer, kt	0	0	0	0	0	0	0	1400	2100	2800
Green fertilizer - $F_{SIDEREAL}$, kt N	0	0	0	0	0	0	0	7.8	11.8	15.7

Table 4-22: Projections for areas on which conservation agriculture system will be used in the Republic of Moldova over 1990-2035, thousand hectares

	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
	WEM									
Areas on which the conservation agriculture system will be used, including:	0	0	0	0	0	54	66	100	150	200
winter wheat	0	0	0	0	0	21	25	35	50	70
autumn barley	0	0	0	0	0	6	13	15	25	30
maize	0	0	0	0	0	21	25	35	50	70
sunflower	0	0	0	0	0	6	13	15	25	30
	WAM									
Areas on which the conservation agriculture system will be used, including:	0	0	0	0	0	54	66	150	200	250
winter wheat	0	0	0	0	0	21	25	50	70	80
autumn barley	0	0	0	0	0	6	13	25	30	45
maize	0	0	0	0	0	21	25	50	70	80
sunflower	0	0	0	0	0	6	13	25	30	45

CO_2 emissions projections

CO_2 emissions in the agriculture sector occur only under category 3H 'Urea application'. The results of the respective calculations are presented in Table 4-23. As we can see from the table, CO_2 emissions from category 3H 'Urea application' will increase by about 95 times by the year 2035 compared to the level of CO_2 emissions recorded from that category in the reference year (1990) in the case of WEM, respectively about 92 times in the case of WAM. The implementation of good practices and mitigation policies at the branch level will allow to reduce some of the growth rate of CO_2 emissions from category 3H 'Urea application'.

Table 4-23: Projections of CO_2 emissions from the category 3H 'Urea Application' in the Republic of Moldova under the scenarios analyzed for 1990-2035

	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
	WEM									
CO_2 emissions, kt	0.6	0.1	0.4	0.2	1.7	11.2	42.6	45.9	50.5	55.2
	WAM									
CO_2 emissions , kt	0.6	0.1	0.4	0.2	1.7	11.2	42.6	44.6	49.0	53.5

CH_4 emissions projections

In agriculture sector CH_4 emissions are generated from categories 3A 'Enteric Fermentation' and 3B 'Manure Management'. Projections for these emissions are shown in Table 4-24. In 2020, CH_4 emissions from enteric fermentation exceeded almost 9 times the emissions from manure management, which call for greater attention to measures optimizing the livestock and poultry structure, to be promoted to reduce GHG emissions from this category. At the same time, manure management also generates N_2O emissions (Table 4-25), which by amount, are about at the same level as CH_4 emissions from enteric fermentation. Thus, the effort to mitigate GHG emissions in the livestock sector has to be divided practically equally between these two categories.

Table 4-24: Projections of CH_4 emissions from agriculture sector until 2035, kt CO_2 equivalent

	1990	2010	2015	2020	2025	2030	2035
WEM							
3. Agriculture	**2,684.5**	**787.4**	**698.1**	**433.4**	**405.2**	**368.0**	**330.2**
3A. Enteric fermentation	2,189.4	708.2	629.2	389.0	362.5	327.7	292.1
3B. Manure management	495.1	79.2	68.9	44.4	42.7	40.2	38.1
WAM							
3. Agriculture	**2,684.5**	**787.4**	**698.1**	**433.4**	**381.8**	**345.1**	**307.1**
3A. Enteric fermentation	2,189.4	708.2	629.2	389.0	342.2	307.4	271.9
3B. Manure management	495.1	79.2	68.9	44.4	39.6	37.6	35.2

N_2O emission projections

Projected N_2O emissions from the agriculture sector are shown in Table 4-25. In 2020, N_2O emissions from category 3D 'Agricultural soils' by more than five times exceeded the emissions in category 3B 'Manure Management'.

Total aggregated GHG emissions projections

Table 4-26 and Figure 4-7 show the projected aggregate GHG emissions from the agriculture sector, in comparison with emissions reported in 1990.

Table 4-25: Prospects of N_2O emissions from agriculture by 2035, equivalent kt CO_2

	1990	2010	2015	2020	2025	2030	2035
WEM							
3. Agriculture	**2,391.6**	**1,014.6**	**991.9**	**1,062.2**	**1,332.9**	**1,388.0**	**1,443.7**
3B Manure management	899.7	300.4	249.9	166.4	165.5	157.7	148.6
3D. Agricultural soils	1,491.9	714.2	742.0	895.8	1,167.4	1,230.3	1,295.1
WAM							
3. Agriculture	**2,391.6**	**1,014.6**	**991.9**	**1,062.2**	**1,316.7**	**1,360.5**	**1,401.7**
3B Manure management	899.7	300.4	249.9	166.4	163.5	154.9	145.0
3D. Agricultural soils	1,491.9	714.2	742.0	895.8	1,153.3	1,205.6	1,256.7

Table 4-26: Projections of aggregated total GHG emissions from agriculture sector by 2035, kt CO_2 equivalent

	1990	2010	2015	2020	2025	2030	2035
WEM							
Agriculture	**5,076.7**	**1,803.7**	**1,701.2**	**1,538.2**	**1,784.0**	**1,806.5**	**1,829.1**
3A. Enteric fermentation	2,189.4	708.2	629.2	389.0	362.5	327.7	292.1
3B. Manure management	1,394.8	379.6	318.8	210.8	208.1	197.9	186.7
3D. Agricultural soils	1,491.9	714.2	742.0	895.8	1,167.4	1,230.3	1,295.1
3H. Urea application	0.6	1.7	11.2	42.6	45.9	50.5	55.2
WAM							
Agriculture	**5,076.7**	**1,803.7**	**1,701.2**	**1,538.2**	**1,743.1**	**1,754.6**	**1,762.3**
3A. Enteric fermentation	2,189.4	708.2	629.2	389.0	342.2	307.4	271.9
3B. Manure management	1,394.8	379.6	318.8	210.8	203.1	192.5	180.2
3D. Agricultural soils	1,491.9	714.2	742.0	895.8	1,153.3	1,205.6	1,256.7
3H. Urea application	0.6	1.7	11.2	42.6	44.6	49.0	53.5

Compared to the reference year, in 2035 the level of GHG emissions under the WEM and WAM scenarios will be 36.0% and 34.7%, respectively.

Figure 4-7: Projections of aggregated total GHG emissions from the agriculture sector, by 2035.

Sensitivity analysis

The main indicators affecting GHG emissions in the agriculture sector are: the amount of nitrogenous chemical fertilizers and the numbers of dairy cows and other cattle. The sensitivity analysis is based on the scenario in which these two indicators, during the years 2025, 2030 and 2035, will get values by 5% higher than values calculated in WEM scenario. The results are shown in Table 4-27 and Table 4-28. As seen from these tables, provided there is a 5% increase in the amount of chemical nitrogen fertilizers applied to the soil, and numbers of dairy cows and other cattle during the years 2025, 2030 and 2035, a 1.9-2.5% increase in GHG emissions from the categories under review can be anticipated, compared to the values included in the WEM.

Table 4-27: Sensitivity analysis (SA) for aggregate direct GHG emissions at the sub-sector level (crop production and soil resources) compared to the same included in the WEM scenario, kt CO_2 eq.

	2020	2025	2030	2035
3H. Urea application, CO_2 emissions, WEM	42.6	45.9	50.5	55.2
3H Urea application, CO_2 emissions, SA	42.6	48.2	53.1	57.9
WEM-SA difference, %	**0.0**	**5.0**	**5.0**	**5.0**
3D. Agricultural soils, total N_2O emissions, WEM	894.5	1,160.6	1,211.3	1,277.3
3D. Agricultural soils, total N_2O emissions, SA	894.5	1,181.1	1,233.0	1,300.7

	2020	2025	2030	2035
WEM-SA difference, %	**0.0**	**1.8**	**1.8**	**1.8**
Total, crop growing and soil resources, GHG emissions, WEM	937.1	1,206.6	1,261.9	1,332.5
Total, crop growing and soil resources, GHG emissions, SA	937.1	1,229.3	1,286.1	1,358.6
WEM-SA difference, %	**0.0**	**2.2**	**2.0**	**1.9**

Table 4-28: Sensitivity analysis (SA) for aggregate direct GHG emissions at the sub-sector level (animal husbandry) compared to the same included in the WEM scenario, kt CO_2 eq.

	2020	2025	2030	2035
3A. Enteric fermentation, CH_4 emissions, WEM	389.0	362.5	327.7	292.1
3A. Enteric fermentation, CH_4 emissions, SA	389.0	374.3	338.0	300.8
WEM-SA difference, %	**0.0**	**3.2**	**3.1**	**3.0**
3B. Manure management, CH_4 emissions, WEM	44.4	42.7	40.2	38.1
3B. Manure management, CH_4 emissions, SA	44.4	43.2	40.7	38.5
WEM-SA difference, %	**0.0**	**1.3**	**1.2**	**1.1**
3B. Manure management, N_2O emissions, WEM	166.4	165.5	157.7	148.6
3B. Manure management, N_2O emissions, SA	166.4	167.4	159.4	150.1
WEM-SA difference, %	**0.0**	**1.2**	**1.1**	**1.0**
Total, Animal husbandry, GHG emissions, WEM	599.8	570.6	525.7	478.8
Total, Animal Husbandry, GHG emissions, SA	599.8	584.9	538.1	489.4
WEM-SA difference, %	**0.0**	**2.5**	**2.4**	**2.2**

4.3.4. Land Use, Change of Land Use and Forestry Sector

Within the LULUCF sector, GHG emissions/removals are monitored in categories 4A "Forest Land", 4B "Cropland", 4C "Grassland", 4D "Wetland", 4E "Settlements", 4F "Other Land" 4G "Harvested Wood Products". CH_4 and N_2O emissions related to LULUCF sector are not considered in this analysis because of low values. At the same time, they were taken into account in calculation of total GHG emissions/removals, expressed in kt CO_2 equivalent in each of the categories mentioned above.

The policies used for development of WEM and WAM scenarios for the LULUCF sector are described in Chapter 3.5.4. These policies are aimed at expanding wooded areas, with subsequent increase of the wood mass; diminishing the areas prone to forest fires; gradual increase of protection belts, plantations of trees and shrubs, orchards and vineyards, improving the quality of plantations, etc.

The following assumptions were made under the WEM scenario for:

- forests – summarizing the measures and policies described in Chapter 3.3.4, including due to the fact that most were partially implemented and expired in 2020, the targets for 2030 were set according to the GD 1470/2016 on implementation of the LEDS until 2030, with the extension of the period until 2035. This would mean that the average afforestation rates would be 8,549 kha/year. The year 2022 is considered an intermediate year of planning, primary organization of afforestation works, strengthening of technical capacities for production of forest reproductive material, etc. Thus, in the period 2023-2035 the total area of 111,137 kha would be planted. The experience gained demonstrates that this is an optimistic and difficult to achieve pace;
- forest belts and other types of forest vegetation (PFP) – the target is to plant 20,423 kha new lands (11,998 kha PFP; 8,425 kha energy crops) or an average rate of 1,571 kha annually;
- vineyards – by 2025 the area will increase by 340 ha, or on average by 85 ha annually, based on the GD 742 of 21.10.2015 (amended by the GD 785/2018) for the approval of the Action Plan on the implementation of the National Strategy for Agricultural and Rural Development;
- orchards – the orchards area will be maintained at the level of 2020, with quality improving activities in existing plantations, including through comprehensive reconstructions;
- mineralized agricultural soils – gradual extension of conservation tillage and organic fertilization practices on about 30% of arable soils, thus ensuring the reduction of carbon emissions from 0.31 t/ha/year to 0.25 t/ha/year;
- grassland – the grassland area will be maintained at the level of 2021, with ongoing activities improving the quality of existent grassland;
- wetlands – the wetlands area will be maintained at the level of 2021;
- inhabited areas and infrastructure - the area will increase by 1000 ha annually (roads, infrastructure, residential areas, agricultural storage and processing areas etc.);
- wood products - the benchmark used was the possibility of harvesting of 611.7 thousand m3/year as forest cutbacks, including 320.3 thousand m^3/year from cutting of main products (GD 958/2020); 291.4 thousand m^3 of by-products and other cuts (average for the period 2016-2020, including municipalities – 32.2 thousand m^3 and Transnistria – 20.8 thousand m^3).

The scenario with additional measures (WAM) provides for an increase of expansion indexes for areas with other types of vegetation, based on draft policy documents, donor financed projects, etc.

The main benchmark is the "NAMA on Afforestation of Degraded Land, Riparian Areas and Protection Belts", which aims to reverse the forest and land degradation trend and increase carbon removal by 261.6 kt CO_2 annually until 2030 by afforestation of 45 kha of degraded, unproductive lands and by planting 15 kha of riparian forest belts and 1.5 kha of forest protection belts in farming systems. At the same time, the WAM includes the provisions of the draft GD regarding the approval of the National Plan for the extension of forest vegetation areas for the years 2022-2031 (afforestation of 7.5 kha of degraded land), which is the Government's commitment as part of NAMA. Overall, it is expected that 57.1 kha will be afforested, at an average annual rate of 4.395 kha. Thus, the WAM main assumptions are:

- forests – planting forest vegetation on the total area of 41,795 kha or on average 3,215 kha annually (in addition to WEM). The year 2022 is considered an intermediate year, dedicated primarily to the planning and primary organization of afforestation works.

- forest belts – 15.34 kha, which is an average 1.18 kha annually (in addition to WEM).
- vineyards – the area will conventionally by 0.5 kha/year compared to WEM or a total increase of 7.0 kha.
- orchards – the area will conventionally increase by 0.5 kha/year compared to WEM or a total increase of 7.0 kha.
- mineralized agricultural soils – the gradual extension of the conservation tillage and organic fertilization practices on most arable lands, an action that will ensure reduction of carbon emissions from 0.31 t/ha/year to 0.15 t/ha/year (coefficient calculated in the period 1970-1989), this practice being continued until 2035.
- grasslands – increase the grasslands area to reach 12% of the country's area[245] or up to 406,152 kha in 2035. This means, that 68,507 kha of grassland still needs to be created at an annual rate of 5,270 kha.
- settlements – the area will increase by 0.5 kha annually (in addition to WEM) or a total increase of 6.5 kha.

To simulate the GHG emissions/removals evolution under both scenarios, the Land Use Matrix for 1970-2020, extended for the period 2021-2035. Tis application includes all ratios, emission/removal coefficients, and equations necessary for development of the national GHG inventory and/or projecting for future periods.

Based on the assumptions made under the WEM and WAM scenarios, the evolution of the land fund area was simulated, broken down by land use categories (Table 4-29) and CO_2 removals in the LULUCF sector (Table 4-30, Figure 4-8).

Table 4-29: Evolution of the areas of the main land use categories over 2020-2035, ha

Categories of use	2021	2025	2030	2035
WEM				
Agricultural land	1,871,031	1,839,531	1,781,664	1,709,160
Grassland	362,886	362,886	362,886	362,886
Vineyards	124,853	125,193	125,193	125,193
Orchards	151,564	151,825	151,825	151,825
Forest vegetation	51,127	54,269	60,160	73,121
Forestry	416,967	438,340	481,085	532,379
Areas of annual successful afforestation	858	3,795	5,060	6,072
Settlements	245,681	247,681	251,431	259,681
Swamps	18,423	18,423	18,423	18,423
Waters	78,114	78,114	78,114	78,114
Other land	63,124	64,571	68,786	67,774
WAM				
Agricultural land	1,871,031	1,816,116	1,717,901	1,550,103
Grassland	362,886	374,743	401,093	431,396
Vineyards	124,853	126,193	128,068	132,193
Orchards	151,564	152,825	154,700	158,825
Forest vegetation	51,127	56,626	66,937	89,621
Forestry	416,967	443,161	487,274	575,772
Areas of annual successful afforestation	858	4,746	5,222	10,476
Settlements	245,681	248,681	254,306	266,681
Swamps	18,423	18,686	19,179	20,265
Waters	78,114	79,230	81,322	85,926
Other land	63,124	63,620	68,624	63,370

[245] Galupa D., Talmaci I., et al., (2006), *Development of communal forests and grasslands in the Republic of Moldova.* – Ch. Ed. center of UASM, 2006.-19 pp.

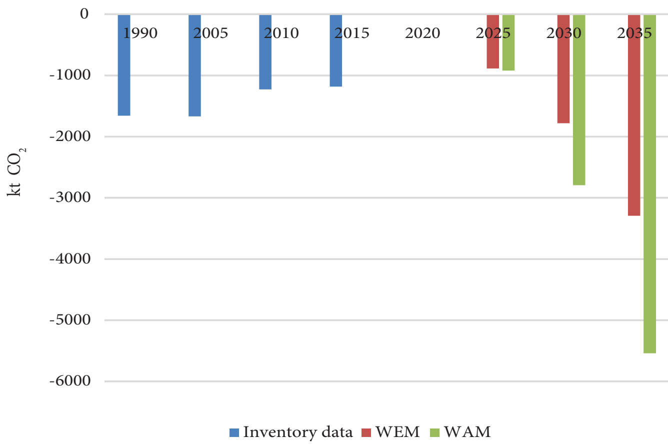


Figure 4-8: CO_2 removals in the LULUCF sector according to considered scenarios by 2035.

Table 4-30: Projected GHG emissions/removals in LULUCF sector, kt CO_2 equivalent

	1990	2010	2015	2020	2025	2030	2035
WEM							
4. LULUCF	**-1,657.5**	**-1,228.2**	**-1,181.9**	**-3.5**	**-886.2**	**-1,779.7**	**-3,291.9**
4A. Forest Land	-2,563.1	-2,484.0	-2,158.4	-1,886.1	-1,885.6	-2,095.2	-2,695.5
4B. Cropland	2,382.3	1,271.9	1,112.7	1,630.0	1,198.9	1,007.6	714.9
4C. Grassland	-1,205.7	-692.0	-418.5	-223.2	-426.4	-1,044.8	-1,782.0
4D. Wetlands	-555.4	-46.4	-82.8	-82.8	-82.8	-82.8	0.0
4E. Settlements	254.2	303.7	229.0	194.7	41.7	54.8	83.0
4F. Other Land	152.4	441.5	86.8	329.1	287.3	400.1	406.9
4G. Harvested Wood Products.	-122.2	-22.8	49.2	34.7	-19.3	-19.3	-19.3
WAM							
4. LULUCF	**-1,657.5**	**-1,228.2**	**-1,181.9**	**-3.5**	**-921.1**	**-2,793.5**	**-5,540.4**
4A. Forest Land	-2,563.1	-2,484.0	-2,158.4	-1,886.1	-1,832.1	-1,834.1	-2,460.1
4B. Cropland	2,382.3	1,271.9	1,112.7	1,630.0	1,210.5	229.8	-434.2
4C. Grassland	-1,205.7	-692.0	-418.5	-223.2	-518.4	-1,653.0	-3,508.1
4D. Wetlands	-555.4	-46.4	-82.8	-82.8	-82.8	-82.8	0.0
4E. Settlements	254.2	303.7	229.0	194.7	48.4	68.0	113.6
4F. Other Land	152.4	441.5	86.8	329.1	274.3	503.7	779.2
4G. Harvested Wood Products.	-122.2	-22.8	49.2	34.7	-21.0	-24.9	-30.9

As seen from Figure 4-8, the CO_2 removals in WAM by 2035 will exceed those in WEM by about 1.7 times. However, in order to achieve this, donors support is required.

Comparison of projected GHG emissions/removals in NC5 and BUR3 for the LULUCF sector

The analysis of NC5 results compared to BUR3 submitted to the UNFCCC on removals projections in LULUCF sector for the period 2025-2035 shows some differences (Table 4-31).

The main reasons for such evolution under the WEM scenario are associated with the chronic non-fulfillment of Government's commitments set out in various policy documents aimed at afforestation of new land, rehabilitation of vineyards and orchards, transforming heavily degraded farmland into grassland, expanding forest belts for the protection of agricultural fields/riparian areas, etc.

Table 4-31: Analysis of projected GHG emissions/removals in LULUCF sector in NC5 compared to BUR3

	2025			2030			2035		
	BUR3	NC5	%	BUR3	NC5	%	BUR3	NC5	%
WEM, removals in the LULUCF sector, kt CO_2 equivalent	-657.4	-886.2	34.8	-804.2	-1,779.7	121.3	-1,404.7	-3,291.9	134.3
WAM, removals in the LULUCF sector, kt CO_2 equivalent	-2 333.3	-921.1	-60.5	-4,203.0	-2,793.5	-33.5	-7,608.5	-5,540.4	-27.2

The main reasons for such evolution under the WEM scenario are associated with the chronic non-fulfillment of Government's commitments set out in various policy documents aimed at afforestation of new land, rehabilitation of vineyards and orchards, transforming heavily degraded farmland into grassland, expanding forest belts for the protection of agricultural fields/riparian areas, etc.

The projections made in NC5 took into account the respective shortcomings/delays, and distributed them over the period 2024-2035. At the same time, in NC5 the pace of the policy documents implementation was phased over three distinct periods: I - 2022-2025, II - 2026-2030, III - 2031-2035, with slower pace at initial stage and gradual speed up at stages II and III.

Another important aspect that has influenced the differences between NC5 compared to BUR3 are the recalculations for some source categories/subcategories (4B1) made within the GHG inventory during the period 1990-2020, as well as the modification of some approaches in the calculation process of land conversion to different categories of use (especially grasslands). Consequently, the cumulated differences in LULUCF sector variate widely from -60.5% to +134.3%.

Sensitivity Analysis

For the purpose of sensitivity analysis (SA) of the LULUCF sector projections under the WEM scenario, the parameters deemed sensitive are the indicators associated with the growth and harvesting of biomass in forests: biomass growth in forests; wood harvesting from forests; net accumulation of biomass/wood stands in forests.

The above mentioned parameters were selected due to the reason that under the scenario for LULUCF sector category 4A 'Forest Land' has the highest weight as absolute value both in 2021 (44.9%) and in 2035 (47.3%). At the same time, it is mentioned that the capacity of forests to capture carbon dioxide is expressed by the net accumulations of biomass, which is dependent on current increases, but also on the volume of harvested wood by authorized and/or illicit logging.

Cumulatively, all these parameters will depend to a large extent on the rates of forest areas extension on new lands, but also on the quality of the forest management by the owners/administrators in the course of implementing the forestry regime. Also, certain influences will be caused by natural parameters (amount of rainfall; droughts; floods, etc.). The analysis of the selected parameters sensitivity under the projected WEM scenario for category 4A 'Forest Land' of LULUCF sector is shown in Table 4-32.

Table 4-32: Values of parameters with impact on GHG emissions/removals in LULUCF sector used in the Sensitivity Analysis (SA), thousand m^3

Parameters and measurement unit	2021	2025	2030	2035
Current biomass increases according to WEM	1,412.0	1,512.1	1,681.1	1,862.0
Current biomass increases according to SA	1,412.0	1,360.9	1,513.0	1,675.8
Wood harvesting, WEM	611.7	611.7	611.7	611.7
Wood harvesting, SA	611.7	672.9	672.9	672.9
Net accumulation of biomass in stands in forests, WEM	800.3	900.4	1,069.4	1,250.3
Net accumulation of biomass in stands in forests, SA	800.3	688.0	840.1	1,002.9

The following were applied as sensitivities values: the decrease of biomass increases in forests by 10% and the increase of wood mass harvests in forests by 10%. The decrease of current biomass growth by 10%, cumulated with the increase in the same proportion of the harvested wood volumes, will decrease the GHG removal capacity of forests in the RoM on average by 21.6% on the account of the accumulated net biomass volume in category 4A 'Forest Land' under WEM (Table 4-33).

Table 4-33: Sensitivity analysis (SA) projections undertaken for category 4A 'Forest Land' in LULUCF sector under WEM scenario

Source category	2021	2025	2030	2035
4A. Forest Land WEM, kt CO_2	-1,807.1	-1,885.6	-2,095.2	-2,695.5
4A. Forest land, SA, kt CO_2	-1,807.1	-1,440.8	-1,646.0	-2,162.2
WEM-SA difference, %	0.0	23.6	21.4	19.8

4.3.5. Waste Sector

In the waste sector, direct GHG emissions from solid waste management activities are monitored, including industrial waste (source categories 5A "Solid Waste Disposal", 5B „Biological Treatment of Solid Waste", 5C "Incineration and Open Burning of Waste") and wastewater treatment (source category 5D "Wastewater Treatment and Discharge"). GHG emissions projections were made based on the methodological approaches described in the 2006 IPCC Guidelines.

Policies used in mitigation scenarios for the waste sector (WEM and WAM) are described in Chapter 3.5.5. GHG emissions mitigation measures for the waste sector include:

development of regional waste disposal infrastructure, construction of regional SWDs, composting stations, sorting stations, and transfer stations, in line with the Waste Management Strategy for 2013-2027 and EU and national standards; expanding the current system of primary collection and storage of urban waste in rural area; improving the water supply and sanitation infrastructure.

The two scenarios for mitigating GHG emissions in the waste sector include:

The *With Existing Measures (WEM) scenario*– which provides for potential GHG emission reductions through separate collection of waste paper and cardboard which is assumed to account for 5% of municipal waste collected from institutions and other businesses in urban areas, and 2% in rural ones. This scenario will not include options to reduce GHG emissions as a result of the integrated waste management systems implementation entailing construction of regional DMSs, composting stations, sorting stations and transfer stations.

WEM provides for the extension of municipal waste collection systems in rural areas by 25% during 2021-2030 and 1% annually during 2030-2035, as well as for the promotion and motivation of separate collection. Thus, the rate of open-air combustion of municipal waste is expected to decrease from about 3.93% in 2021 to 0.33% in 2035. Regarding the combustion of medical waste outdoors or in non-compliant installations, the scenario with existing measures provides for application of the Health Regulation on medical waste management, approved by the GD no. 696/2018, the projected burn rate of the total medical waste generated shows a decrease from about 10% in 2019 to 5% in 2035.

Under the WEM, the projections for methane and nitrous oxide emissions from category 5D 'Wastewater treatment and discharge' were developed based on the Water Supply and Sanitation Strategy for the years 2014-2030 (GD No. 99/2014)[246], including the refurbishment of wastewater treatment plants in Chisinau, with anaerobic sludge treatment, starting with 2023. Therefore, WEM provides for ensuring access to sanitation systems (sewerage system or other water collection and management systems, such as septic tanks) to 85% of the urban population and 50% of the rural population by 2030, and to 100% of the urban population and about 75% of the rural population by 2035.

In terms of industrial wastewater, WEM provides for ensuring access to sanitation systems (sewerage system or other water collection and management systems, such as septic tanks) to 85% of the urban population and 50% of the rural population by 2030, and to 100% of the urban population and about 75% of the rural population by 2035. Consequently, it is assumed that protein consumption rates per capita will remain constant compared to 2019 while endowment with modern wastewater treatment facilities will be improving from 22.8% in 2020 to 72.3% in 2035.

In the case of the *With Additional Measures (WAM) scenario*, the GHG emissions reduction scenario provides for a higher implementation rates of the Waste Management Strategy for 2013-2027, approved by GD no. 248 of 10.04.2013, in particular development of integrated waste management systems by construction of regional SWD sites, composting stations, sorting stations and transfer stations. It was also taken into account that at the stage of the Waste Management Strategy for 2013-2027 development two options were considered: construction of two mechanical-biological waste treatment plants or two incinerators in Chisinau and Balti municipalities. The medium-term impact (until 2030) from the construction of a single mechanical-biological waste treatment plant is 20% reduction of direct GHG emissions from the waste sector. It was also taken into account that in the process of developing projections for the waste sector, an error was made in the calculation file for the source category 5A1 'Solid Waste Disposal', and the value of the share of inert waste was corrected from 31% to 41% for the years 2016-2020.

The WAM assumes that the open burning of waste will be gradually decreasing, with the implementation of the Waste Management Strategy for 2013-2027 and of regional waste management systems, along with the promotion of more efficient sanitation control in settlements. Thus, the share of waste burned in open conditions will gradually decrease from 3.93% in 2021 to 0.03% in 2035.

Strict compliance with environmental legislation, Health Regulations on medical waste management, in addition to developing and implementing a sector strategic document, would allow to eliminate open burning of medical waste by 2035.

In category 5D 'Wastewater Treatment and Discharge', the WAM provides for the full implementation of the Water Supply and Sanitation Strategy for 2014-2030 (GD No. 99/2014), as well as the refurbishment of wastewater treatment plants in Chisinau, with anaerobic sludge treatment starting with 2022.

Therefore, the WAM provides for ensuring access to sanitation systems (sewerage system or other water collection and management systems, such as septic tanks) to 85% of the urban population and 53% of the rural population by 2030, and to 100% of the urban population and about 85% of the rural population by 2035. At the same time, the WAM proposes the additional measure to mitigate the CH_4 emissions by refurbishing the wastewater treatment plant in Balti municipality starting with 2028.

Regarding the industrial wastewater, similar to the WEM, it is foreseen to equip the enterprises with wastewater treatment or pre-treatment facilities, to improve access to efficient water treatment systems, according to the connection targets mentioned in the above paragraph, and in the districts where the sewerage systems are completely missing, it is assumed to build them and to connect both the population and businesses, as well as to enforce the requirements of the Regulation on the requirements for wastewater collection, treatment and discharge into the sewerage system and/or into water emissaries in urban and rural settlements, approved by GD 950/2013. Thus, the amount of degradable organic substances in industrial wastewater is being gradually reduced by 3% in 2020 to 55% in 2035.

[246] GD no. 199 of 20.03.2014 on the approval of the Water Supply and Sanitation Strategy (2014 – 2028), Published: 28.03.2014 in the Official Gazette No. 72-77, art. No.: 222, as amended by GD 442 of 01.07.20, MO188-192/24.07.20 art.634, <https://www.legis.md/cautare/getResults?doc_id=122590&lang=ro>

CO_2 emissions projections

The CO_2 emissions projections in the waste sector refer to CO_2 emissions generated under the source category 5C "Incineration and Open Burning of Waste". The projected CO_2 emissions do not exceed 1% of the total GHG emissions attributed to the waste sector.

CH_4 emissions projections

The projected CH_4 emissions from the waste sector for both scenarios (WEM and WAM) are shown in Table 4-34. These emissions are mainly generated from solid waste deposit sites, as well as from as well as domestic and industrial wastewater treatment.

Table 4-34: Projections of CH_4 emissions from the waste sector, kt CO_2 equivalent

	1990	2010	2015	2020	2025	2030	2035
WEM							
5. Waste	**1,468.0**	**1,433.5**	**1,353.4**	**1,491.9**	**1,435.4**	**1,411.4**	**1,380.4**
5A. Solid Waste Disposal	1,106.0	1,160.7	1,104.5	1,246.2	1,237.9	1,223.6	1,208.8
5B. Biological Treatment of Solid Waste	1.4	1.1	1.3	1.4	1.6	1.7	2.2
5C. Incineration and Open Burning of Waste	7.7	6.6	6.8	7.1	5.7	3.6	0.7
5D. Wastewater Treatment and Discharge	353.0	265.2	240.8	237.2	190.2	182.4	168.8
WAM							
5. Waste	**1,468.0**	**1,433.5**	**1,353.4**	**1,491.9**	**1,435.4**	**1,067.3**	**885.5**
5A. Solid Waste Disposal	1,106.0	1,160.7	1,104.5	1,246.2	1,237.9	903.2	746.2
5B. Biological Treatment of Solid Waste	1.4	1.1	1.3	1.4	1.6	2.8	3.9
5C. Incineration and Open Burning of Waste	7.7	6.6	6.8	7.1	5.7	3.2	0.1
5D. Wastewater Treatment and Discharge	353.0	265.2	240.8	237.2	190.2	158.2	135.4

N_2O emissions projections

The projected N_2O emissions from the waste sector for both scenarios (WEM and WAM) are shown in Table 4-35. These emissions are mainly generated from the source category 5D "Wastewater Treatment and Discharge".

Table 4-35: Projections of N_2O emissions from the waste sector, kt CO_2 equivalent

	1990	2010	2015	2020	2025	2030	2035
WEM							
5. Waste	**90.5**	**55.1**	**56.5**	**61.0**	**57.9**	**55.2**	**52.8**
5B. Biological Treatment of Solid Waste	1.0	0.8	0.9	1.0	1.1	1.2	1.6
5C. Incineration and Open Burning of Waste	1.6	1.4	1.4	1.5	1.2	0.8	0.1
5D. Wastewater Treatment and Discharge	87.9	52.9	54.2	58.5	55.6	53.2	51.1
WAM							
5. Waste	**90.5**	**55.1**	**56.5**	**61.0**	**58.1**	**55.9**	**53.9**
5B. Biological Treatment of Solid Waste	1.0	0.8	0.9	1.0	1.4	2.0	2.8
5C. Incineration and Open Burning of Waste	1.6	1.4	1.4	1.5	1.2	0.7	0.0
5D. Wastewater Treatment and Discharge	87.9	52.9	54.2	58.5	55.6	53.2	51.1

Projected aggregated total GHG emissions

Table 4-36 and Figure 4-9 show the projected aggregate GHG emissions from the waste sector, compared to the GHG emissions reported in 1990. Compared to the level of emissions reported in the reference year, in 2035 the level of GHG emissions from the waste sector will is expected to reach 91.2 % under the WEM and 59.7% under WAM.

Table 4-36: Projections of aggregate GHG emissions from waste sector, kt CO_2 equivalent

	1990	2010	2015	2020	2025	2030	2035
	WEM						
5. Waste	**1,573.5**	**1,501.5**	**1,423.2**	**1,566.6**	**1,504.4**	**1,473.7**	**1,434.5**
5A. Solid Waste Disposal	1,106.0	1,160.7	1,104.5	1,246.2	1,237.9	1,223.6	1,208.8
5B. Biological Treatment of Solid Waste	2.3	1.8	2.2	2.4	2.7	3.0	3.7
5C. Incineration and Open Burning of Waste	24.3	20.8	21.5	22.3	18.0	11.5	2.1
5D. Wastewater Treatment and Discharge	440.9	318.1	295.0	295.7	245.8	235.6	219.9
	WAM						
5. Waste	**1,573.5**	**1,501.5**	**1,423.2**	**1,566.6**	**1,464.8**	**1,129.3**	**939.4**
5A. Solid Waste Disposal	1,106.0	1,160.7	1,104.5	1,246.2	1,204.8	903.2	746.2
5B. Biological Treatment of Solid Waste	2.3	1.8	2.2	2.4	3.3	4.8	6.6
5C. Incineration and Open Burning of Waste	24.3	20.8	21.5	22.3	17.4	9.9	0.2
5D. Wastewater Treatment and Discharge	440.9	318.1	295.0	295.7	239.2	211.4	186.5

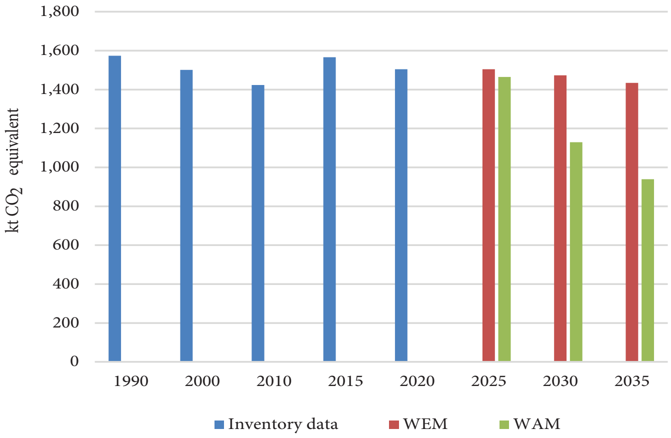


Figure 4-9: Projections of aggregated total GHG emissions from waste sector, kt CO_2 equivalent.

Sensitivity Analysis

In the structure of GHG emissions of the waste sector, the largest share belongs to the source category 5A "Solid Waste Disposal" which accounted for 84% in 2020. Compared to the WEM scenario, the amount of municipal waste was reduced by 25% for all years until 2035. The impact of changing this key parameter on GHG emissions is reflected in Table 4-37.

Table 4-37: Sensitivity Analysis (SA) for projections for category 5A "Solid Waste Disposal" of the waste sector under the WEM scenario

	2020	2025	2030	2035
GHG emissions for the category 5A under the WEM, kt CO_2 equivalent	672.2	712.3	759.3	803.8
GHG emissions for the category 5A under the SA, kt CO_2 equivalent	672.2	695.1	723.4	752.4
WEM-SA difference, %	0.0	-2.4	-4.7	-6.4

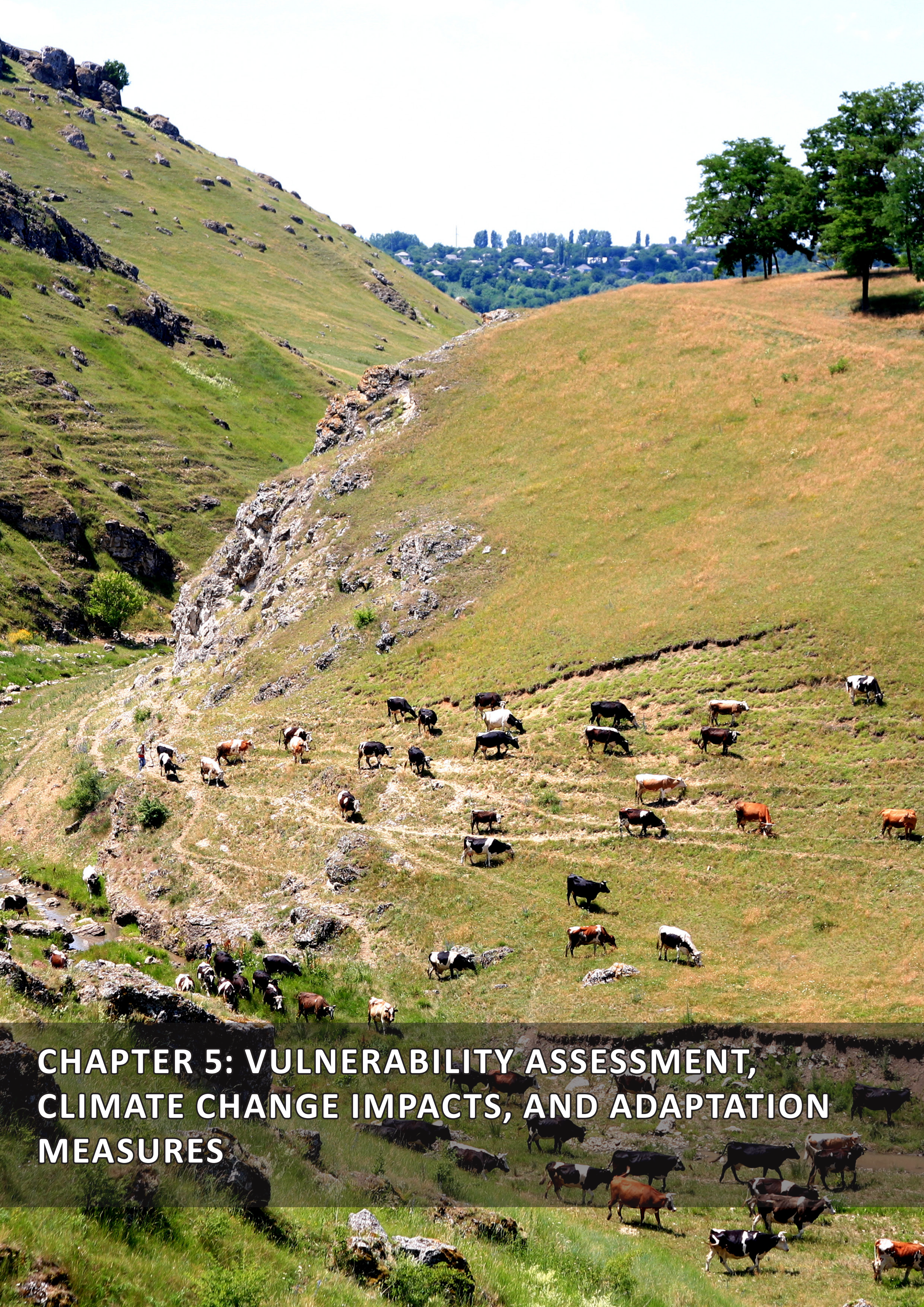
4.3.6. International Bunkers

Of the two types of international transport, water-born and air-born, only the air-born transport is relevant for the RoM (international water-born transport is not registered in the country). The projections listed below for international aviation were not considered for calculation of aggregated total national GHG emissions. These projections were developed on the basis of information on international aviation offered by the Civil Aviation Authority for the period up to 2020. The data for 2000-2020 was subject to regression analysis. Emissions were calculated using the EFs available in the 2006 IPCC Guidelines for National GHG Inventories.

Projected GHG emissions from international aviation are shown in Table 4-38. It is estimated that compared to 2020, emissions from international air transport will increase by about 5 times by 2035.

Table 4-38: Projections of GHG emissions from international aviation until 2035, kt CO_2 equivalent

	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035
CO_2	193.5	42.0	63.1	37.9	41.1	56.8	35.3	130.2	151.9	173.3
CH_4	0.4	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
N_2O	1.9	0.4	0.6	0.4	0.4	0.5	0.3	1.1	1.3	1.4
Total	**195.7**	**42.5**	**63.8**	**38.4**	**41.5**	**57.5**	**35.6**	**131.3**	**153.2**	**174.8**



CHAPTER 5: VULNERABILITY ASSESSMENT, CLIMATE CHANGE IMPACTS, AND ADAPTATION MEASURES

CHAPTER 5: VULNERABILITY ASSESSMENT, CLIMATE CHANGE IMPACTS, AND ADAPTATION MEASURES

5.1. Current Climate of the Republic of Moldova

5.1.1. Summary of Observed Trends in Temperature and Precipitation

The climate of the RoM is moderately continental, characterized by relatively mild winters with little snow, long warm summers and low humidity. The country is located in the area where the air masses coming from the Atlantic Ocean via Western Europe interact and mix with the air from the extreme continental north-eastern regions and the Mediterranean air from the south-west.

Two distinctive patterns can be observed regarding the territorial distribution of the climatic features in RoM: (i) distinct zoning of the annual rainfall averages which show a decreasing trend from the North to the South; and (ii) the increase by approximately 100 mm of the multiannual rainfall averages in the upland regions depending on the neighboring flatland areas.

As regarding to the historic climate change trends, over the last 133 years, the RoM has experienced changes in temperature and mean precipitation. The country has become warmer, with the average temperature increase by 1.2°C (Figure 5-1), while the increase in precipitations constituted only around 51.3 mm (Figure 5-2).

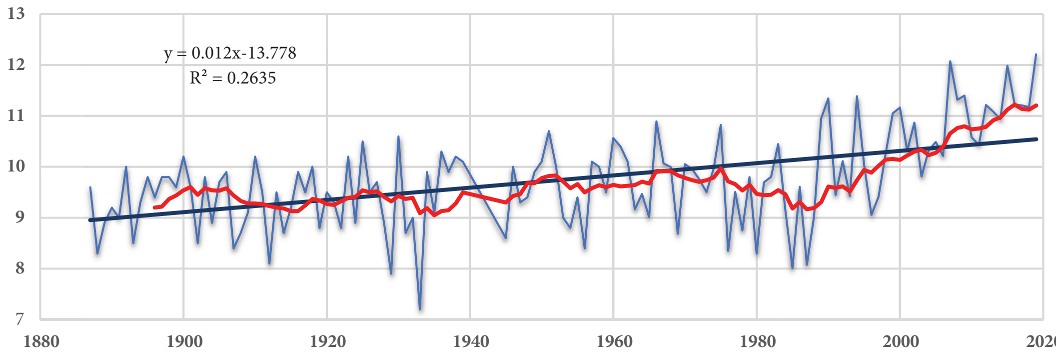


Figure 5-1: Trends of annual average air temperature change (°C) for 1887-2019: blue (actual course trend), black solid line (linear trend secular course) and red line (10 year moving average trend) at the oldest the Republic of Moldova's meteorological station Chisinau, the central part of the country.

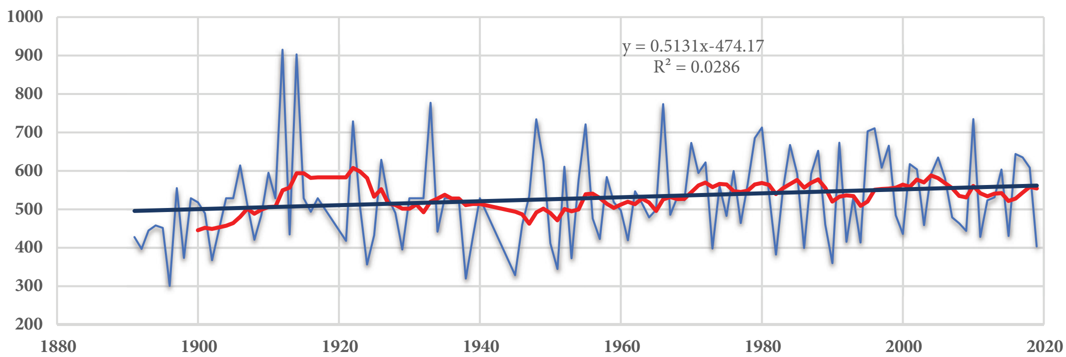


Figure 5-2: Trends of annual average precipitation (mm) for 1891-2019: blue (actual course trend), black solid line (linear trend secular course) and red line (10 year moving average trend) at the oldest the Republic of Moldova's meteorological station Chisinau, the central part of the country.

The early 1980s are generally regarded as a "turning point" in the long-term air temperature curve, when human influence on the atmosphere is most pronounced (IPCC, 2007); this fact has been statistically confirmed both by foreign (Gil-Alana, 2008), as well as national studies (Corobov et al., 2013; Taranu, 2014; Taranu et al., 2018; NC4, 2018).

The annual course of mean air temperature in the RoM, with a maximum in July-August and a minimum in January, and total precipitation, maximum in July and minimum in March, is shown in Figure 5-3.

To identify the climate change, two climatic periods (1961-1990 and 1991-2019) were compared. These periods reflect, respectively, the relatively "normal" regional climate and climate of intensive global warming. The climate changes may be considered real if the parameters of trends are statistically significant.

The temperature rise in the south direction is clearly seen from the mean annual value of 7.8°C (Northern AEZ) to 9.8°C (Southern AEZ) in the 1961-1990 and/or 8.1°C (Northern AEZ) to 10.9°C (Southern AEZ) in the 1991-2019, followed by a decrease in the amount of annual precipitation, respectively, from 613-618[247] mm to 550-516 mm. The comparison of the mean air temperatures for two referred periods, both annual and season, have confirmed substantial changes in temperature regime, Table 5-1.

[247] Here and further the first number is 1961-1990, the second one is 1991-2019.

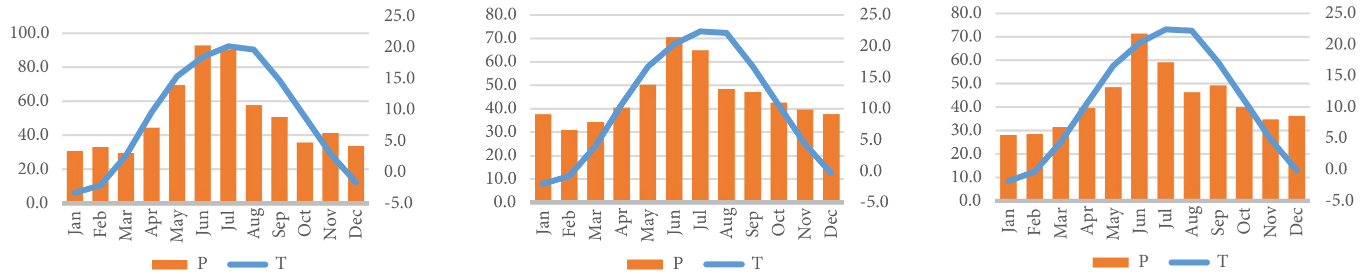


Figure 5-3: Diagrams of total monthly precipitation (columns) with superimposed curves of mean monthly temperatures in 1981-2019.

Table 5-1: Comparison of the seasonal and annual max, mean, and min air temperatures and total precipitation for two time periods 1961-1990 and 1991-2019

Season	Northern AEZ				Central AEZ				Southern AEZ			
	1961-1990		1991-2019		1961-1990		1991-2019		1961-1990		1991-2019	
	X	CV, %	X	CV, %	X	CV, %	X	CV, %	X	CV, %	X	CV, %
Maximal air temperature, °C												
Winter	0.4	>50	0.7	>50	1.4	>50	2.3	>50	1.6	>50	2.8	>50
Spring	13.4	13.9	14.8	9.2	14.8	2.7	16.0	8.4	15.1	12.3	16.4	9.4
Summer	23.9	4.3	25.8	5.0	25.8	4.3	27.6	4.8	26.1	3.8	28.0	5.0
Autumn	13.3	9.8	13.6	10.0	15.1	9.9	15.2	8.1	15.6	9.0	16.1	8.5
Annual	**12.5**	**7.8**	**13.7**	**7.6**	**14.3**	**7.3**	**15.3**	**6.5**	**14.6**	**6.6**	**15.8**	**7.3**
Mean air temperature, °C												
Winter	-3.5	>50	-2.2	>50	-1.8	>50	-0.8	>50	-1.5	>50	-0.6	>50
Spring	8.1	18.3	9.5	11.2	9.7	15.1	10.8	9.1	9.8	14.4	10.9	10.6
Summer	19.1	5.6	19.9	4.9	20.3	3.9	22.1	4.7	20.4	4.0	22.1	4.7
Autumn	8.4	12.2	9.1	12.2	10.2	9.8	10.8	10.2	10.7	9.8	11.3	10.7
Annual	**7.8**	**10.9**	**8.1**	**9.3**	**9.6**	**8.9**	**10.7**	**7.6**	**9.8**	**7.9**	**10.9**	**8.7**
Minimal air temperature, °C												
Winter	-6.5	36.1	-4.8	35.5	-4.4	45.7	-3.4	41.8	-4.1	41.2	-3.2	44.2
Spring	3.6	34.9	4.8	17.4	5.4	21.1	6.4	11.8	5.5	19.7	6.2	14.2
Summer	12.9	5.9	14.6	5.3	15.3	3.9	17.1	4.8	15.4	4.0	16.8	4.6
Autumn	4.3	24.1	5.3	19.0	6.3	14.3	7.1	15.2	5.8	14.3	7.4	15.1
Annual	**3.6**	**22.3**	**5.0**	**13.9**	**5.6**	**13.7**	**6.8**	**9.9**	**5.9**	**11.2**	**6.9**	**14.5**
Precipitations, mm												
Winter	110.7	41.4	95.3	41.2	114.4	46.5	107.9	43.9	113.3	49.7	89.5	45.5
Spring	154.3	24.8	144.5	35.0	128.0	38.9	128.0	40.3	127.8	43.9	121.3	41.9
Summer	238.3	27.4	239.3	34.1	189.6	31.9	181.3	35.5	195.8	36.5	174.1	47.3
Autumn	109.8	48.5	138.9	45.3	112.5	53.0	136.5	51.0	113.3	57.3	131.3	52.8
Annual	**613.2**	**19.0**	**618.0**	**21.8**	**544.5**	**18.6**	**553.7**	**18.1**	**550.3**	**19.1**	**516.3**	**24.5**

However, as it follows from the above definition of climate, it is described not only by the mean values, but also by their variability, which is usually characterized by standard deviations (σ) from the medium. The ratio of σ to the mean value (x), expressed as a percentage, or the so-called coefficient of variation (CV) provides an easily interpretable magnitude of the climate variability variable.

$$CV = \sigma / x \times 100\% \quad (5.1)$$

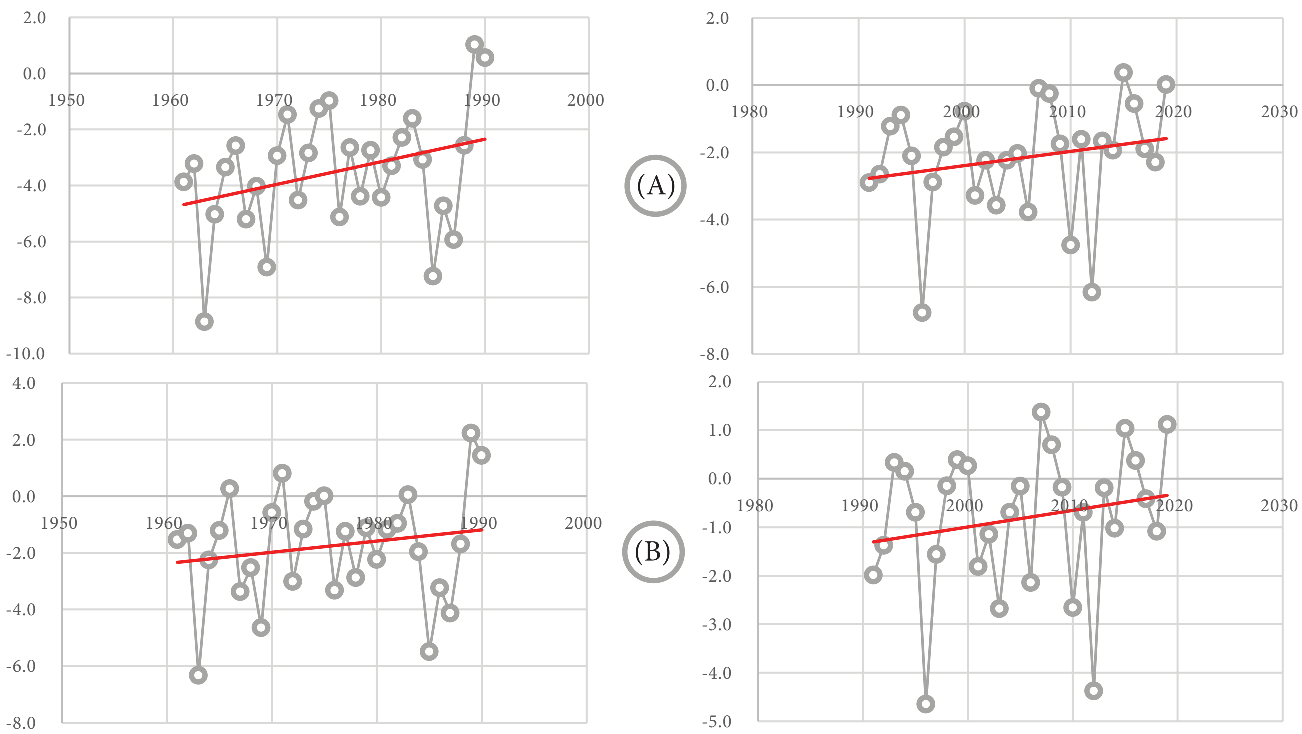
The temperature is the most variable in the winter, reaching 50 per cent or more for the mean, maximum and minimum temperatures. The least variables are the mean, maximum and minimum summer temperatures, when the CV ranges from 3.8 to 5.9 per cent (1961-1990) and 4.6 to 5.3 per cent (1991-2019).

With regard to annual temperatures, CV range from 7.8-7.6 per cent (Northern AEZ) to 6.6-7.3 per cent (Southern AEZ) for maximum temperatures to up to 11.2-14.5 per cent (Southern AEZ), 13.7-9.9 per cent (Central), and 22.3-13.9 per cent (Northern AEZ) for minimum temperatures.

Variability of precipitation is considerably higher and it is >30 per cent for all seasons, with the exception of the annual precipitation, when the CV ranges from 18.6 per cent (Central AEZ) to 19.0 (Northern, and Southern AEZs) in 1961-1990 and from 18.1 per cent (Central AEZ) to 21.8-24.5 per cent (Northern, and Southern AEZs) in 1991-2019 time periods.

Trends in seasonal and annual max, mean, and min air temperature and precipitation calculated by linear regression analysis and their statistical significance of change (p-value) for two time periods are shown in Figures 5-4, 5-5, 1-6, 5-7, and 5-8, more details are provided in Table 5-2 and 5-3.

Figure 5-4: Trends in mean annual air temperature for two time periods - left 1961-1990, and right 1991-2019: (A) Briceni – Northern AEZ, (B) Chisinau – Central AEZ, (C) Cahul – Southern AEZ.



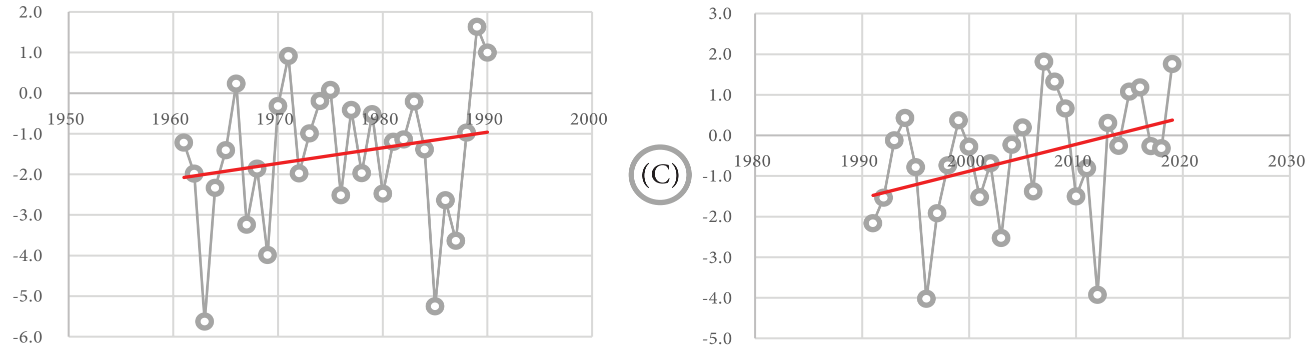


Figure 5-5: Trends in winter mean air temperature for two time periods - left 1961-1990, and right 1991-2019: (A) Briceni – Northern AEZ, (B) Chisinau – Central AEZ, (C) Cahul – Southern AEZ.

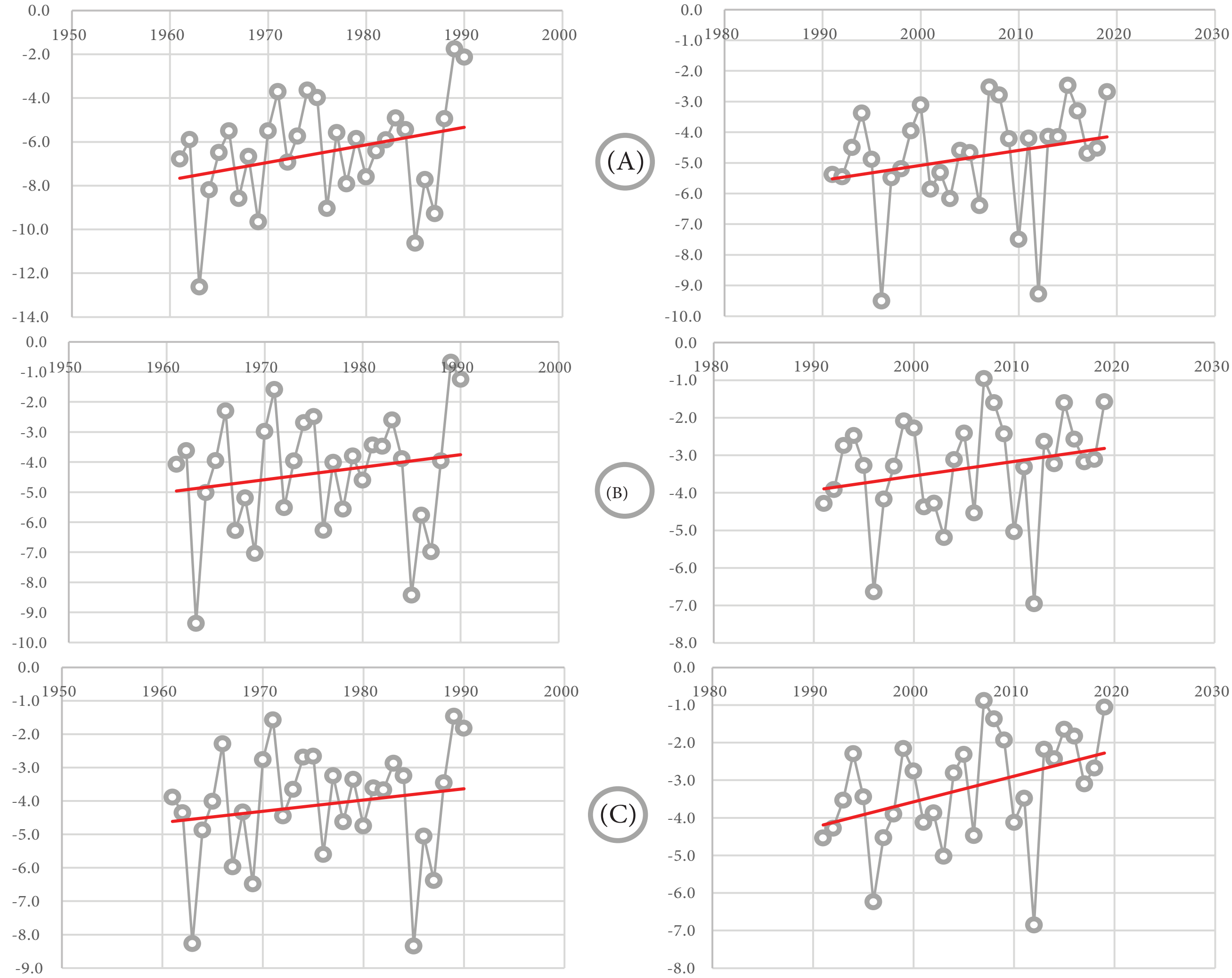
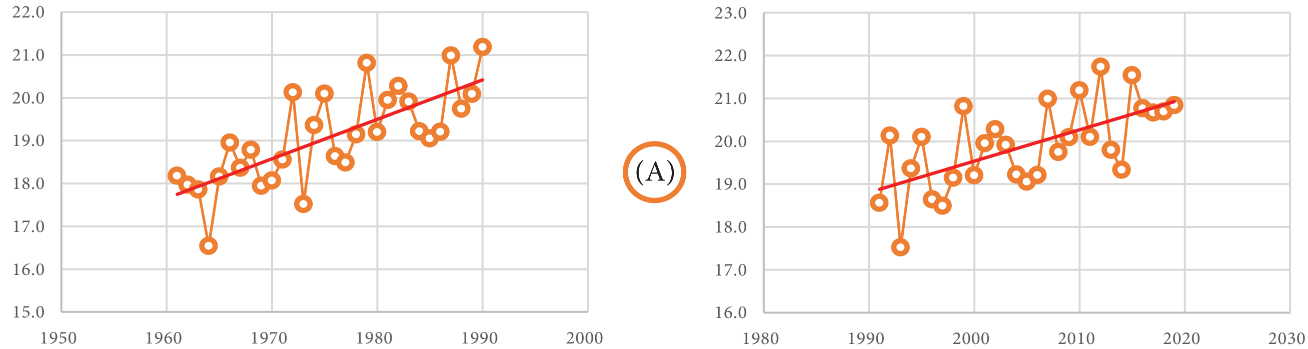


Figure 5-6: Trends in winter min air temperature for two time periods - left 1961-1990, and right 1991-2019: (A) Briceni – Northern AEZ, (B) Chisinau – Central AEZ, (C) Cahul – Southern AEZ.



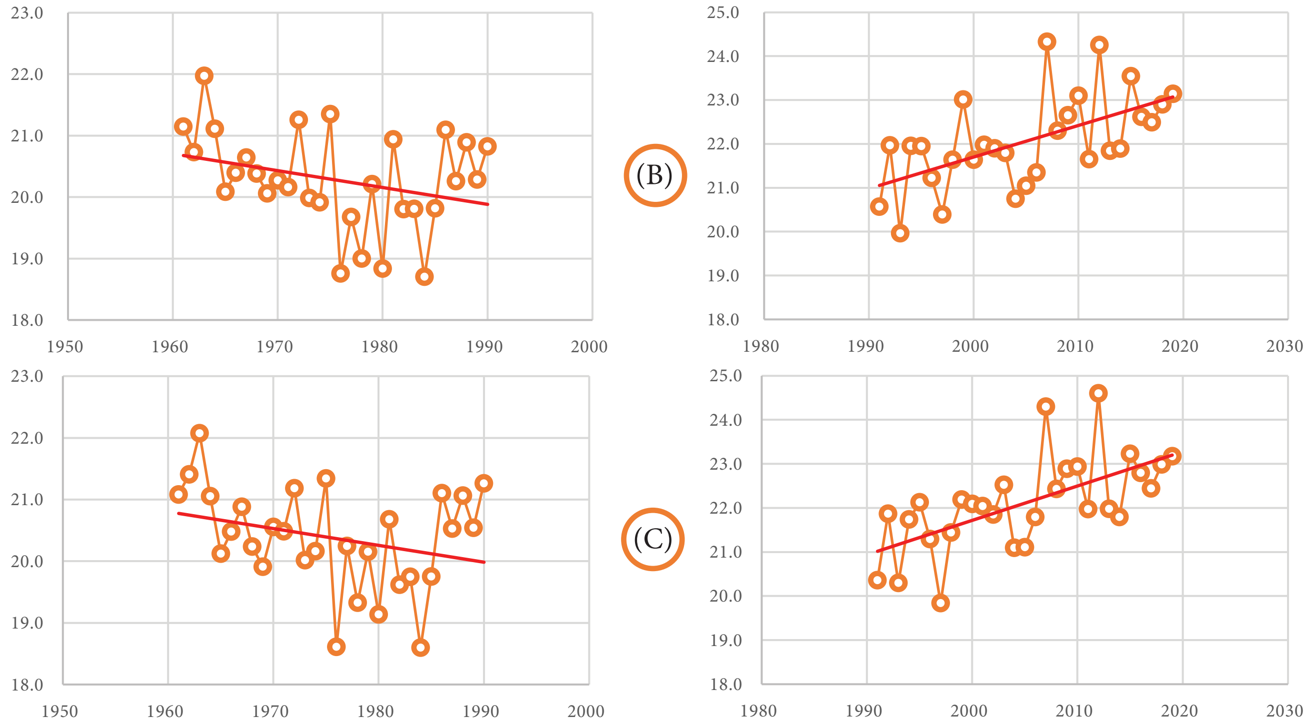


Figure 5-7: Trends in summer mean air temperature for two time periods - left 1961-1990, and right 1991-2019: (A) Briceni – Northern AEZ, (B) Chisinau – Central AEZ, (C) Cahul – Southern AEZ.

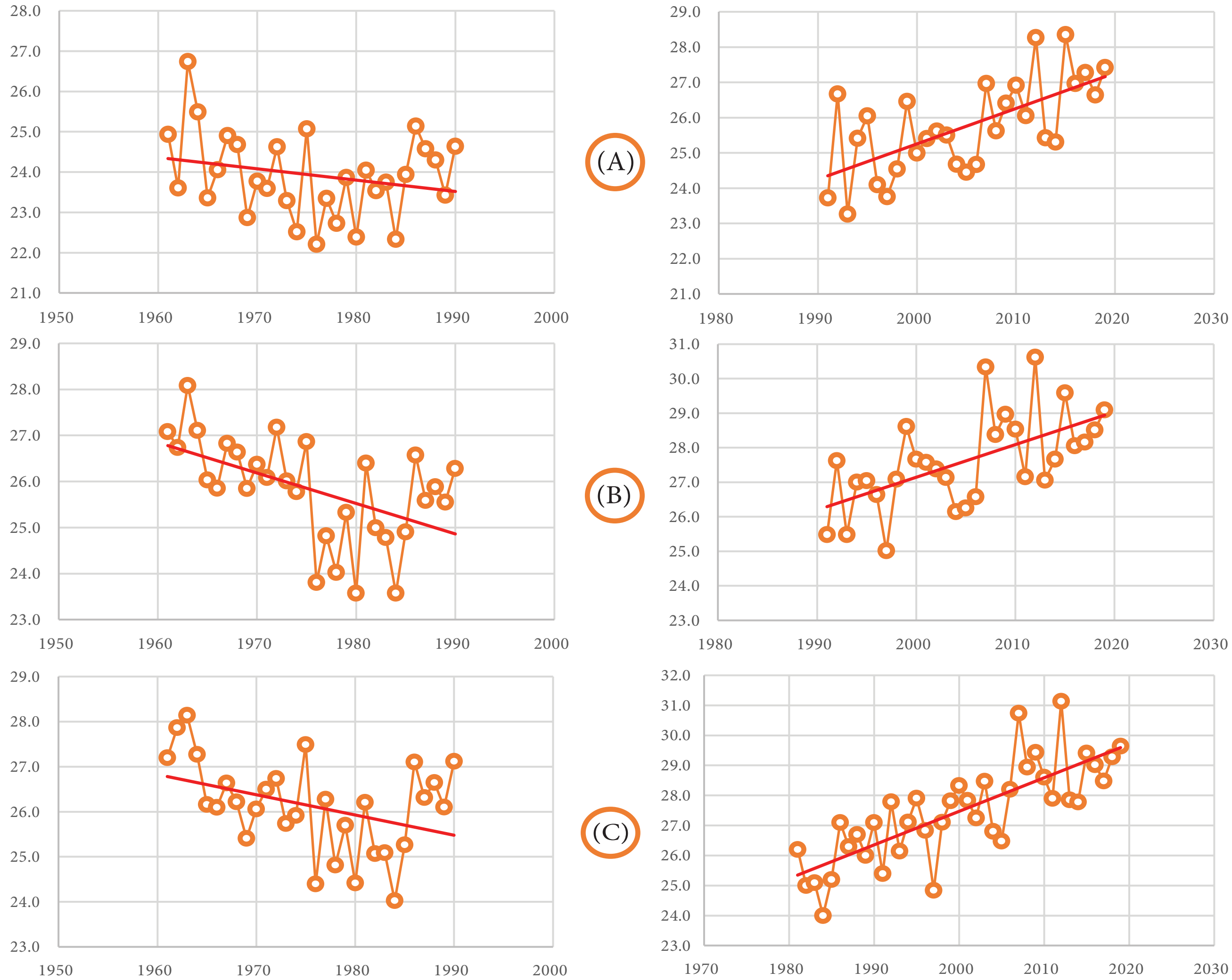


Figure 5-8: Trends in summer max air temperature for two time periods - left 1961-1990, and right 1991-2019: (A) Briceni – Northern AEZ, (B) Chisinau – Central AEZ, (C) Cahul – Southern AEZ.

Table 5-2: Comparison of the seasonal max, mean, and min air temperature (⁰C/10 year), linear trends, statistical significance of change (p-value) for two time periods 1961-1990 and 1991-2019

Season	Time period	AEZ	Temperature, (⁰C/10 year)					
			T max		T avg		T min	
			Trend	p-value	Trend	p-value	Trend	p-value
Winter	1961-1990	Northern	0.26	0.5511	0.80	0.0765	0.8	0.1137
		Central	0.36	0.3843	0.40	0.3438	0.42	0.3396
		Southern	0.46	0.2347	0.39	0.2930	0.34	0.3638
	1991-2019	Northern	0.45	0.2583	0.43	0.2607	0.49	0.2126
		Central	0.35	0.3515	0.34	0.307	0.38	0.2332
		Southern	0.69	0.0636	0.66	0.0404	0.68	0.0032
Spring	1961-1990	Northern	0.29	0.4692	0.22	0.4938	0.25	0.3671
		Central	-0.34	0.4108	-0.10	0.7696	0.14	0.5715
		Southern	-0.26	0.5232	-0.15	0.6178	-0.10	0.6883
	1991-2019	Northern	1.10	0.0000	0.87	0.0000	0.58	0.0009
		Central	0.98	0.0004	0.74	0.0002	0.52	0.0001
		Southern	1.28	0.0000	1.03	0.0000	0.80	0.0000
Summer	1961-1990	Northern	-0.28	0.2069	0.92	0.0000	-0.06	0.7053
		Central	-0.66	0.0034	-0.27	0.1042	0.20	0.1193
		Southern	-0.45	0.0345	-0.27	0.1167	-0.10	0.4509
	1991-2019	Northern	1.30	0.0000	0.73	0.0002	0.48	0.0036
		Central	0.95	0.0007	0.72	0.0009	0.44	0.0117
		Southern	1.10	0.0000	0.78	0.0003	0.49	0.0039
Autumn	1961-1990	Northern	-0.57	0.0391	-0.46	0.0338	-0.40	0.0691
		Central	-0.97	0.0012	-0.45	0.0336	-0.11	0.5614
		Southern	-0.9	0.0016	-0.55	0.0108	-0.39	0.0615
	1991-2019	Northern	1.10	0.0000	0.84	0.0002	0.58	0.0084
		Central	0.92	0.0003	0.80	0.0005	0.68	0.0036
		Southern	1.16	0.0000	1.03	0.0000	0.86	0.0002
Annual	1961-1990	Northern	0.06	0.7714	0.06	0.7293	0.15	0.4023
		Central	-0.40	0.0731	-0.11	0.5674	-0.40	0.0731
		Southern	-0.29	0.1652	-0.15	0.3759	-0.07	0.6650
	1991-2019	Northern	0.92	0.0000	0.72	0.0000	0.53	0.0001
		Central	0.80	0.0000	0.65	0.0000	0.51	0.0002
		Southern	1.06	0.0000	0.88	0.0000	0.86	0.0000

Note: p - statistical significance of the trend.

In 1961-1990, both the increase (positive slope) and decrease (negative slope) of max, min, mean annual, winter and spring temperatures were small in their absolute values and mostly statistically insignificant.

The statistical significance of the trend is shown by their p-values. Trends, where *p<0.10*, underlined in the table by shading should be considered as valid with 90 *per cent* confidence level. In many cases, the statistical significance is significantly higher *p<0.05 (95 per cent confidence level)*, and even *p<0.001 (99 per cent confidence level)*. The climate change may be considered real if the parameters of the trends are statistically significant.

As can be seen from Table 5-2 and Figure 5-4 that before the 90's years of 20th century a slight increase in mean annual temperature by +0.06°C per decade statistically not significant is observed only in Northern AEZ, while a slight decreasing trend by -0.11-0.15°C per decade, statistically significant in Central AEZ is followed by sharp increasing trend in the last three decades (1991-2019) from +0.72°C per decade (Northern AEZ) to +0.88°C per decade (Southern AEZ), and annual T max increase from +0.8°C per decade (Central), +0.9°C per decade (Northern AEZ) to +1.06 °C per decade (Southern AEZ) with a very high degree of certainty.

Climate is getting warmer to a lesser degree during the winter months, by +0.4-0.6°C per decade and this growth is statistically significant in case of T avg for Northern AEZ in 1961-1990, and T max, T avg, and T min only for Southern AEZ in 1990-2019 time periods, Figure 5-5, 5-6, Table 5-2.

The greatest annual temperature rise in 1991-2019 time period is registered due to T max, the largest increase T max by +1.06°C per decade is observed in Southern AEZ against +0.92°C per decade in Northern AEZ, comparative to T min increase from +0.53 °C per decade (Northern AEZ) to +0.86 °C per decade (Southern AEZ), Figure 5-8, Table 5-2.

In the transitional seasons, during the 1981-2019 time period the greatest statistically significant increase in temperature is observed for T max in the spring from +1.1°C (Northern AEZ) to +1.3°C (Southern AEZ) over the decade, and the lowest over autumn from +0.9°C (Central AEZ) to +1.2°C (Southern AEZ) per decade, while T min shows an autumn growth trend from +0.6°C (Northern AEZ) to +0.9°C (Southern AEZ) per decade, as compared to +0.6°C (Northern AEZ), and +0.8°C (Southern AEZ) per decade in spring.

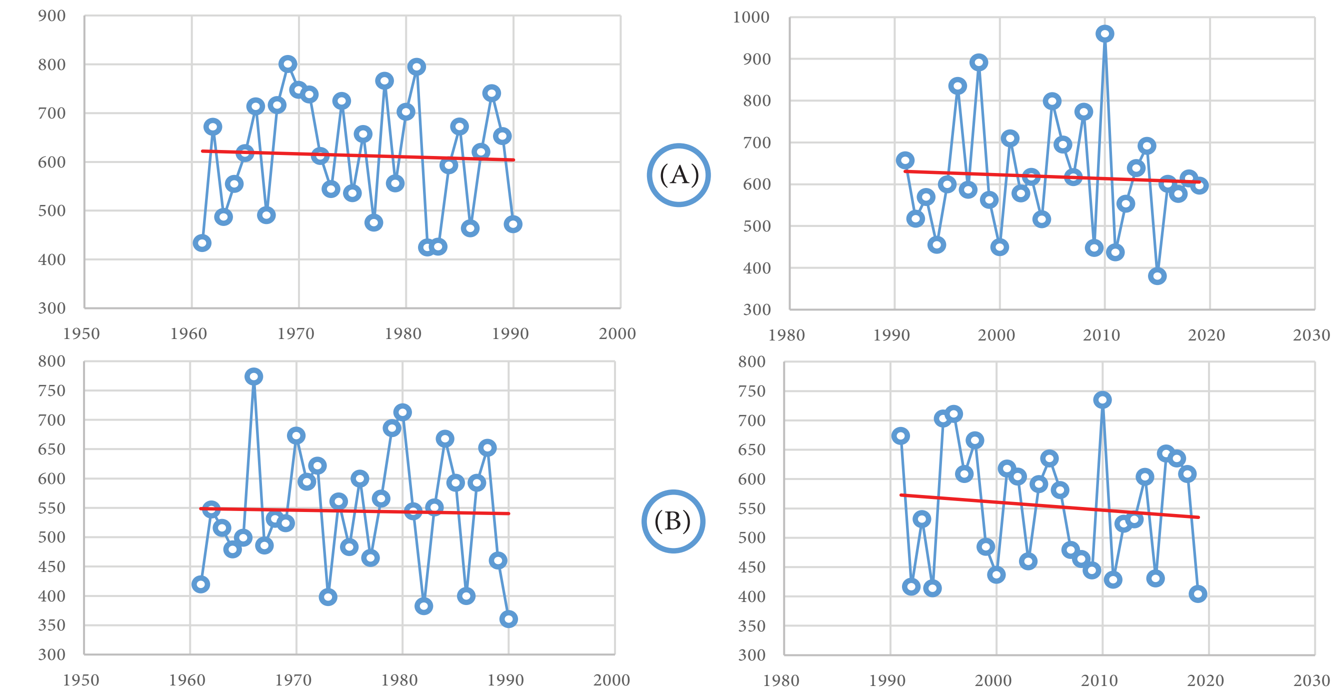
The air temperature rises on the territory of the RM over the years 1991-2019 bears no doubt and it is most clearly seen during the warm season, especially in summer, when the mean temperature T avg rises by 0.7-0.8°C, and T max increase from +1.0°C per decade (Central, Southern AEZs) to +1.3°C per decade (Northern AEZ) with a very high degree of certainty, comparative to observed decreasing mean temperature trend statistical not significant by -0.3°C per decade (Central, Southern AEZs) and statistical significant T max decreasing trend by -0.5 -0.7°C, respectively in 1961-1990, Figure 5-7, 5-8, Table 5-2.

Unlike temperature, statistically significant changes in precipitation are not observed, so it can be noted just a tendency to increase or decrease in precipitation in 1961-1990 and 1991-2019 time periods. The slight upward trend in mean annual precipitation from -9.2 mm (Northern AEZ) to -13.5 mm (Central AEZ) per decade is observed, while for winter precipitation the trend is towards a slight growth from +2.6 mm (Northern AEZ) to 11.5 mm (Southern AEZ) per decade, comparative to decreasing statistically not significant annual precipitation trend from -6.2 mm (Northern AEZ) to -24.5 mm (Southern AEZ), and -9.0-16.3 mm per decade, respectively in winter during the 1961-1990 time period. Moreover, a trend towards decrease of precipitation from 6.0 mm (Northern AEZ) to 19.2 mm (Southern AEZ) per decade during summer is observed in 1991-2019, comparative with the slight upward trend from 10.6 mm (Northern AEZ) to 12.7 mm (Southern AEZ) per decade in the 1961-1990 time period, Figure 5-9, Table 5-3.

Table 5-3: Comparison of seasonal precipitation linear trends, (mm/10 year) and their statistical significance of change (p-value) for two time periods 1961-1990 and 1991-2019

Season	Time period	AEZ	Precipitation, (mm/10 year)	
			Trend	*p-value*
Winter	1961-1990	Northern	-9.04	*0.3668*
		Central	-16.27	0.1579
		Southern	-16.27	0.1735
	1991-2019	Northern	2.65	0.7711
		Central	11.73	0.2785
		Southern	11.49	0.2169
Spring	1961-1990	Northern	-9.04	0.2785
		Central	-0.43	0.9688
		Southern	-1.20	0.9226
	1991-2019	Northern	8.74	0.4534
		Central	-0.84	0.9343
		Southern	-4.76	0.6864
Summer	1961-1990	Northern	12.30	0.3887
		Central	10.58	0.4241
		Southern	-2.17	0.8904
	1991-2019	Northern	-5.97	0.7733
		Central	-10.72	0.4716
		Southern	-19.16	0.3112
Autumn	1961-1990	Northern	-0.41	0.9723
		Central	3.27	0.8034
		Southern	-4.51	0.7521
	1991-2019	Northern	-14.44	0.3185
		Central	-13.67	0.3951
		Southern	10.96	0.4938
Annual	1961-1990	Northern	-6.19	0.8092
		Central	-2.84	0.8986
		Southern	-24.47	0.2859
	1991-2019	Northern	-9.02	0.7727
		Central	-13.50	0.5609
		Southern	-1.47	0.9602

Note: p - statistical significance of the trend.



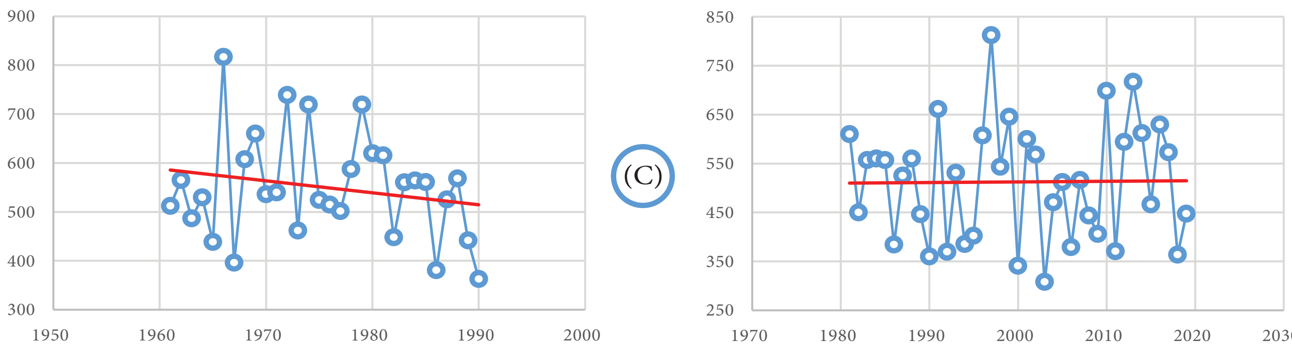


Figure 5-9: Trends in annual total precipitation for two time periods - left 1961-1990, and right 1991-2019: (A) Briceni – Northern AEZ, (B) Chisinau – Central AEZ, (C) Cahul – Southern AEZ.

5.1.2. Summary of Observed Trends in Extremes Indices

The climate change indices defined by the Expert Team on Climate Change Detection and Indices (ETCCDI), simply referred hereafter to as indices, have been widely used for analyzing global changes in extremes in observational records (e.g., Alexander et al., 2006; and in RM by Taranu, 2014; Taranu et al., 2018) as well as in future climate projections (e.g., Tebaldi et al., 2006; Sillmann and Roeckner, 2008; Orlowsky and Seneviratne, 2012; van der Linden, et al., 2015, and in RM by Taranu, 2014; Taranu et al., 2018).

5.1.2.1. Climate Extremes Indices Definition

The indices are defined and described in detail in Klein Tank et al. (2009) and Zhang et al. (2011). The indices fall roughly into four categories:

1) absolute indices, which describe, for instance, the hottest or coldest day of a year, or the annual maximum 1 day or 5-day precipitation rates;
2) threshold indices, which count the number of days when a fixed temperature or precipitation threshold is exceeded, for instance, frost days or tropical nights;
3) duration indices, which describe the length of wet and dry spells, or warm and cold spells; and
4) percentile-based threshold indices, which describe the exceedance rates above or below a threshold which is defined as the 10th or 90th percentile derived from the 1961–1990 base period. The latter are referred to as percentile indices in the following.

The list of extreme temperature and precipitation indices have been used in the study is summarized in Table 5-4.

Table 5-4: The definitions of temperature and precipitation extreme indices have been used in the assessment

Label	Index Name	Index Definition	Units
TN10p	Cold nights	Let TN_{ij} be the daily minimum temperature on day *i* in period *j* and let $TN_{in}10$ be the calendar day 10th percentile centred on a 5-day window. The percentage of days in a year is determined where $TN_{ij} < TN_{in}10$	%
TX10p	Cold days	Let TX_{ij} be the daily maximum temperature on day *i* in period *j* and let $TX_{in}10$ be the calendar day 10th percentile centred on a 5-day window. The percentage of days is determined where $TX_{ij} < TX_{in}10$	%
TN90p	Warm nights	Let TN_{ij} be the daily minimum temperature on day *i* in period *j* and let $TN_{in}90$ be the calendar day 90th percentile centred on a 5-day window. The percentage of days is determined where $TN_{ij} > TN_{in}90$	%
TX90p	Warm days	Let TX_{ij} be the daily maximum temperature on day *i* in period *j* and let $TX_{in}90$ be the calendar day 90th percentile centred on a 5-day window. The percentage of days is determined where $TX_{ij} > TX_{in}90$	%
WSDI	Warm spell duration	Let TX_{ij} be the daily maximum temperature on day *i* in period *j* and let $TX_{in}90$ be the calendar day 90th percentile centered on a 5-day window for the base period 1961–1990. Then the number of days per period is summed where, in intervals of at least 6 consecutive days: $TX_{ij} > TX_{in}90$	Days
CSDI	Cold spell duration	Let TN_{ij} be the daily minimum temperature on day *i* in period *j* and let $TN_{in}10$ be the calendar day 10th percentile centered on a 5-day window for the base period 1961–1990. Then the number of days per period is summed where, in intervals of at least 6 consecutive days: $TN_{ij} < TN_{in}10$	Days
TX_X	Max TX	Let TX_x be the daily maximum temperatures in month *k*, period *j*. The maximum daily maximum temperature each month is then: $TX_{xkj} = \max(TX_{xkj})$	C
TX_N	Min TX	Let TX_n be the daily maximum temperature in month *k*, period *j*. The minimum daily maximum temperature each month is then: $TX_{nkj} = \min(TX_{nkj})$	C
TN_X	Max TN	Let TN_x be the daily minimum temperatures in month *k*, period *j*. The maximum daily minimum temperature each month is then: $TN_{xkj} = \max(TN_{xkj})$	C
TN_N	Min TN	Let TN_n be the daily minimum temperature in month *k*, period *j*. The minimum daily minimum temperature each month is then: $TN_{nkj} = \min(TN_{nkj})$	C
FD	Frost days	Let TN be the daily minimum temperature on day *i* in period *j*. Count the number of days where $TN_{ij} < 0°C$	Days
ID	Ice days	Let TX be the daily maximum temperature on day *i* in period *j*. Count the number of days where $TX_{ij} < 0°C$	Days
SU	Summer days	Let TX be the daily maximum temperature on day *i* in period *j*. Count the number of days where $TX_{ij} > 25°C$	Days
TR	Tropical nights	Let TN be the daily minimum temperature on day *i* in period *j*. Count the number of days where $TN_{ij} > 20°C$	Days
GSL	Growing season length	Let T be the mean temperature ((TN+TX)/2) on day *i* in period *j*. Count the number of days between the first occurrence of at least 6 consecutive days with T > 5°C and the first occurrence after 1st July (NH) or 1st January (SH) of at least 6 consecutive days with $T_{ij} < 5°C$	Days
DTR	Diurnal temperature range	Let TN and TX be the daily minimum and maximum temperature respectively on day *I* in period *j*. If *I* represent the number of days in *j*, then: $DTRj=\Sigma^{I}_{n=1}(TXij - TNij)/I$	C

Label	Index Name	Index Definition	Units
RX1DAY	Max 1-day precipitation	Let PR_{ij} be the daily precipitation amount on day *i* in period *j*. The maximum 1 day value for period *j* is: $RX1day_j$ = max (PR_{ij})	mm
RX3DAY	Max 3-day precipitation	Monthly maximum 3-day precipitation. Let RRij be the daily precipitation amount on day *i* in period *j*. The maximum 3-day value for period *j* is $RX3day_j$ = max (PR_{ij}).	mm
RX5DAY	Max 5-day precipitation	Let PR_{kj} be the precipitation amount for the 5-day interval ending *k*, period *j*. Then maximum 5-day values for period *j* are: $RX5day_j$ = max (PR_{kj})	mm
SDII	Simple daily intensity	Let PR_{wj} be the daily precipitation amount on wet days, PR >= 1mm in period *j*. If *W* represents number of wet days in *j*, then: $SDIIj = (\Sigma^{W}_{w=1} PRw)/ W$	mm
R10MM	Heavy precipitation days	Let PR_{ij} be the daily precipitation amount on day *i* in period *j*. Count the number of days where PR_{ij} > 10mm	Days
R20MM	Very heavy precipitation days	Let PR_{ij} be the daily precipitation amount on day *i* in period *j*. Count the number of days where PR_{ij} > 20mm	Days
CDD	Consecutive dry days	Let PR_{ij} be the daily precipitation amount on day *i* in period *j*. Count the largest number of consecutive days where PR_{ij} < 1mm	Days
CWD	Consecutive wet days	Let PR_{ij} be the daily precipitation amount on day *i* in period *j*. Count the largest number of consecutive days where PR_{ij} > 1mm	Days
R95P	Very wet days	Let PR_{wj} be the daily precipitation amount on a wet day *w* (PR >= 1mm) in period *i* and let $PR_{wn}95$ be the 95th percentile of precipitation on wet days in the 1961–1990 period. If *W* represents the number of wet days in the period, then: $R95p_j$ = $\Sigma^{W}_{w=1} PRwj$, where PR_{wj} > $PR_{wn}95$	mm
R99P	Extremely wet days	Let PR_{wj} be the daily precipitation amount on a wet day *w* (PR >= 1mm) in period *i* and let $PR_{wn}99$ be the 95th percentile of precipitation on wet days in the 1961–1990 period. If *W* represents the number of wet days in the period, then: $R99p_j$ = $\Sigma^{W}_{w=1} PRw$, where PR_{wj} > $PR_{wn}99$	mm
R95pTOT%	Contribution from very wet days	100 * R95pTOT/PRCPTOT. Let PR_{wj} be the daily precipitation amount on a wet day (PR ≥ 1 mm) in period *j* and let $RR_{wn}95$ be the 95th percentile of precipitation on wet days in the base period *n* (1961- 1990). Then $R95pTOT_j$ = sum (PRw_j), where PR_{wj} > $PR_{wn}95$.	%
R99pTOT%	Contribution from extremely wet days	100 * R99pTOT / PRCPTOT. Let PR_{wj} be the daily precipitation amount on a wet day (PR ≥ 1 mm) in period *j* and let $RR_{wn}99$ be the 99th percentile of precipitation on wet days in the base period *n* (1961-1990). Then $R99pTOT_j$ = sum (PR_{wj}), where PR_{wj} > $PR_{wn}99$.	%
PRCPTOT	Total wet-day precipitation	Let PR_{ij} be the daily precipitation amount on day *i* in period *j*. If I represent the number of days in *j*, then: $PRCPTOTj = \Sigma^{I}_{n=1} PRij$	mm

5.1.2.2. Observed Trends in Temperature Extremes Indices

The analyses of data presented in Table 5-5 show that during the 1961-1990 the annual maximum daily minimum (TNx) have had the decreased trend by -0.3°C / 10 years in Northern AEZ, and increased trend by +0.1-0.2°C / 10 years in Central and Southern AEZs, and vice versa the decreasing trend in maximum daily maximum (TXx) was observed in Central (-0.6 °C per decade), and for Southern AEZs -0.4°C per decade, while in Northern AEZ the slight increasing trend by +0.1°C / 10 years. However, the TNx and TXx increasing and decreasing trends in this period are not statistically significant so it can be noted just a tendency to slight decrease or increase in TNx and TXx on the territory of the RoM AEZs.

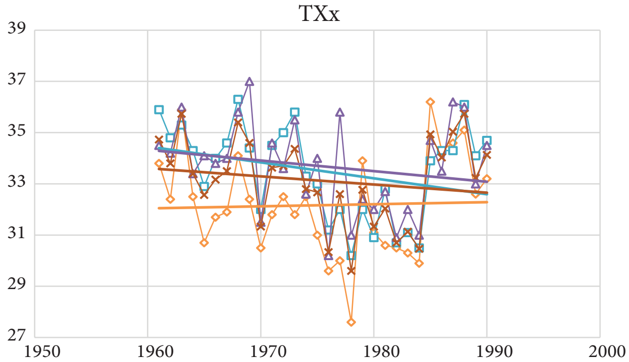
The both (TNx) and (TXx) temperatures have increased during the 1991-2019 over the RoM, all the trends have had a positive sign and varied from +0.5 to +0.8°C / 10 years. However, the CLTS values of TNx and TXx on the entire territory of the RoM AEZs were mostly not statistically significant, with the exception of TNx in Northern AEZ and TXx in Southern AEZ, where R^2 was from 10% to 11%, which shows tendency to gradual increase in the TNx and TXx during the 1991-2019 years in the region, especially for TNx in Northern and TXx in Southern AEZs during the 1991-2019 years, Table 5-5, Figure 5-10.

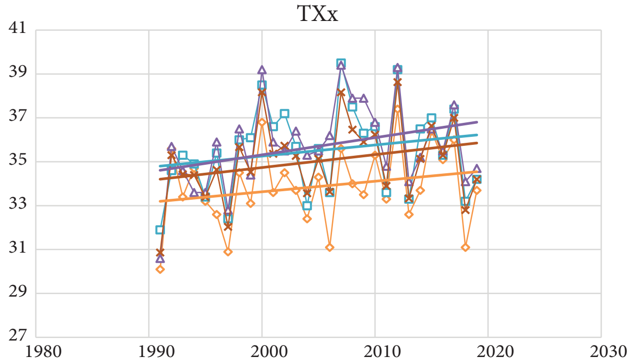
Unlike the TNx and TXx, the statistically significant changes in annual minimum daily minimum (TNn) and maximum daily minimum (TXn) temperatures have observed during the 1961-1990 years. The upward trend in TNn have observed from +2.1 °C per decade in Northern to 1.4°C per decade in Southern AEZs, R^2 was from 11% to 19%, which shows the gradual increase in TNn during the 1961-1990 years in the region, more pronounced in Northern AEZ. The statistically increasing trend in TXn have been observed in Southern (+1.4°C per decade), and Northern (+1.2°C per decade) AEZs, R^2 was from 10% to 14%, which shows the gradual increase in TXn during the 1961-1990 years in these AEZs, while in Central AEZ the increasing trend by +0.9°C per decade was not statistically significant. The upward trend in TNn and TXn is continued during the 1991-2019 years, but the CLTS values of TNn and TXn on the entire territory of the RoM AEZs were not statistically significant and their values were much lower than in 1961-1990, especially for TXn, Table 5-5; Figure 5-10.

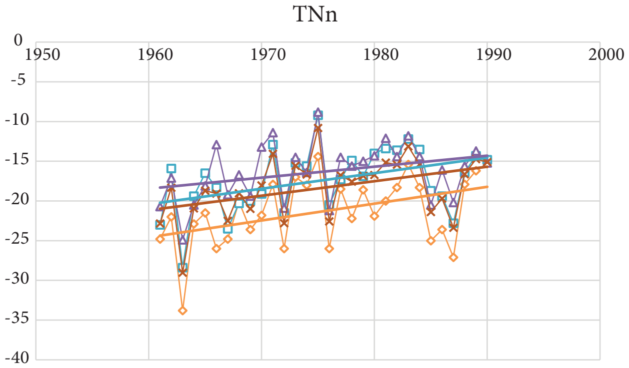
The negative trend statistically significant of diurnal temperature range (DTR) have been observed in Central (-0.6°C per decade) and Southern AEZs (-0.2°C per decade), R^2 was from 16% to 50%, during the 1961-1990 that indicates that daily minimum temperature increases with higher magnitude than daily maximum temperature. Controversially, in 1991-2019 the statistically significant increasing trend in DTR by +0.3-0.4°C per decade have been observed on the entire territory of the RoM AEZs, R^2 was from 34% to 39%, that indicates that daily maximum temperature increases with higher magnitude than daily minimum temperature, Table 5-5; Figure 5-10.

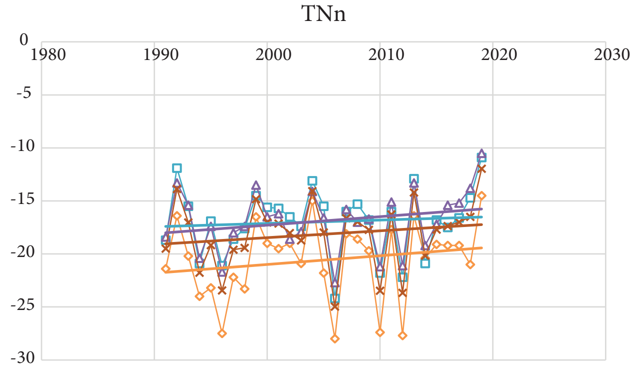
Table 5-5: The Minimum daily minimum temperature (TNn), Maximum daily maximum temperature (TXx), Maximum daily minimum temperature (TNx), Minimum daily maximum temperature (TXn), and Diurnal temperature range (DTR), °C, Trend Slope (°C / 10 Years), Coefficient of Determination, R^2 and Statistical Significance of Changes, p -value, for Two Time Periods: 1961-1990, and 1991-2019

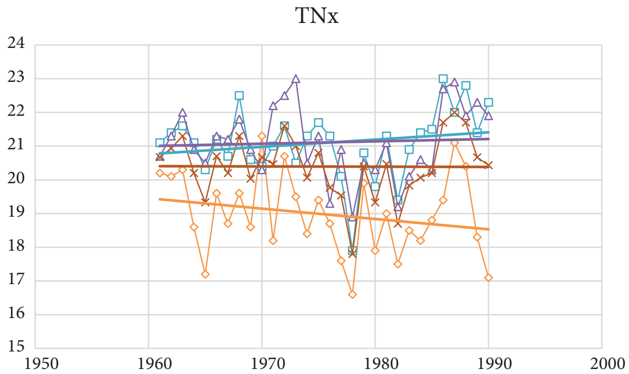
Extreme Indices	Northern AEZ				Central AEZ				Southern AEZ			
	Mean	*Trend*	*R^2*	*p*	*Mean*	*Trend*	*R^2*	*p*	*Mean*	*Trend*	*R^2*	*p*
						1961-1990						
TNn	-21.3	2.1	19	**0.0171**	-17.4	1.9	18	**0.0198**	-16.3	1.4	11	**0.0678**
TXx	32.2	0.1	0.1	0.8506	33.5	-0.6	9	0.1002	33.7	-0.4	4	0.2814
TNx	19	-0.3	5	0.2324	21.1	0.2	3	0.3244	21.1	0.1	0.3	0.7642
TXn	-11.6	1.2	10	**0.0830**	-10.1	0.9	7	0.1567	-9.4	1.4	14	**0.0389**
DTR	9	-0.1	2	0.4739	8.6	-0.6	50	**0.0000**	8.7	-0.2	16	**0.0264**
						1991-2019						
TNn	-20.6	0.8	4	0.3279	-17	0.3	0.7	0.6585	-16.9	0.8	6	0.2094
TXx	33.9	0.5	5	0.2305	35.5	0.5	5	0.2577	35.7	0.8	11	**0.0736**
TNx	20.4	0.5	10	**0.0923**	22.9	0.5	8	0.1474	22.8	0.1	0.2	0.8312
TXn	-12.4	0.3	0.9	0.6304	-10.9	-0.1	0.1	0.8741	-9.8	0.2	0.3	0.7703
DTR	8.8	0.4	39	**0.0002**	8.5	0.3	34	**0.0005**	9	0.4	37	**0.0005**

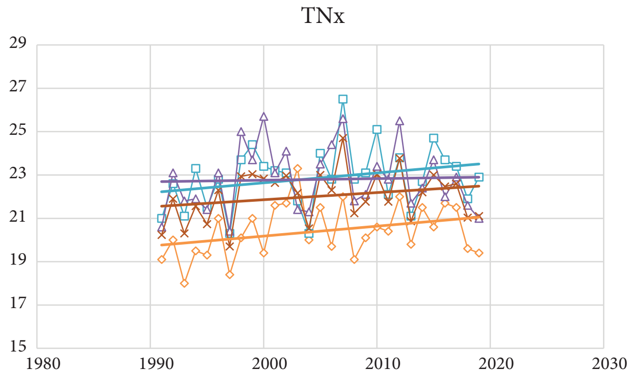












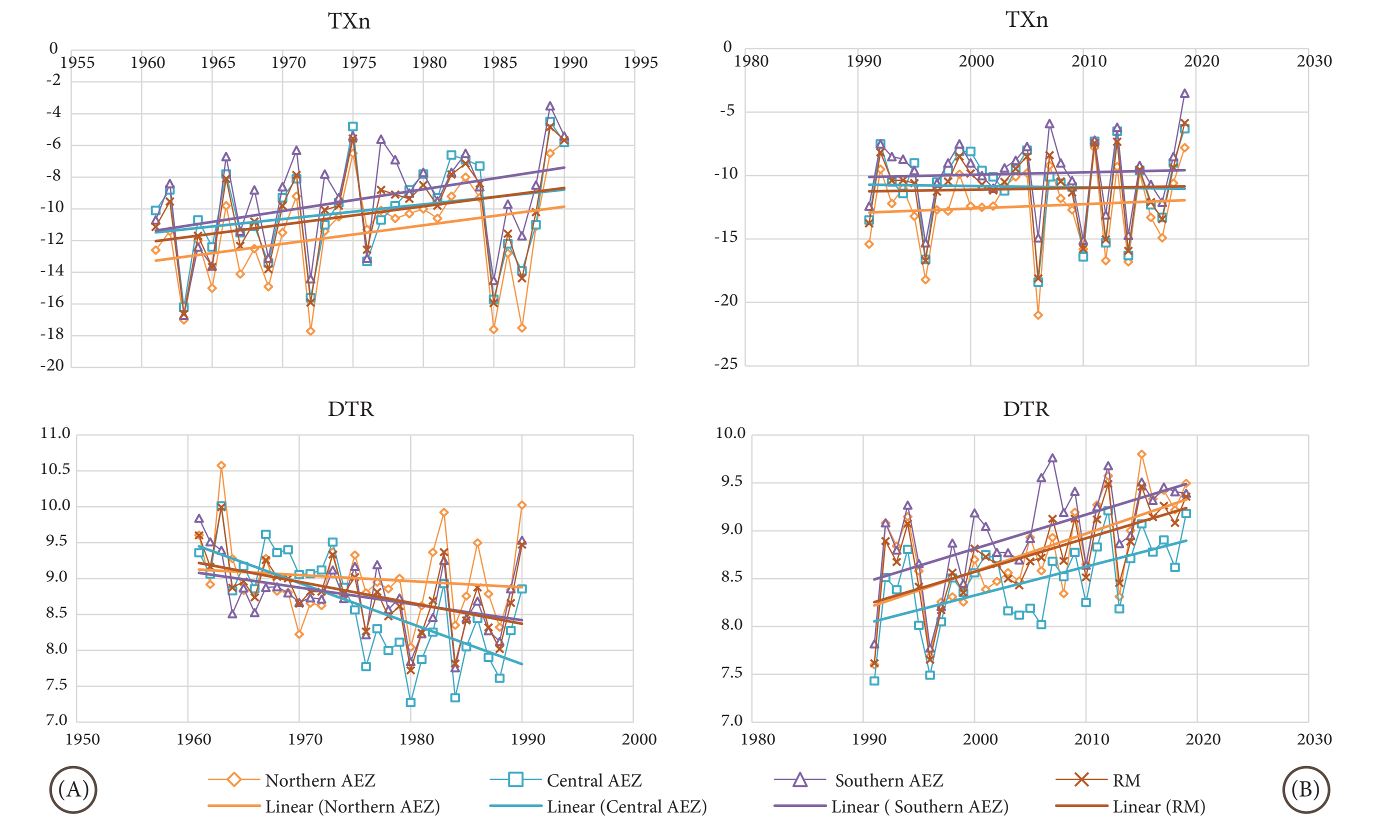


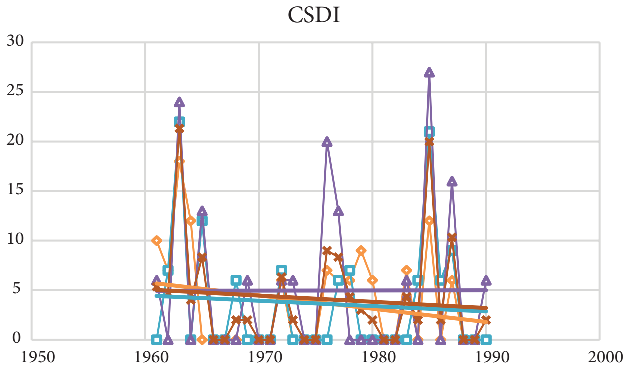
Figure 5-10: Trends in Maximum daily maximum temperature (TXx), Minimum daily minimum temperature (TNn), Maximum daily minimum temperature (TNx), Minimum daily maximum temperature (TXn), and Diurnal temperature range (DTR), °C, for two time periods: (A) 1961-1990, and (B) 1991-2019.

Consistent changes are found in the temperature threshold indices; specifically, these indices are frost days (FD) and tropical nights (TR), which are derived from daily minimum temperature, and ice days (ID) and summer days (SU), are derived from daily maximum temperature, Table 5-6; Figure 5-11.

During the 1991-2019, have observed decreases in frost days (FD) and ice days (ID) over the RoM. The CLTS values of the FD on the entire territory of the RoM were statistically significant, had a negative sign and varied from -8.9 (Central AEZ), -9.4 (Northern AEZ) to -13.5 (Southern AEZ) days / 10 years, R^2 was from 31% to 53%, which shows a gradual decrease in the FD in the region, relative to 1961-1990 time period when only the tendency statistical not significant to decrease in FD was observed in Northern and Central AEZs.

Table 5-6: Temperature Extreme Indices, (Days), the Trend Slope (Days / 10 Years), Coefficient of Determination, R^2, and Statistical Significance of Changes, p -value, for Two Time Periods: 1961-1990 and 1991-2019

Extreme Indices	Northern AEZ				Central AEZ				Southern AEZ			
	Mean	*Trend*	*R^2*	*p*	*Mean*	*Trend*	*R^2*	*p*	*Mean*	*Trend*	*R^2*	*p*
1961-1990												
CSDI	4	-1.3	6	0.2006	3.6	-0.5	0.6	0.6770	5.0	-0.02	0.0	0.9927
WSDI	6	0.8	1	0.6171	3.6	-0.5	0.8	0.6440	5.0	-0.6	0.6	0.6837
FD	122	-2.5	2	0.4583	100	-0.4	0.1	0.8947	99.0	1.2	0.5	0.7035
ID	54	-4.7	6	0.2102	39	-0.1	0	0.9790	37.0	-1.1	0.5	0.7093
SU	48	-5	8	0.1299	72	-9.2	21	**0.0113**	76.0	-6.4	15	**0.0348**
TR	0	-0.1	3	0.3760	3.6	1.5	16	**0.0294**	4.0	0.8	4	0.2815
GSL	223	-0.6	0.1	0.8660	239	0.3	0.0	0.9525	245.0	-7.2	5	0.2337
1991-2019												
CSDI	2	-0.7	4	0.3073	3.9	-1.6	6	0.2199	4.4	-2.2	11	**0.0791**
WSDI	19	7.6	20	**0.0149**	17.9	6.6	13	**0.0502**	21.3	9.9	27	**0.0039**
FD	106	-9.4	36	**0.0006**	89	-8.9	31	**0.0018**	87	-13.5	53	**0.0000**
ID	44	-5.9	12	**0.0623**	34	-5.1	11	**0.0851**	31	-7.2	21	**0.0126**
SU	67	14.4	53	**0.0000**	87	13.3	49	**0.0000**	94	15	48	**0.0000**
TR	1	0.5	7	0.1508	14.4	4	16	**0.0343**	11.2	2	5	0.2632
GSL	234	12.5	21	**0.0124**	249	2.9	1	0.5731	255	11.1	16	**0.0298**


CSDI
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25
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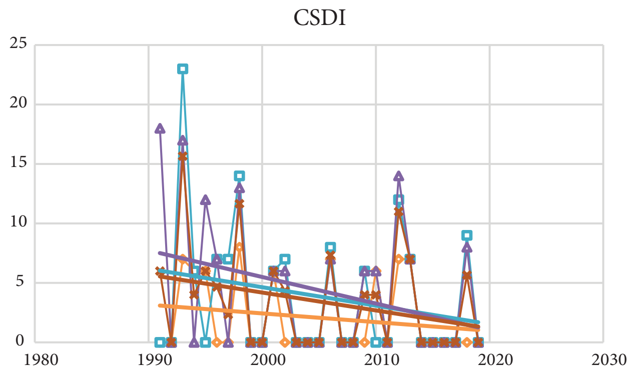
CSDI
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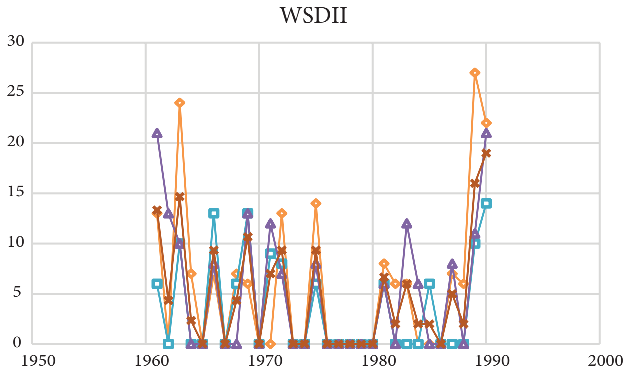
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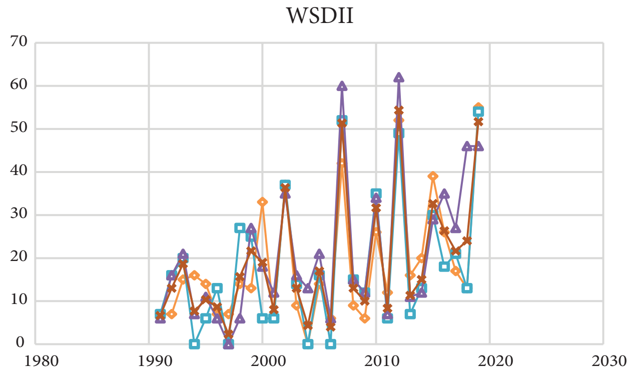
1950 1960 1970 1980 1990 2000


WSDII
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60
50
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10
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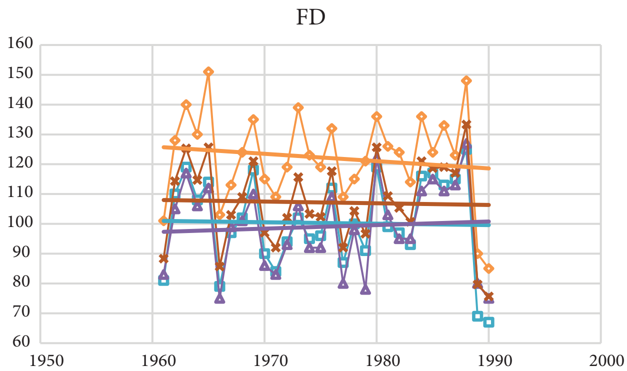
1980 1990 2000 2010 2020 2030


FD
160
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70
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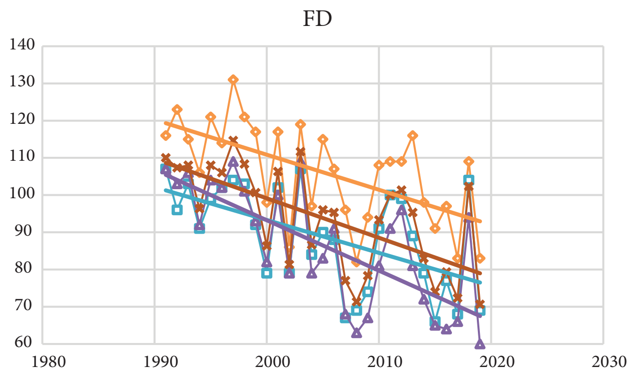
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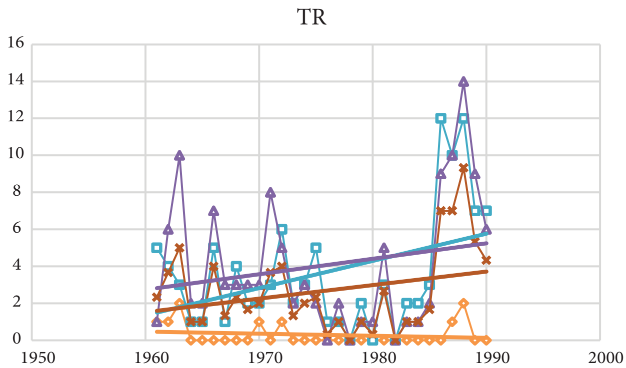
1980 1990 2000 2010 2020 2030


TR
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14
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10
8
6
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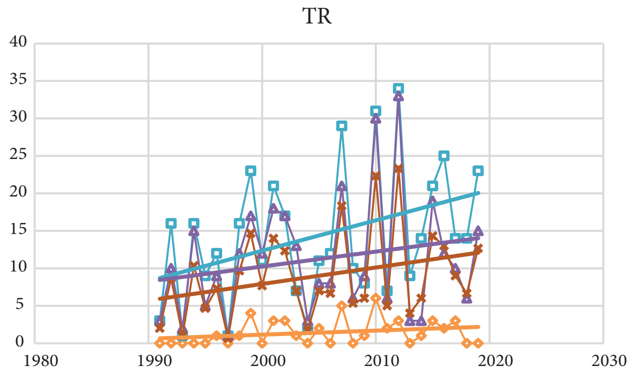
1950 1960 1970 1980 1990 2000


TR
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35
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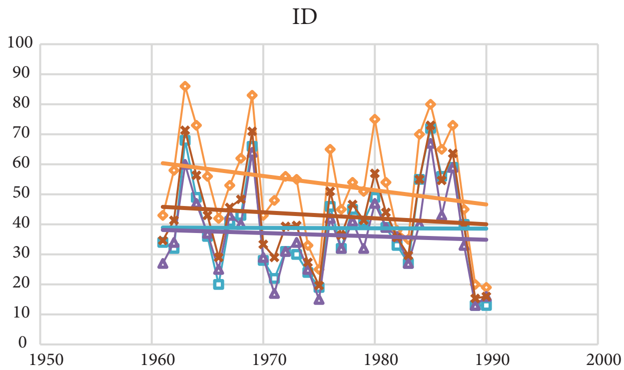
1980 1990 2000 2010 2020 2030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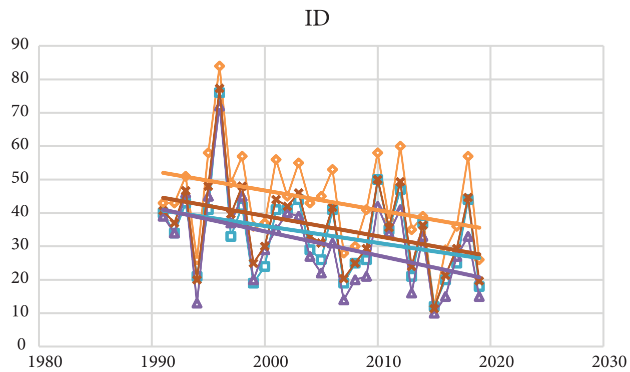
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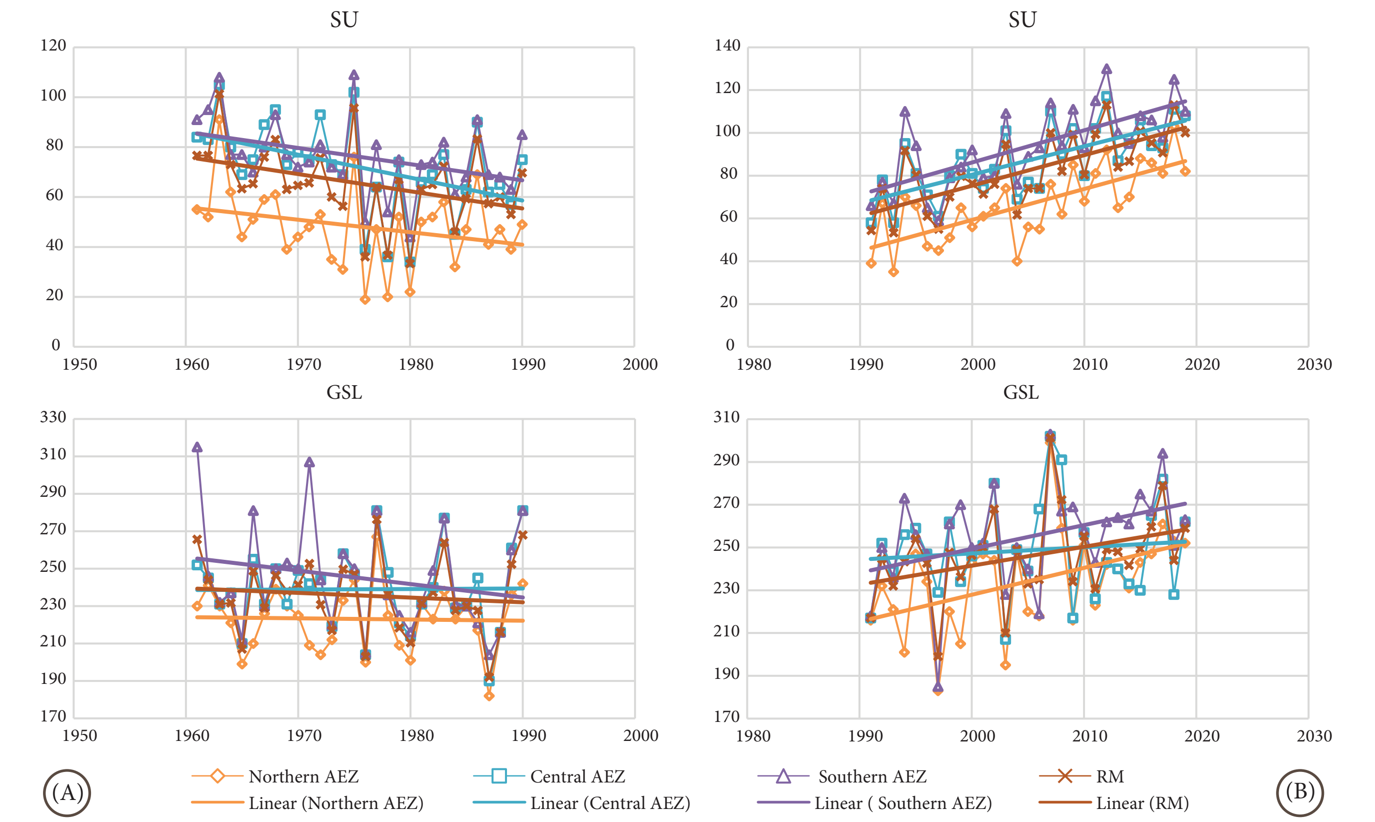


Figure 5-11: Trends in Cold spell duration (CSDI), Warm spell duration (WSDI), Frost days (FD), Tropical nights (TR), Ice days (ID), Summer days (SU), and Growing season length (GSL), Days, for two time periods: (A) 1961-1990, and (B) 1991-2019.

The value of the determination coefficient, R^2, amounting to 11-21% is considerably lower for the ID, with CLTS from -5.1 (Central AEZ), -5.9 (Northern AEZ) to -7.2 (Southern AEZ) days / 10 years, which shows a low degree of probability of changes in Northern and Central AEZs, and high degree of probability of changes in Southern AEZ, comparative to slight decreasing tendency in the 1961-1990 time period, Table 5-6; Figure 5-11.

The increasing statistically significant trend in tropical nights (TR) have been observed only in Southern AEZ from +1.5 (1961-1990) up to +4.0 (1991-2019) days / 10 years. The R^2 was by 16%, which shows a gradual increase in the TR in Southern AEZ. During the 1991-2019, the increasing trend statistically significant in summer days (SU) have been observed on the entire territory of the RoM.

The CLTS values of the SU were statistically significant, had a positive sign and varied from +14.4 (Northern AEZ) to +13.3 (Central AEZ) days / 10 years, with maximum +15.0 (Southern AEZ) days / 10 years, R^2 was from 48 to 53%, which shows a high degree of probability of changes in SU on the entire territory of the RoM AEZs, comparative to decreasing statistically significant trend from -9.2 (Central AEZ) to -6.5 (Southern AEZ) days / 10 years, R^2 was from 15% to 21%, which shows a high degree of probability of decrease in SU in these AEZs during 1961-1990 time period. The tendency to decrease in SU (-5.0 days per decade) was observed also in Northern AEZ, Table 5-6; Figure 5-11.

In both studied time periods, there were no statistically significant changes in cold spell duration index (CSDI) with the exception of decreasing trend in Southern AEZ (-2.2 days / 10 years, R^2 was 11%, during the 1991-2019 time period. Unlike the CSDI, statistically significant changes in warm spell duration index (WSDI) have observed in 1991-2019 time period. The *CLTS* values of the WSDI were statistically significant, have had a positive sign and varied from +7.6 (Northern AEZ) to +6.6 (Central AEZ) days / 10 years, with maximum +9.9 (Southern AEZ) days / 10 years, R^2 was from 13 to 27%, which shows a high degree of probability of changes in WSDI on the entire territory of the RM AEZs, comparative to statistically not significant decreasing tendency by -0.5-0.6 days / 10 years in Central and Southern AEZs during the 1961-1990 time period, Table 5-6; Figure 5-11.

During the 1991-2019, the increasing trend statistically significant in growing season length (GSL) have been observed. The CLTS values of the GSL, have had a positive sign and varied from +12.5 (Northern AEZ) to +11.1 (Southern AEZ) days / 10 years, R^2 was from 16 to 21%, which shows a high degree of probability of changes in GSL in these AEZs, while in Central AEZ only a tendency to increase in GSL was observed, comparative to statistically not significant decreasing tendency from -0.6 (Northern AEZ) to -7.2 (Southern AEZ) days / 10 years, and increasing tendency by +0.3 days / 10 years (Central AEZ) in the 1961-1990 time period, Table 5-6; Figure 5-11.

Observed changes of cold nights (TN10p) and cold days (TX10p) warn nights (TN90p) and warm days (TX90p) are shown in Figure 5-12. Consisting with warming and observed trends of absolute and threshold temperature indices a decrease in TN10p and TX10p have observed during the 1991-2019 over the RM's AEZs. The CLTS values of the TN10p on the entire territory of the RoM's AEZs were statistically significant, had a negative sign and varied from -1.9 (Northern AEZ) to -2.9 (Southern AEZ) % / 10 years, R^2 was from 41% to 51%, which shows with high degree of probability the gradual decrease in the cold nights in the region.

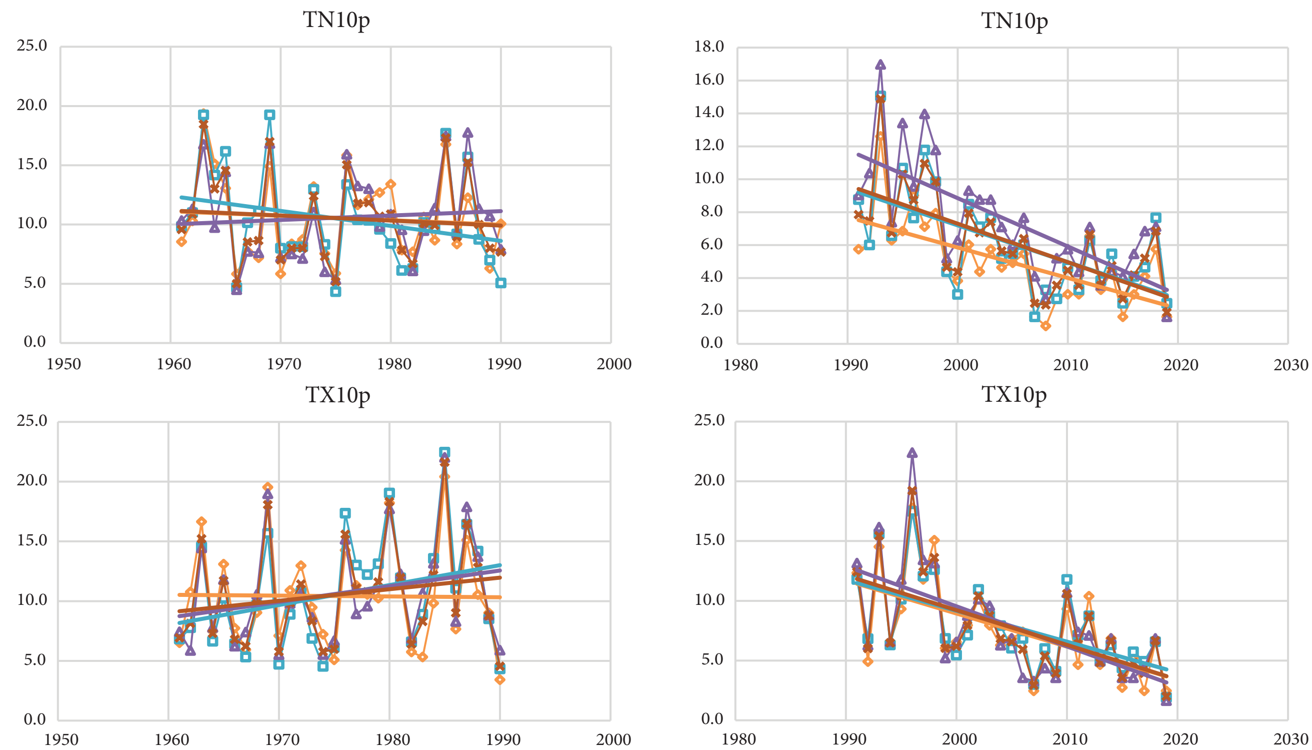
The value of the determination coefficient, R^2, amounting to 37-39% was lower for cold days (TX10p), however the CLTS values of the TX10p were statistically significant, higher, and varied from -2.8 (Northern AEZ) to -3.3 (Southern AEZ) % / 10 years, that shows with high degree of probability the gradual decrease in the cold days on the entire territory of the RoM's AEZs, comparative to statistically significant increasing trend by +1.7 % / 10 years (Central AEZ), with R^2, amounting to 10%, and statistically not significant tendency to increase by +1.3 % / 10 years (Southern AEZ) in the 1961-1990 time period, Table 5-7; Figure 5-12.

The warm nights (TN90p) and warm days (TX90p) have increased substantial during the 1991-2019 over the RoM AEZs. The *CLTS* values of the TN90p on the entire territory of the RoM's AEZs were statistically significant, have had a positive sign and varied from +3.5 (Northern AEZ) to +5.0 (Southern AEZ) % / 10 years, and TX90p from +3.9 (Central AEZ) to +4.9 (Northern AEZ) with maximum +5.9 (Southern AEZ) % / 10 years, R^2 was from 33 to 55% and from 39 to 61%, respectively, which shows with high degree of probability the consistent increase in the TN90p, and TX90p during the 1991-2019 years in the region.

The value of the determination coefficient, R^2, amounting to 39-61% is higher for the warm days (TX90p), with *CLTS* from +3.9 to +5.9 % / 10 years, which shows a greater statistical significance of changes in TX90p on the entire territory of the RoM's AEZs towards warming, comparative to statistically significant decreasing trend in TX90p by -2.2% / 10 years in Central AEZ, with R^2, amounting to 15%, and statistically not significant tendency to decrease by -1.4 % / 10 years (Southern AEZ) during the 1961-1990 time period, Table 5-7; Figure 5-12.

Table 5-7: Temperature-Based Percentile Extreme Indices, (%), the Trend Slope (% / 10 Years), Coefficient of Determination, R,[2] and Statistical Significance of Changes, p -value, for two time periods: 1961-1990, and 1991-2019

Extreme Indices	Northern AEZ				Central AEZ				Southern AEZ			
	Mean	Trend	R^2	p	Mean	Trend	R^2	p	Mean	Trend	R^2	p
						1961-1990						
TN10p	10.5	-0.4	1	0.6207	10.4	-1.3	8	0.1419	10.6	0.4	0.8	0.6429
TX10p	10.4	-0.07		0.9392	10.6	1.7	10	**0.0870**	10.7	1.3	7	0.1552
TN90p	10.4	0.2	0.3	0.7650	10.4	0.5	1	0.5657	10.6	-0.5	1	0.5327
TX90p	10.6	0.5	0.7	0.6550	10.6	-2.2	15	**0.0348**	10.6	-1.4	7	0.1704
						1991-2019						
TN10p	4.9	-1.9	41	**0.0002**	6.1	-2.2	37	**0.0004**	7.4	-2.9	51	**0.0000**
TX10p	7.6	-2.8	37	**0.0005**	7.9	-2.6	37	**0.0005**	7.9	-3.3	39	**0.0003**
TN90p	19.3	3.5	41	**0.0002**	19.8	3.3	33	**0.0011**	17.7	5	55	**0.0000**
TX90p	16.9	4.9	46	**0.0000**	15.9	3.9	39	**0.0003**	17.7	5.9	61	**0.0000**



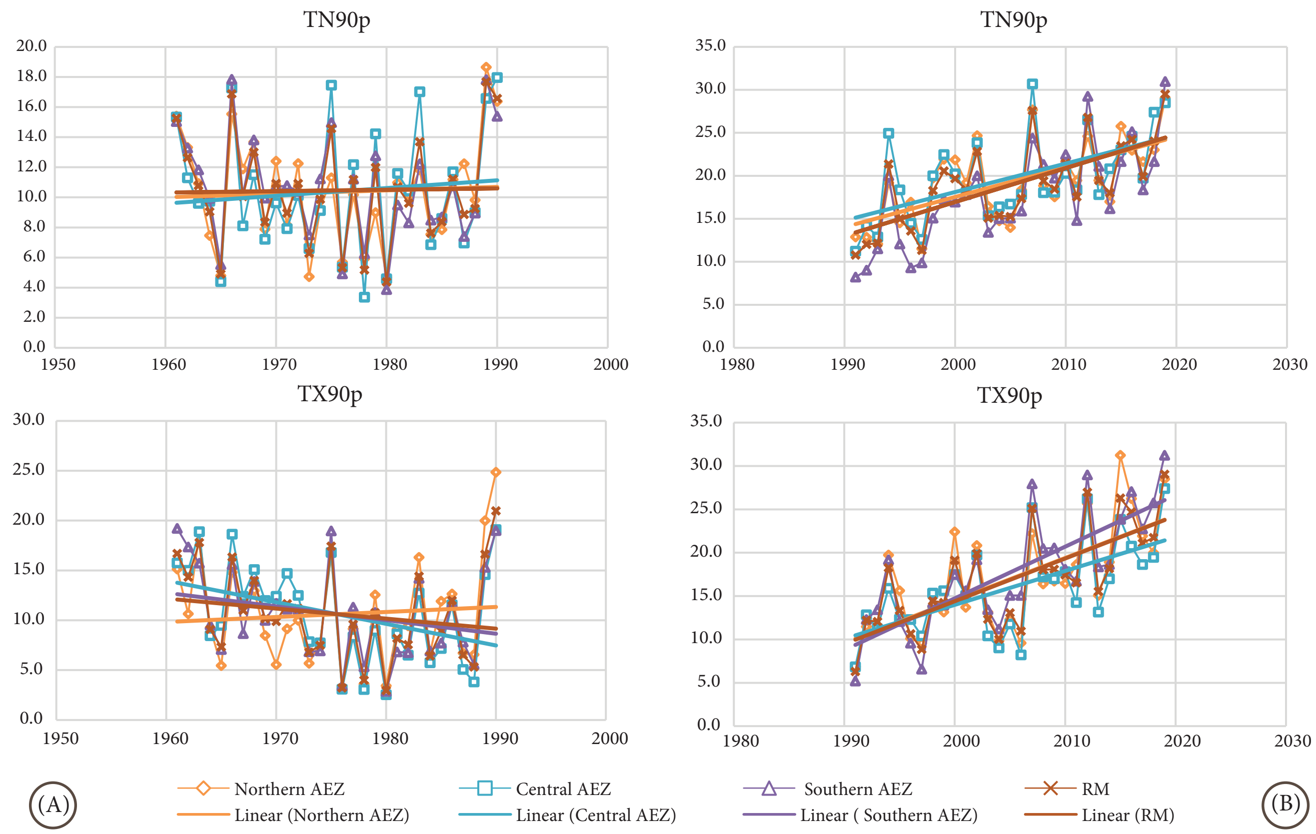


Figure 5-12: Trends in Cold Nights (TN10p), Warm Nights (TN90p), Cold Days (TX10p), and Warm Days (TX90p), %, for two time periods: (A) 1961-1990, and (B) 1991-2019.

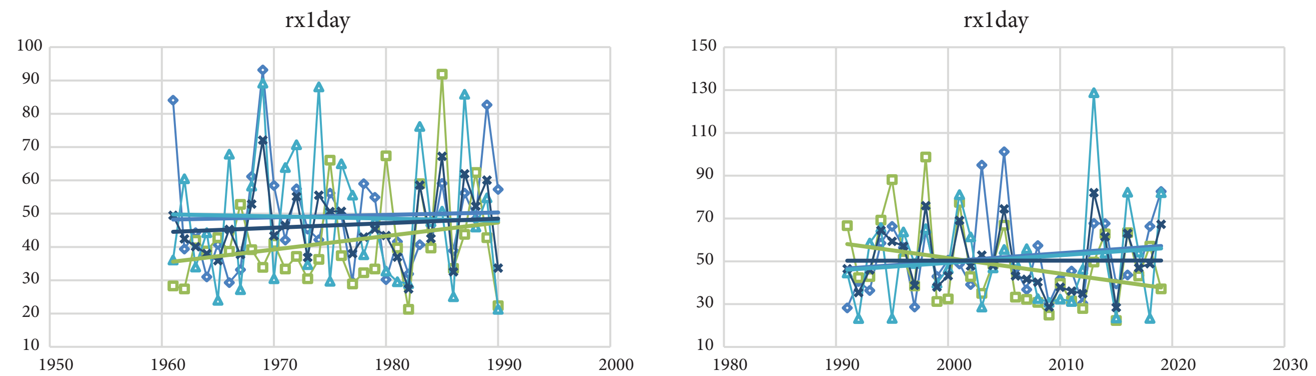
5.1.2.3. Observed Trends in Precipitation Extremes Indices

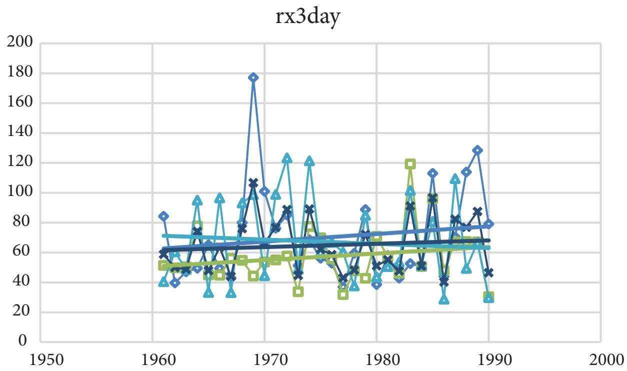
The indices of extreme precipitation values for RoM's AEZs were calculated based on the daily observations data of precipitation for the period from 1961 to 2019, to identify climate change evidences in the RoM's AEZs, and two climatic periods (1961-1990 and 1991-2019) were compared. These time periods reflect, respectively, the relatively "normal" regional climate and climate when intensive global warming was observed.

The patterns of recent changes in precipitation indices appear spatially and temporally more heterogeneous across the RoM's AEZs than the consistent warming pattern seen in the temperature extreme indices. Observational records of most of the precipitation extreme indices do not indicate significant trends in case of estimations across the Republic of Moldova.

Some changes in these variables have been observed across the RoM's AEZs but most of them are not statistically significant due to large natural variability. Most of the precipitation indices show changes toward more intense precipitation over Northern and Central AEZs, while in Southern AEZ there was a tendency to a decrease in rainfall intensity during the 1961-1990 time period. Such changes in extreme precipitation are found, for example, for the max 1-day precipitation (RX1day), max 3-day precipitation (RX3day), max 5-day precipitation (RX5day), and extremely wet days (R99p).

The tendency towards an increase in precipitation intensity is continued in 1991-2019 time in Northern and Southern AEZs, with maximum in R95p, and R99p (Northern AEZ), and in RX1day, and RX5day (Southern AEZ), while in Central AEZ conversely is observed a clear tendency to a decrease in precipitation intensity RX1day, RX3day, RX5day, R95p, and R99p, Figure 5-13, Table 5-8.




rx3day
200
180
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1950
1960
1970
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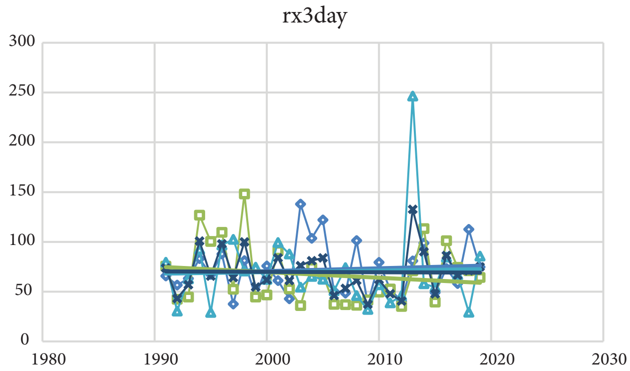
rx3day
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100
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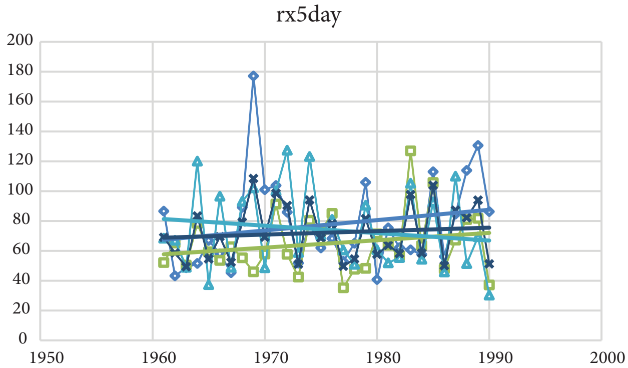
rx5day
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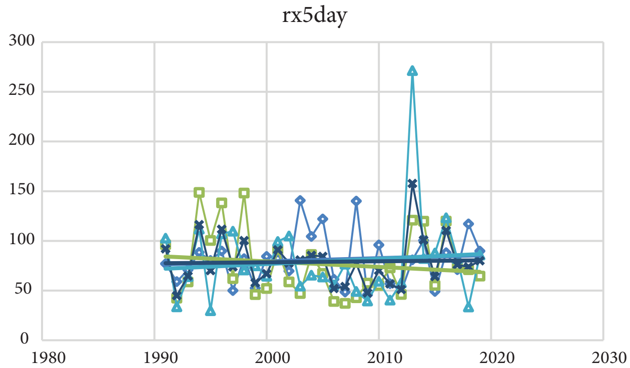
rx5day
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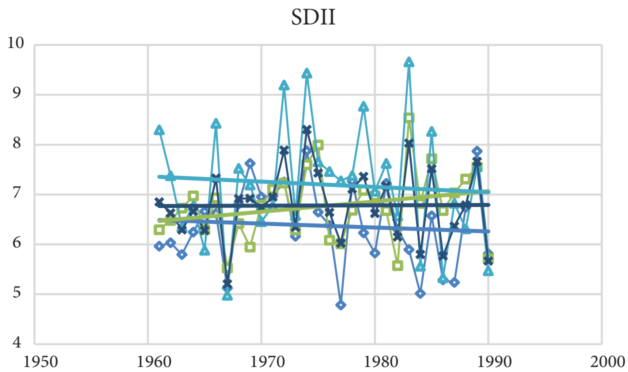
SDII
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9
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7
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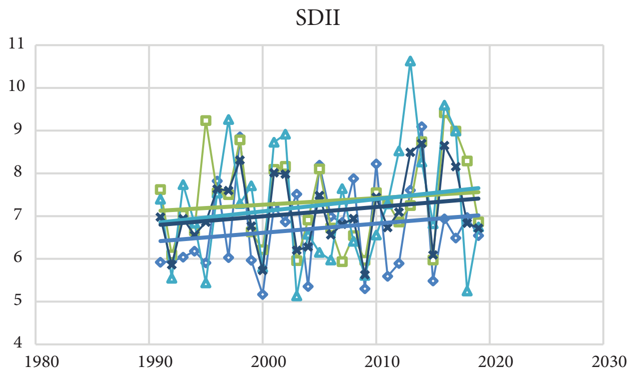
SDII
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8
7
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1980
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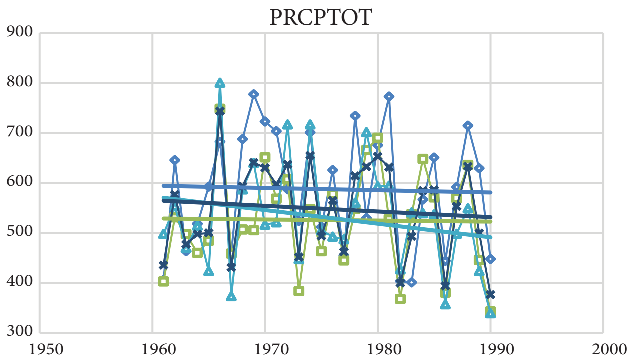
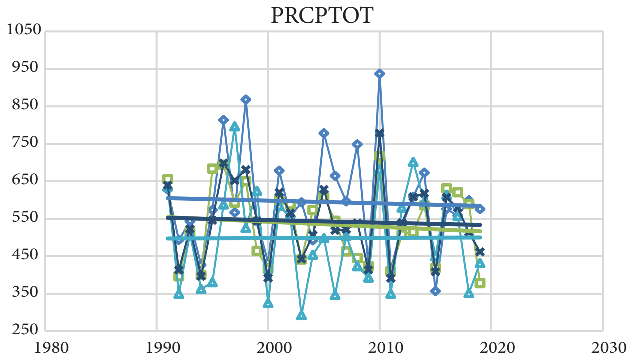
2030


PRCPTOT
900
800
700
600
500
400
300
1950
1960
1970
1980
1990
2000


PRCPTOT
1050
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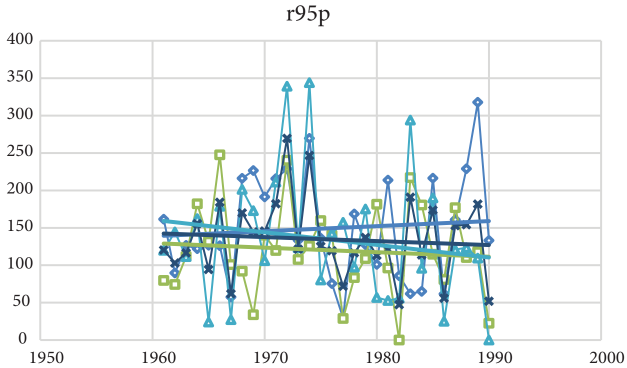
r95p
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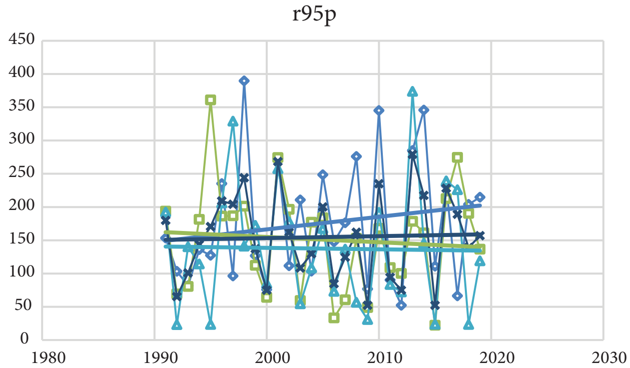
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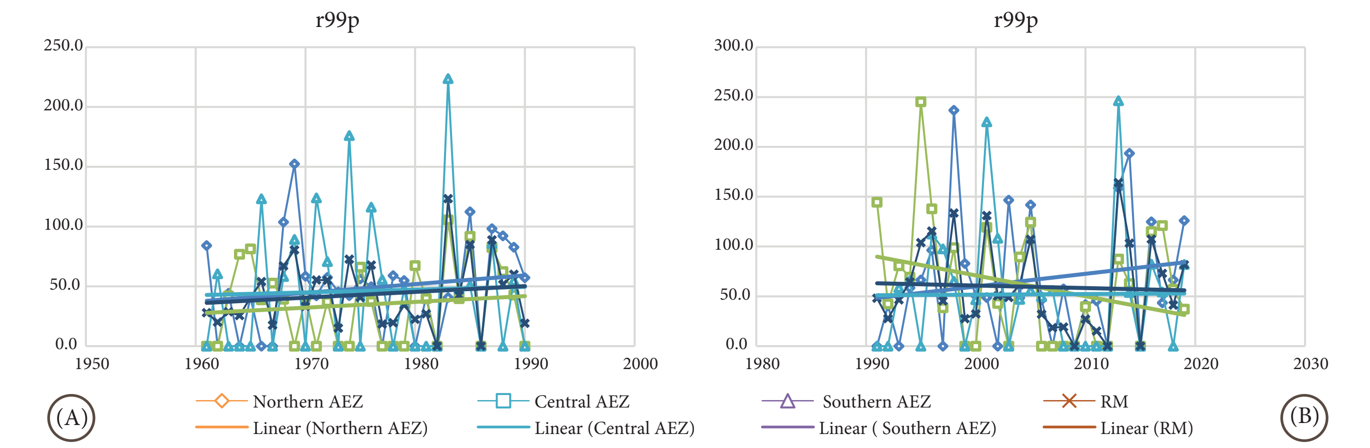


Figure 5-13: Trends in Max 1-day Precipitation (RX1day), Max 3-day Precipitation (RX3day), Max 5-day Precipitation (RX5day), Simple Daily Intensity Index (SDII), Total Precipitation in Wet Days (PRCPTOT), Very Wet Days (R95p), and Extremely Wet Days (R99p), mm, for two time periods: (A) 1961-1990, and (B) 1991-2019.

Table 5-8: Precipitation Extreme Indices, (mm), the Trend Slope (mm / 10 Years), Coefficient of Determination, R^2, and Statistical Significance of Changes, p -value, for Two Time Periods: 1961-1990 and 1991-2019.

Extreme Indices	Northern AEZ				Central AEZ				Southern AEZ			
	Mean	Trend	R^2	p	Mean	Trend	R^2	p	Mean	Trend	R^2	p
						1961-1990						
SDII	6.0	-0.1	0.7	0.6586	7.0	0.2	7	0.1723	7.0	-0.1	0.6	0.6813
RX1day	49.3	0.7	0.2	0.834	41.5	4	6	0.2069	48.8	-0.7	0.1	0.8818
RX3day	70.1	5.1	2	0.4537	57.4	4.4	4	0.2681	67.1	-2.8	0.8	0.6471
RX5day	77.5	6.9	4	0.2823	64.9	4.9	5	0.2552	74.1	-4.9	3	0.3981
PRCPTOT	587.6	-4.5	0.1	0.8596	525.8	-2.1	0	0.9234	530.9	-27.3	5	0.2379
R95p	149.1	6.7	0.7	0.6603	120.2	-6	0.8	0.6428	134.8	-16.8	3	0.3612
R99p	48.6	7.4	3	0.3824	34.8	4.8	2	0.5029	46.2	2.3	0.1	0.8546
						1991-2019						
SDII	6.7	0.2	3	0.3801	7.3	0.2	2	0.5136	7.2	0.3	3	0.3757
RX1day	50.8	1.5	0.6	0.6338	47.9	-7.2	10	**0.0911**	51.1	3.6	2	0.4842
RX3day	72.0	2.8	0.8	0.6359	66.8	-5.6	2	0.4153	70.4	1.5	0.1	0.8672
RX5day	81.0	3.2	1	0.5884	76.6	-5.5	2	0.4702	79.4	5.2	1	0.6104
PRCPTOT	594.7	-7.4	0.2	0.8112	535.2	-13.5	1	0.5614	498.6	0.9	0	0.9761
R95p	175.8	18.9	3	0.3741	151.0	-8	0.7	0.6577	137.6	-2.1	0	0.9192
R99p	66.3	12.7	3	0.3751	60.5	-20.9	9	0.1231	52.0	0.7	0	0.9619

The annual total precipitation in wet days (PRCPTOT) displays downward trends during the past 60 years over the entire territory of RoM's AEZs, with maximum decreasing in Southern AEZ during the 1961-1990 years, while during the 1991-2019 time period the maximum PRCPTOT decreasing tendency is observed in Central AEZ, Figure 5-14; Table 5-8.

The both precipitation-based percentile indices contribution from wet days (R95pTOT), and contribution from extremely wet days (R99pTOT) show not significant trends toward wetter conditions, more frequent and abundant and intense precipitation in Northern AEZ, which is amplified during the 1990-2019 time period. Controversially, in Southern and Central AEZs the decreasing trend in R99pTOT, and increasing trend in R95pTOT is registered. While during the 1990-2019 time period in Southern and Central AEZs have been observed not significant slight trend toward less frequent and intense precipitation, Figures 5-14; Table 5-9.

Table 5-9: Precipitation-Based Percentile Extreme Indices, (%), the Trend Slope (% / 10 Years), Coefficient of Determination, R^2, and Statistical Significance of Changes, p -value, for two time periods: 1961-1990, and 1991-2019

Extreme Indices	Northern AEZ				Central AEZ				Southern AEZ			
	Mean	Trend	R^2	p	Mean	Trend	R^2	p	Mean	Trend	R^2	p
						1961-1990						
R95pTOT	24.9	0.7	0.4	0.7508	22.3	-1.5	2	0.4844	24.1	-2.2	2	0.4391
R99pTOT	8.1	1	2	0.4453	6.4	0.5	0.5	0.7042	8.0	1.2	1	0.5979
						1990-2019						
R95pTOT	28.4	3.6	8	0.1357	27.4	-0.6	0.2	0.8161	25.6	-0.5	0.1	0.8501
R99pTOT	10.6	2.3	4	0.2763	10.3	-3.3	9	0.1117	9.6	-0.3	0.1	0.9005

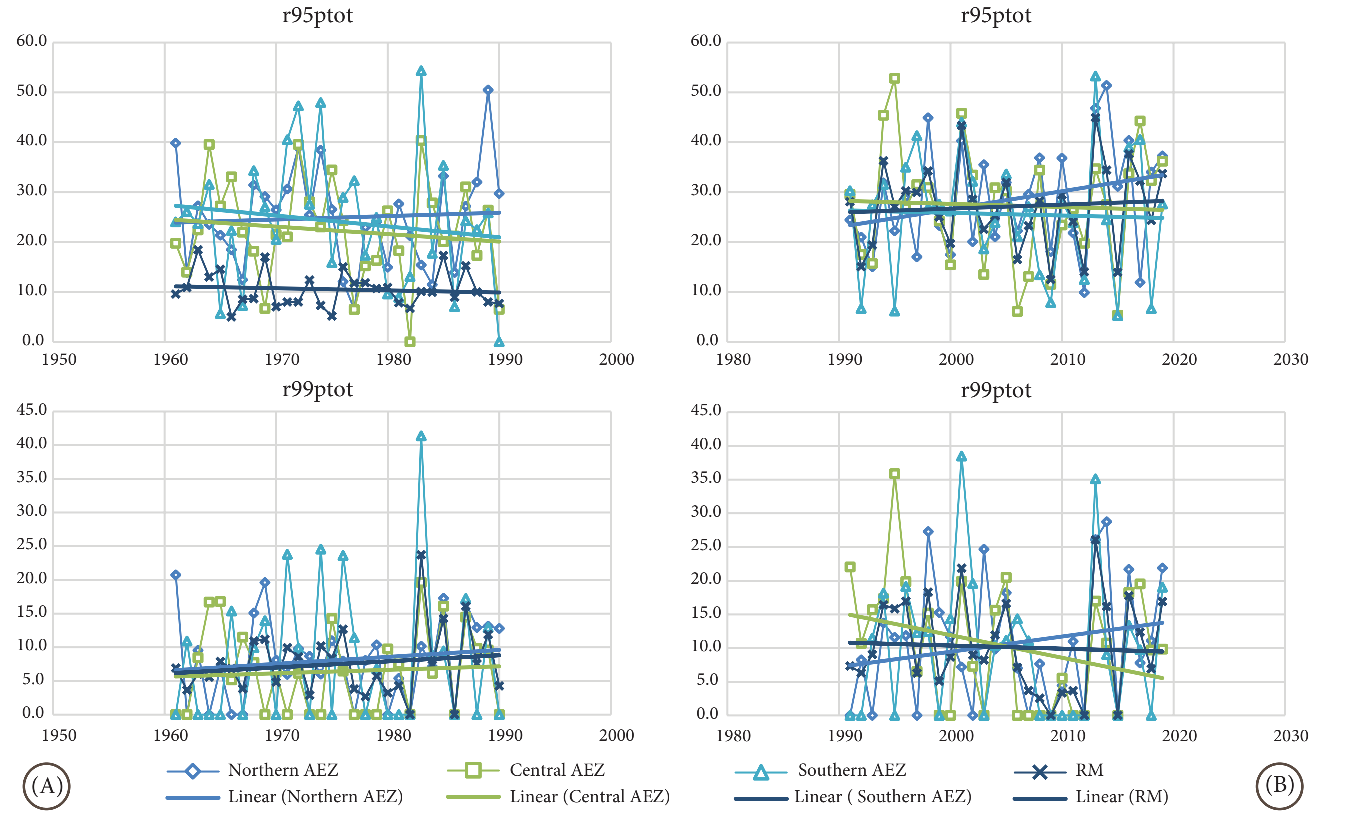
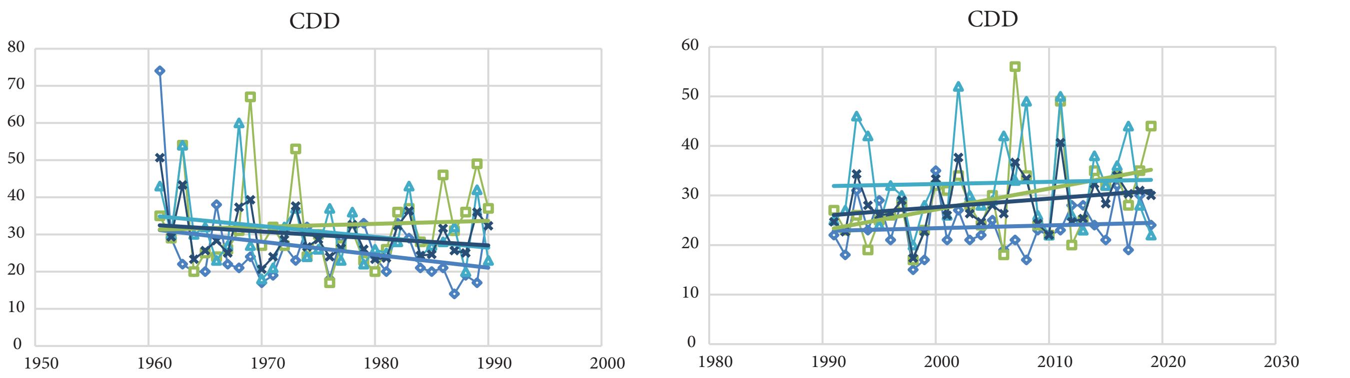


Figure 5-14: Trends in Contribution from very wet days (R95pTOT), and Contribution from extremely wet days (R99pTOT), %, for two time periods: (A) 1961-1990, and (B) 1991-2019.

Observational records do not indicate significant trends in either the number of dry days (CDD), indicating drought risks or consecutive wet days (CWD), indicating flood risks in case of estimations across the RoM's AEZ. Some changes in these variables have been observed across the RoM's AEZs but all of them are not statistically significant due to large natural variability, with except of Central AEZ, where is observed statistically significant increasing trend in CDD by +4.2 days / 10 years, R^2 17%, which shows with high degree of probability the consistent increase of CDD and drought risks during the 1991-2019 years in the region, Table 5-10 and Figure 5-15.

Table 5-10: Precipitation Extreme Indices, (Days), the Trend Slope (Day/10 Years), Coefficient of Determination, R^2 and Statistical Significance of Changes, p -value, for two time periods: 1961-1990, and 1991-2019

Extreme Indices	Northern AEZ				Central AEZ				Southern AEZ			
	Mean	Trend	R^2	p	Mean	Trend	R^2	p	Mean	Trend	R^2	p
1961-1990												
CDD	26.1	-3.5	8	0.134	32.5	0.8	0.4	0.7436	30.7	-2.9	7	0.1640
CWD	5.8	-0.03	0	0.9199	5.6	-0.05	0.1	0.8709	5.5	0.02	0	0.9385
R10mm	16.1	-0.9	3	0.3614	15.9	-0.2	0.1	0.8571	16.2	-1.3	7	0.1559
R20mm	5.4	0.2	0.4	0.7235	5.1	-0.3	2	0.4912	5.2	-0.7	8	0.1222
1990-2019												
CDD	23.7	0.6	1	0.6146	29.3	4.2	17	**0.0285**	32.5	0.4	0.2	0.8332
CWD	5.7	0.07	0.2	0.8056	5.1	-0.2	1	0.5879	4.7	0.06	0.2	0.8269
R10mm	17.5	-0.6	1	0.6248	16.7	-0.1	0.1	0.8846	14.4	0.06	0	0.9529
R20mm	5.7	0.4	1	0.5597	5.5	0.1	0.2	0.8406	5.0	0.3	1	0.6308



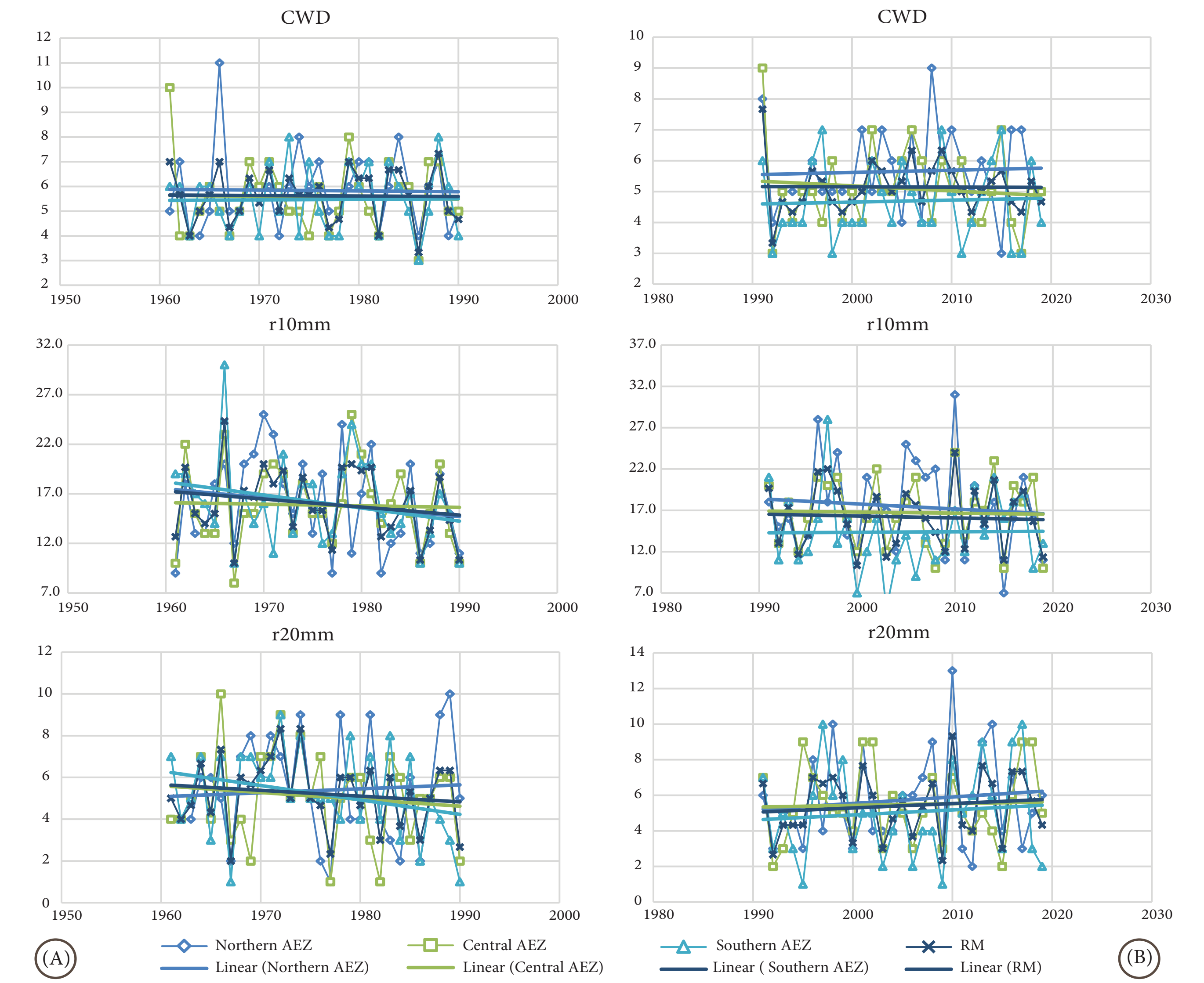


Figure 5-15: Trends in Consecutive Dry Days (CDD), and Consecutive Wet Days (CWD), Heavy Precipitation Days (R10mm), and Very Heavy Precipitation Days (R20mm), Days, for two time periods: (A) 1961-1990, and (B) 1991-2019.

5.2. Republic of Moldova's New CMIP6 Climate Change Projections

Studies undertaken to date for developing regional GCM-based scenarios in the Republic of Moldova have used the 30-year period 1961 to 1990 as a climatologic baseline, and have studied the influence of climate on relevant sectors within three-time horizons: 2010-2039, 2040-2069 and 2070-2099. Three individual coupled atmosphere-ocean General Circulation Models (GCMs) based on IS92a scenario were used for the vulnerability and adaptation assessments in First and Second National Communications of the Republic of Moldova under the UNFCCC (NC1, 2000; NC2, 2010).

The 2009/2010 NHDR for the Republic of Moldova (NHDR, 2010) uses the experiments of an ensemble of six GCM experiments based on the SRES A2 and B2 scenarios for downscaling climate projections for RoM, as recommended by IPCC Third Assessment Report (TAR, 2001a).

The multi-model ensemble of the 10 GCMs simulations introduced by three SRES emission scenarios A2, A1B and B1 as recommended by IPCC Fourth Assessment Report (AR4, 2007a) covering the end of 20th (reference period) and 21st (scenario) centuries were used for the vulnerability and adaptation assessments in Third National Communications of the Republic of Moldova under the UNFCCC (NC3, 2014; Taranu, 2014).

The regional climate projections over the Republic of Moldova's Northern, Central and Southern Agro-Ecological Zones (AEZs) in terms of the distribution of temperature and precipitation, based on CMIP5 multi-model ensemble of the 21 GCMs, and extreme temperature and precipitation indices, based on CMIP5 multi-model ensemble of the 14 GCMs, introduced by three Representative Concentration Pathways (RCP): RCP8.5, RCP4.5 and RCP2.6 as recommended by IPCC (AR5), 2013, covering the end of 20th (reference period) and 21st (scenario) centuries were used for the vulnerability and adaptation assessments in NC4 of the RM under the UNFCCC (NC4, 2018; Taranu, et al., 2018).

One of the main objectives that the country has for preparation of the NC5 to the UNFCCC (2022) is to assess and evaluate the vulnerability and impact of climate change. In order to do so, it is required to assess the observed and future climate change over the territory of RoM. This means to analyze the change in air temperature and level of precipitations between the base period and future projections.

The objective of this study was developing new regional climate change projections and analyzing the changes over the RoM's Northern, Central and Southern Agro-Ecological Zones (AEZs) in terms of the distribution of temperature, precipitation, and extreme temperatures and precipitation events based on new CMIP6 multi-model ensemble as recommended by IPCC AR6 (2021).

In order to do so, the output data for different scenarios of Coupled Model Intercomparison Project Phase 6 (CMIP6) is used for modelling of future climate change projections. At the same time, observation data of E-OBS datasets (European Ensemble observational gridded dataset) are used to assess the climate of the past (historical) for the base (reference) period.

5.2.1. Data and Methods

The main focus of this study is on the new simulations of the future climate under scenarios of human emissions, referred to as ScenarioMIP (O'Neill et al. 2016). There are important new developments in ScenarioMIP compared to CMIP5, but there are also features of the other MIPs that are relevant as well. Simulations in CMIP5 were made under a set of scenarios of anthropogenic greenhouse gas and aerosol concentrations resulting in different levels of radiative forcing – the Representative Concentration Pathways (RCPs) outlined in van Vuuren et al., 2011.

Each ScenarioMIP[248] simulation in CMIP6 is made under a combination of an RCP and a Shared Socio-economic Pathway (SSP), outlined in Meinshausen et al. (2019), named for the SSP value then the RCP value. The RCPs, defined by the magnitude of enhanced radiative forcing at 2100 contain the same values as for CMIP5 but include some new ones: 1.9, 2.6, 3.4, 4.5, 6.0, 7.0 and 8.5 W m^{-2}.

The five SSPs are summarized by the narrative headlines:

- **SSP1 - Sustainability: taking the green road;**
- **SSP2 – Middle of the road;**
- SSP3 – Regional rivalry: a rocky road;
- SSP4 – Inequality: a road divided; and
- **SSP5 – Fossil-fueled development: taking the highway.**

The framing by both SSP and RCP dimensions provides new opportunities to examine the future in terms of physical climate change and global socio-economic pathways, including the interactions between the two.

This study has used one simulation each from 22 CMIP6 models that were available at this time for downscaling in case of monthly data, and 6 CMIP6 GCMs in case of daily data with models having historical simulations available for evaluation purposes and models available for ScenarioMIP. The focus for projections will be on the SSP experiments, as these provides the smallest, medium, and strongest climate change signal, where GCMs models will be examined (more for temperature and precipitation, and fewer for extremes analyses, because not all models are available for all analyses).

Evaluation is calculated for the IPCC AR6 (2021) baseline 1995-2014 for mean temperature, precipitation, and extremes. Observed daily temperature and precipitation data used for climate modelling is kindly provided by the State Hydrometeorological Service (SHS) of the RoM.

Mean climate means of evaluating climate models comparing their simulation of the historical climate against observations (Taranu 2014; Taranu et.al., 2018). Doing so enables us to identify particular regions and processes where models may be in some way deficient (Christensen et al. 2013).

This information may then be used to inform the confidence in the relevant climate change projections provided by these models. We will evaluate the climatological state of the historical simulation of temperature, precipitation, and extremes, comparing the performance of a subset of CMIP6 GCM models for four seasons: December - February (DJF), March -May (MAM), June - August (JJA), and September - November (SON). We will focus this analysis on three AEZs of the Republic of Moldova (see more in Taranu, 2014; Taranu et al., 2018).

E-OBS datafiles

E-OBS comes as an ensemble dataset and is available on a 0.1- and 0.25-degree regular grid for the elements daily mean temperature TG, daily minimum temperature TN, daily maximum temperature TX, daily precipitation sum RR, daily averaged sea level pressure PP and daily mean global radiation QQ, Cornes, et al., 2018[249]. They cover the area: 25N-71.5N x 25W-45E. The data files are in NetCDF-4 format. The Global 30 Arc-Second Elevation Data Set (GTOPO30), a global raster Digital Elevation Model (DEM) with a horizontal grid spacing of 30 arc seconds (approximately 1 kilometer) developed by USGS is used for the elevation file as well.

The list of CMIP6 22 GCMs that have been used in the RoM AEZs for the historical scenario and SSP1-2.6, SSP2-4.5 and SSP5-8.5 emissions-driven future projections is presented in Table 5-10.

The variables will be analysed are mean (tas, in °C), maximum (tx, in °C) and minimum (tn, in °C) temperatures, – and precipitation (pr, in mm day^{-1}).

Columns lon and lat indicate the horizontal longitude and latitude effective resolutions of each model (in °).

[248] https://www.wcrp-climate.org/modelling-wgcm-mip-catalogue/cmip6-endorsed-mips-article/1070-modelling-cmip6-scenariomip.

[249] "We acknowledge the E-OBS dataset from the EU-FP6 project UERRA (https://www.uerra.eu) and the Copernicus Climate Change Service, and the data providers in the ECA&D project (https://www.ecad.eu)."

Table 5-10: The CMIP6 models will be used in the Republic of Moldova AEZs for the historical scenario and the SSP1-2.6, SSP2-4.5 and SSP5-8.5 emissions-driven mean climate future projections

No	Model Name	Modelling Centre (or Group)	Institute ID	Resolution
1	**CNRM-ESM2-1**	CNRM (Centre National de Recherches Meteorologiques, Toulouse, France), CERFACS (Centre Europeen de Recherche et de Formation Avancee en Calcul Scientifique, Toulouse, France)	CNRM-CERFACS	250 km
2	**EC-Earth3-Veg[250]**	EC-Earth consortium, Rossby Center, Swedish Meteorological and Hydrological Institute/SMHI, Norrköping, Sweden	EC-Earth-Consortium	100 km

[250] The model was run by the AEMET, Spain; BSC, Spain; CNR-ISAC, Italy; DMI, Denmark; ENEA, Italy; FMI, Finland; Geomar, Germany; ICHEC, Ireland; ICTP, Italy; IDL, Portugal; IMAU, The Netherlands; IPMA, Portugal; KIT, Karlsruhe, Germany; KNMI, The Netherlands; Lund University, Sweden; Met Eireann, Ireland; NLeSC, The Netherlands; NTNU, Norway; Oxford University, UK; surf SARA, The Netherlands; SMHI, Sweden; Stockholm University, Sweden; Unite ASTR, Belgium; University College Dublin, Ireland; University of Bergen, Norway; University of Copenhagen, Denmark; University of Helsinki, Finland; University of Santiago de Compostela, Spain; Uppsala University, Sweden; Utrecht University, The Netherlands; Vrije Universiteit Amsterdam, the Netherlands; Wageningen University, The Netherlands.

No	Model Name	Modelling Centre (or Group)	Institute ID	Resolution
3	**BCC-CSM2-MR**	Beijing Climate Center, Beijing, China (BCC)	BCC	100 km
4	**FGOALS-g3**	Chinese Academy of Sciences, Beijing 100029, China	CAS	250 km
5	**CanESM5**	Climate Modelling and Analysis, Environment and Climate Change Canada, Victoria, Canada	CCCma	500 km
6	**CNRM-CM6-1**	CNRM (Centre National de Recherches Meteorologiques, Toulouse, France), CERFACS (Centre Europeen de Recherche et de Formation Avancee en Calcul Scientifique, Toulouse, France)	CNRM-CERFACS	250 km
7	**GFDL-CM4**	National Oceanic and Atmospheric Administration, Geophysical Fluid Dynamics Laboratory, Princeton, USA	NOAA-GFDL	100 km
8	**GFDL-ESM4**	National Oceanic and Atmospheric Administration, Geophysical Fluid Dynamics Laboratory, Princeton, NJ 08540, USA	NOAA-GFDL	100 km
9	**MIROC-ES2L**	JAMSTEC (Japan Agency for Marine-Earth Science and Technology, Kanagawa 236-0001, Japan), AORI (Atmosphere and Ocean Research Institute, The University of Tokyo, Chiba 277-8564, Japan), NIES (National Institute for Environmental Studies, Ibaraki 305-8506, Japan), and R-CCS (RIKEN Center for Computational Science, Hyogo 650-0047, Japan)	MIROC	500 km
10	**IPSL-CM6A-LR**	Institute Pierre Simon Laplace, Paris, France	IPSL	250 km
11	**MRI-ESM2-0**	Meteorological Research Institute, Tsukuba, Japan	MRI	100 km
12	**NESM3**	Nanjing University of Information Science and Technology, Nanjing, China	NUIST	250 km
13	**UKESM1-0-LL**	Met Office Hadley Centre, Fitzroy Road, Exeter, Devon, UK	MOHC	250 km
14	**CIESM**	Department of Earth System Science, Tsinghua University, Beijing, China	THU	100 km
15	**CNRM-CM6-1-HR**	CNRM (Centre National de Recherches Meteorologiques, Toulouse, France), CERFACS (Centre Europeen de Recherche et de Formation Avancee en Calcul Scientifique, Toulouse, France)	CNRM-CERFACS	100 km
16	**EC-Earth3**	EC-Earth consortium, Rossby Center, Swedish Meteorological and Hydrological Institute/SMHI, Norrkoping, Sweden	EC-Earth-Consortium	100 km
17	**HadGEM3-GC31-MM**	Met Office Hadley Centre, Fitzroy Road, Exeter, Devon, UK	MOHC	100 km
18	**INM-CM4-8**	Institute for Numerical Mathematics, Russian Academy of Science, Moscow, Russia	INM	100 km
19	**INM-CM5-0**	Institute for Numerical Mathematics, Russian Academy of Science, Moscow, Russia	INM	100 km
20	**MPI-ESM1-2-HR**	Max Planck Institute for Meteorology, Hamburg, Germany	MPI-M	100 km
21	**MIROC6**	JAMSTEC (Japan Agency for Marine-Earth Science and Technology, Kanagawa 236-0001, Japan), AORI (Atmosphere and Ocean Research Institute, The University of Tokyo, Chiba 277-8564, Japan), NIES (National Institute for Environmental Studies, Ibaraki 305-8506, Japan), and R-CCS (RIKEN Center for Computational Science, Hyogo 650-0047, Japan)	MIROC	100 km
22	**MPI-ESM1-2-LR**	Max Planck Institute for Meteorology, Hamburg 20146, Germany	MPI-M	250 km

5.2.2. Elaboration CMIP6 GCMs climate change projections using monthly data

5.2.2.1. Projections of Future Changes in Annual and Seasonal Temperatures

The three Shared Socio-economic Pathways, (SSPs) project similar temperature in the near-term decades by +1.1-1.4°C across the RoM's AEZs. Only beginning around the 2060s the three SSPs scenarios produce temperature patterns that are distinguishable from each other. This is due to both the large inertia of the climate system; it takes centuries for the full climate effects of greenhouse gas emissions to be felt and due to the fact that it takes time for the different emissions scenarios to produce large differences in greenhouse gas concentrations.

Annual changes for temperatures will be very homogeneous over the RoM's AEZs, according to CMIP6 22 GCMs ensembles. By the 2100s, the rate of warming will be higher under SSP5-8.5, average reach +5.7°C; medium under SSP2-4.5, from +2.7°C in Southern AEZ to +2.9°C in Northern AEZ, and smaller under the SSP1-2.6 scenarios, average would be +1.5-1.6°C. The individual GCMs show an increase of up to 8.4-9.3°C, (see more in Table 5-11).

All CMIP6 22 GCM models used agree that for the three future periods (2021–2040, 2041–2060 and 2081–2100) there will be an increase of the mean winter temperature, with respect to the 1995–2014 baseline period. As it was expected, the magnitude of the positive found differences is increasing with increasing greenhouse gas forcing. It can be seen that the temperature rise will be larger over Northern and Central parts of the country.

The warming would be higher during winter up to +5.9°C in Northern, and +5.6°C in Central AEZ's, but in Southern AEZ temperature rise will be lower up to +5.3°C according to the SSP5-8.5 scenario. The SSP1-2.6 scenario reveals less intense warming over the RoM's AEZs from +1.9°C in Northern to +1.7°C in Southern AEZs. The corresponding results from the SSP2-4.5 scenario show medium intense differences in temperature increase. Estimates of simulations from the SSP2-4.5 scenario show that the warming will be quite uniform by 3.2°C in Northern and Central AEZs, with minimum by 2.9°C in Southern AEZ, (Table 5-11).

The summer warming is found to be even higher than in winter, but the spatial distribution of the changes is quite different. The strongest temperature rise occurs over Southern and Central AEZs. The ensemble, driven by SSP5-8.5 scenario, estimates that the RoM's AEZs will experience the most significant warming during summer from +6.7°C in Northern up to +7.1°C in Southern AEZ's by 2100, comparative to 1995-2014 reference period. The pattern of change derived from the SSP1-2.6 scenario is quite similar, but the magnitude of change is lower by +1.8-1.9°C. The corresponding results from the SSP2-4.5 scenario show medium intensity differences in temperature increase. Estimates of simulations from the SSP2-4.5 ensemble show that the warming will be quite uniform +3.2-3.4°C, over territory of the RM's AEZs, (Table 5-11).

Table 5-11: Projected CMIP6 22 GCMs Ensemble Annual and Seasons Mean Air Temperature Changes (ΔT, °C) Presented for Three 20 Year Time Periods in the Future (2021–2040, 2041–2060 and 2081–2100) for SSP1-2.6, SSP2-4.5 and SSP5-8.5 Scenarios, Relative to the 1995–2014 Climatological Baseline Period

Season	Average (1995-2014)	Scenario	Projected change by 2040	Projected change by 2060	Projected change by 2100
Northern AEZ					
Annual	8.9	SSP1-2.6	1.2	1.5	1.6
		SSP2-4.5	1.3	1.9	2.9
		SSP5-8.5	1.4	2.6	5.7
DJF	-2.6	SSP1-2.6	1.4	1.6	1.9
		SSP2-4.5	1.5	2.2	3.2
		SSP5-8.5	1.4	2.9	5.9
MAM	9.4	SSP1-2.6	0.9	1.2	1.4
		SSP2-4.5	0.9	1.5	2.3
		SSP5-8.5	1.0	2.0	4.4
JJA	19.9	SSP1-2.6	1.3	1.7	1.8
		SSP2-4.5	1.4	2.1	3.2
		SSP5-8.5	1.5	2.9	6.7
SON	9.0	SSP1-2.6	1.3	1.5	1.5
		SSP2-4.5	1.3	1.7	2.8
		SSP5-8.5	1.4	2.6	5.7
Central AEZ					
Annual	10.6	SSP1-2.6	1.2	1.5	1.6
		SSP2-4.5	1.2	1.6	2.8
		SSP5-8.5	1.3	2.6	5.7
DJF	-1.1	SSP1-2.6	1.3	1.5	1.8
		SSP2-4.5	1.4	2.1	3.2
		SSP5-8.5	1.3	2.8	5.6
MAM	10.8	SSP1-2.6	0.9	1.2	1.3
		SSP2-4.5	0.8	1.4	2.2
		SSP5-8.5	0.9	2.0	4.4
JJA	22.0	SSP1-2.6	1.4	1.9	1.9
		SSP2-4.5	1.6	2.3	3.4
		SSP5-8.5	1.5	3.1	7.0
SON	10.7	SSP1-2.6	1.3	1.4	1.4
		SSP2-4.5	1.1	1.5	2.6
		SSP5-8.5	1.3	2.5	5.7
Southern AEZ					
Annual	10.9	SSP1-2.6	1.1	1.4	1.5
		SSP2-4.5	1.1	1.7	2.7
		SSP5-8.5	1.2	2.5	5.6
DJF	-0.8	SSP1-2.6	1.2	1.4	1.7
		SSP2-4.5	1.2	1.9	2.9
		SSP5-8.5	1.2	2.6	5.3
MAM	10.9	SSP1-2.6	0.9	1.2	1.3
		SSP2-4.5	0.9	1.5	2.2
		SSP5-8.5	0.9	2.0	4.5
JJA	22.1	SSP1-2.6	1.4	1.9	1.9
		SSP2-4.5	1.6	2.3	3.4
		SSP5-8.5	1.6	3.1	7.1
SON	11.2	SSP1-2.6	1.2	1.4	1.4
		SSP2-4.5	1.0	1.4	2.5
		SSP5-8.5	1.3	2.5	5.6

Annual changes for maximum mean temperatures will be very homogeneous over the RoM's AEZs, according to CMIP6 22 GCMs ensembles. By the 2100s, the rate of warming will be higher under SSP5-8.5, average reach +5.9-6.0°C; medium under SSP2-4.5, from +2.7-2.9°C in Northern, and Southern AEZs, with maximum +3.1°C in Central AEZ, and smaller under the SSP1-2.6 scenarios, average would be +1.7-1.8°C, (see more in Table 5-12).

Table 5-12: Projected CMIP6 22 GCMs Ensemble Annual and Seasons Maximum Mean Air Temperature Changes (ΔT, °C) Presented for Three 20 Year Time Periods in the Future (2021–2040, 2041–2060 and 2081–2100) for SSP1-2.6, SSP2-4.5 and SSP5-8.5 Scenarios, Relative to the 1995–2014 Climatological Baseline Period

Season	Average (1995-2014)	Scenario	Projected change by 2040	Projected change by 2060	Projected change by 2100
Northern AEZ					
Annual	13.5	SSP1-2.6	1.3	1.6	1.7
		SSP2-4.5	1.3	2.0	2.7
		SSP5-8.5	1.4	2.6	5.9
DJF	0.3	SSP1-2.6	1.2	1.5	1.8
		SSP2-4.5	1.4	2.1	3.0
		SSP5-8.5	1.3	2.7	5.7
MAM	14.7	SSP1-2.6	1.0	1.3	1.5
		SSP2-4.5	1.0	1.7	2.5
		SSP5-8.5	1.1	2.2	4.7
JJA	25.6	SSP1-2.6	1.5	2.0	2.1
		SSP2-4.5	1.5	2.4	3.5
		SSP5-8.5	1.7	3.3	7.3
SON	13.5	SSP1-2.6	1.3	1.5	1.5
		SSP2-4.5	1.2	1.7	2.8
		SSP5-8.5	1.4	2.6	5.9
Central AEZ					
Annual	15.1	SSP1-2.6	1.3	1.7	1.8
		SSP2-4.5	1.4	2.1	3.1
		SSP5-8.5	1.4	2.8	6.0
DJF	1.9	SSP1-2.6	1.3	1.6	1.8
		SSP2-4.5	1.5	2.2	3.2
		SSP5-8.5	1.4	2.8	5.6
MAM	16.0	SSP1-2.6	1.0	1.3	1.4
		SSP2-4.5	1.0	1.6	2.4
		SSP5-8.5	1.0	2.1	4.7
JJA	27.6	SSP1-2.6	1.6	2.1	2.1
		SSP2-4.5	1.8	2.5	3.7
		SSP5-8.5	1.7	3.4	7.5
SON	15.1	SSP1-2.6	1.3	1.5	1.5
		SSP2-4.5	1.2	1.7	2.8
		SSP5-8.5	1.4	2.7	5.9
Southern AEZ					
Annual	15.7	SSP1-2.6	1.3	1.6	1.7
		SSP2-4.5	1.2	2.0	2.9
		SSP5-8.5	1.3	2.7	5.9
DJF	2.4	SSP1-2.6	1.3	1.5	1.8
		SSP2-4.5	1.3	2.0	2.9
		SSP5-8.5	1.3	2.7	5.4
MAM	16.4	SSP1-2.6	1.0	1.3	1.5
		SSP2-4.5	1.0	1.7	2.3
		SSP5-8.5	1.0	2.2	4.8
JJA	28.0	SSP1-2.6	1.6	2.1	2.2
		SSP2-4.5	1.6	2.5	3.5
		SSP5-8.5	1.8	3.5	7.5
SON	15.9	SSP1-2.6	1.3	1.5	1.5
		SSP2-4.5	1.2	1.7	2.8
		SSP5-8.5	1.4	2.7	5.9

All CMIP6 22 GCM models used agree that for the three future periods (2021–2040, 2041–2060 and 2081–2100) there will be an increase of the maximum mean winter temperature, with respect to the 1995–2014 baseline period. As it was expected, the magnitude of the positive found differences is increasing with increasing greenhouse gas forcing. It can be seen that the temperature rise will be larger over Northern and Central parts of the country, (Table 5-12).

The warming would be higher during winter up to +5.7°C in Northern, and Central AEZ's, but in Southern AEZ maximum mean winter temperature rise will be lower up to +5.4°C according to the SSP5-8.5 scenario. The SSP1-2.6 scenario reveals less intense warming over the RoM's AEZs by +1.8°C. The corresponding results from the SSP2-4.5 scenario show medium intense differences in temperature increase. Estimates of simulations from the SSP2-4.5 scenario show that the warming will be quite uniform +2.9°C - 3.0°C in Southern and Northern AEZs, with maximum by 3.2°C in Central AEZ, (Table 5-12).

The summer maximum mean temperature warming is found to be even higher than in winter, but the spatial distribution of the changes is quite different. The strongest maximum mean temperature rise occurs over Central and Southern AEZs. The CMIP6 multi-model ensemble, driven by SSP5-8.5 scenario, estimates that the RoM AEZs will experience the most significant warming during summer from +7.3°C in Northern up to +7.5°C in Southern AEZ's by 2100, comparative to 1995-2014 reference period. The pattern of change derived from the SSP1-2.6 scenario is quite similar, but the magnitude of change is lower by +2.1-2.2°C. The corresponding results from the SSP2-4.5 scenario show medium intensity differences in maximum mean temperature increase. Estimates of simulations from the SSP2-4.5 ensemble show that the warming will be by +3.5-3.7°C, over territory of the RoM's AEZs, (Table 5-12).

Annual changes for minimum mean temperatures will be very homogeneous over the RoM's AEZs, according to CMIP6 22 GCMs ensembles. By the 2100s, the rate of warming will be higher under SSP5-8.5, average reach +5.6-5.4°C; medium under SSP2-4.5, from +2.9-2.7°C in Northern, and Central AEZs, with minimum increase in Southern AEZ, and smaller under the SSP1-2.6 scenarios, average change for minimum mean temperature would be +2.1-1.7°C, (see more in Table 5-13).

All CMIP6 22 GCM models used agree that for the three future periods (2021–2040, 2041–2060 and 2081–2100) there will be an increase of the minimum mean winter temperature, with respect to the 1995–2014 baseline period. As it was expected, the magnitude of the positive found differences is increasing with increasing greenhouse gas forcing. It can be seen that the temperature rise will be larger over Northern and Central parts of the country (Table 5-13).

The warming would be higher during winter from +6.5°C in Northern to +6.0°C in Central AEZs, but in Southern AEZ minimum mean winter temperature rise will be lower up to +5.4°C according to the SSP5-8.5 scenario. The SSP1-2.6 scenario reveals less intense warming over the RoM's AEZs from +2.1°C in Northern to +1.7°C in Southern AEZs. The corresponding results from the SSP2-4.5 scenario show medium intense differences in minimum mean temperature increase. Estimates of simulations from the SSP2-4.5 scenario show that the warming will be from +3.6°C in Northern to +3.0°C in Southern AEZs, (Table 5-13).

Table 5-13: Projected CMIP6 22 GCMs Ensemble Annual and Seasons Minimum Mean Air Temperature Changes (ΔT, °C) Presented for Three 20 Year Time Periods in the Future (2021–2040, 2041–2060 and 2081–2100) for SSP1-2.6, SSP2-4.5 and SSP5-8.5 Scenarios, Relative to the 1995–2014 Climatological Baseline Period

Season	Average (1995-2014)	Scenario	Projected change by 2040	Projected change by 2060	Projected change by 2100
Northern AEZ					
Annual	4.9	SSP1-2.6	1.2	1.4	1.6
		SSP2-4.5	1.3	1.9	2.9
		SSP5-8.5	1.3	2.6	5.6
DJF	-5.2	SSP1-2.6	1.6	1.8	2.1
		SSP2-4.5	1.6	2.6	3.6
		SSP5-8.5	1.6	3.4	6.5
MAM	4.7	SSP1-2.6	0.9	1.2	1.3
		SSP2-4.5	0.9	1.5	2.3
		SSP5-8.5	1.1	2.0	4.3
JJA	14.6	SSP1-2.6	1.2	1.6	1.6
		SSP2-4.5	1.4	2.0	3.1
		SSP5-8.5	1.5	2.8	6.3
SON	5.4	SSP1-2.6	1.2	1.3	1.3
		SSP2-4.5	1.2	1.6	2.6
		SSP5-8.5	1.3	2.4	5.5
Central AEZ					
Annual	6.7	SSP1-2.6	1.2	1.5	1.6
		SSP2-4.5	1.3	1.9	2.9
		SSP5-8.5	1.3	2.6	5.6
DJF	-3.6	SSP1-2.6	1.5	1.7	2.0
		SSP2-4.5	1.5	2.3	3.4
		SSP5-8.5	1.5	3.1	6.0
MAM	6.4	SSP1-2.6	0.8	1.1	1.2
		SSP2-4.5	0.8	1.4	2.1
		SSP5-8.5	0.9	1.8	4.2
JJA	17.1	SSP1-2.6	1.3	1.6	1.7
		SSP2-4.5	1.3	2.1	3.1
		SSP5-8.5	1.4	2.8	6.6
SON	7.1	SSP1-2.6	1.2	1.4	1.4
		SSP2-4.5	1.2	1.7	2.7
		SSP5-8.5	1.3	2.4	5.6
Southern AEZ					
Annual	6.8	SSP1-2.6	1.1	1.3	1.5
		SSP2-4.5	1.1	1.7	2.7
		SSP5-8.5	1.2	2.4	5.4
DJF	-3.4	SSP1-2.6	1.2	1.5	1.7
		SSP2-4.5	1.2	1.9	3.0
		SSP5-8.5	1.2	2.7	5.4
MAM	6.3	SSP1-2.6	0.8	1.1	1.2
		SSP2-4.5	0.9	1.4	2.1
		SSP5-8.5	0.9	1.9	4.2
JJA	16.8	SSP1-2.6	1.3	1.7	1.8
		SSP2-4.5	1.4	2.1	3.2
		SSP5-8.5	1.5	2.9	6.7
SON	7.4	SSP1-2.6	1.2	1.3	1.3
		SSP2-4.5	1.1	1.6	2.6
		SSP5-8.5	1.2	2.3	5.5

The summer minimum mean temperature warming is found to be even higher than in winter, but the spatial distribution of the changes is quite different. The strongest summer minimum mean temperature rise occurs over Central and

Southern AEZs. The CMIP6 multi-model ensemble, driven by SSP5-8.5 scenario, estimates that the RoM's AEZs will experience the most significant warming during summer from +6.3°C in Northern up to +6.7°C in Southern AEZ's by 2100, comparative to 1995-2014 reference period. The pattern of change derived from the SSP1-2.6 scenario is quite similar, but the magnitude of change is lower by +1.6-1.8°C. The corresponding results from the SSP2-4.5 scenario show medium intensity differences in minimum mean temperature increase. Estimates of simulations from the SSP2-4.5 ensemble show that the warming will be by +3.1-3.2°C, over territory of the RM's AEZs, (see more in Table 5-13).

5.2.2.2. Projections of Future Changes in Annual and Seasonal Precipitations

All SSPs scenarios project the slight annual precipitation increase from 2.9-3.3% in Northern to 2.6-4.8% over Southern AEZs by 2021-2040 time period, comparative to 1995-2014 reference period. Annual changes for precipitation became much more differentiated over the RoM's AEZs by the 2100. The CMIP6 22 multi-model projections from the SSP5-8.5 scenario show that the RoM's AEZs would exhibit a general annual decrease in precipitation varying from 4.2% in Northern to 11.0% to Southern AEZs, (see more in Table 5-14).

Conversely, according to SSP1-2.6 scenario moderate increase in precipitation from 4.3% in Northern to 4.0% to Southern AEZs by 2100 is projected. The corresponding results from the SSP2-4.5 scenario show a moderate increase in precipitation from 1.2% to 1.4% only in Central and Northern AEZs by 2100, relative to the reference time period 1995-2014.

The CMIP6 22 GCM multi-model projections from the SSP5-8.5, SSP2-4.5 and SSP1-2.6 scenarios show that the RoM would exhibit a general increase of precipitation during winter and spring. This increase becomes progressively more intense towards the south in winter and north in spring during the 2021-2040 time period. In detail, the 22 GCM multi-model projections from the SSP5-8.5 scenario show that the RoM's AEZs would exhibit a moderate winter increase in precipitation varying from 5.6% (SSP5-8.5) to 6.7% (SSP1-2.6) over Northern and from 6.1% (SSP5-8.5) to 8.4% (SSP1-2.6) in Southern AEZs. Conversely, in spring, increase in precipitation is projected to be more intense from 6.4% (SSP5-8.5) to 7.2% (SSP1-2.6) across Northern and less intense from 4.6% (SSP1-2.6) to 7.4% (SSP5-8.5) across Southern AEZs relative to the reference time period 1995-2014.

Winters are estimated to be wetter in the RoM by the end of the 21st century, the 22 GCM multi-model projections ensemble projections show the largest increase in precipitation from 10.3% (SSP1-2.6) to 19.4% (SSP5-8.5) in winter over Northern and the lowest one from 11.7% (SSP1-2.6) to 8.7% (SSP5-8.5) in Southern parts of the country by 2100.

The ensemble averages for the three SSPs scenarios agree that the precipitation reduction will be much more extended in the RoM during summer and autumn. The drying conditions are expected to characterize all country regions. The ensemble projections forced by SSP5-8.5 scenario project the greatest summer rainfall reduction by 27.7% in Southern and the lowest one by 19.5% in Northern AEZs.

Table 5-14: Projected CMIP6 22 GCMs Ensemble Annual and Seasons Mean Precipitation Changes, (%) Presented for Three 20 Year Time Periods in the Future (2021–2040, 2041–2060 and 2081–2100) for SSP1-2.6, SSP2-4.5, and SSP5-8.5 Scenarios, Relative to the 1995–2014 Climatological Baseline Period

Season	Average (1995-2014)	Scenario	Projected change by 2040	Projected change by 2060	Projected change by 2100
Northern AEZ					
Annual	647.76	SSP126	2.9	3.4	4.3
		SSP245	3.5	0.9	1.4
		SSP585	3.3	-0.9	-4.2
DJF	101.8	SSP126	6.7	8.1	10.3
		SSP245	3.4	4.7	14.4
		SSP585	5.6	10.1	19.4
MAM	139.87	SSP126	7.2	7.0	10.7
		SSP245	6.8	7.0	10.5
		SSP585	6.4	6.7	9.8
JJA	267.4	SSP126	1.3	0.4	0.3
		SSP245	2.9	-4.1	-5.9
		SSP585	1.7	-9.0	-19.5
SON	138.69	SSP126	-1.1	2.2	0.9
		SSP245	1.5	1.9	-3.2
		SSP585	1.8	-1.1	-5.9
Central AEZ					
Annual	565.15	SSP126	2.4	3.7	4.5
		SSP245	2.6	0.6	1.2
		SSP585	4.3	-2.6	-6.9
DJF	120.64	SSP126	7.0	8.7	11.8
		SSP245	4.3	3.7	14.6
		SSP585	5.8	9.7	13.8
MAM	121.27	SSP126	4.2	3.7	9.1
		SSP245	5.9	3.7	10.2
		SSP585	7.8	4.3	4.5
JJA	176.18	SSP126	2.1	-0.1	-1.4
		SSP245	1.0	-4.2	-10.9
		SSP585	3.7	-11.6	-26.0
SON	147.06	SSP126	-2.7	4.2	1.9
		SSP245	0.2	1.2	-2.6
		SSP585	1.0	-7.6	-9.5
Southern AEZ					
Annual	527.3	SSP126	2.6	3.2	4.0
		SSP245	3.3	-0.1	-2.2
		SSP585	4.8	-3.5	-11.0
DJF	96.8	SSP126	8.4	8.7	11.7
		SSP245	3.9	1.3	12.2
		SSP585	6.1	7.6	8.7
MAM	111.5	SSP126	4.6	4.3	8.6
		SSP245	6.9	1.6	9.2
		SSP585	7.4	2.8	0.6
JJA	180.9	SSP126	2.6	-0.5	-1.4
		SSP245	1.8	-1.6	-12.3
		SSP585	3.8	-9.8	-27.7
SON	138.1	SSP126	-3.3	3.2	2.1
		SSP245	1.8	-0.6	-8.1
		SSP585	3.2	-8.1	-12.2

The pattern for ensemble projection forced by SSP2-4.5 scenario is quite similar but the magnitude of changes is lower decreasing from 5.9% to 12.3% with maximum seen again over Southern and the minimum one over Northern AEZs, relative to the 1995-2014 reference time period by the 2081-2100.

5.2.3. Elaboration CMIP6 GCMs climate change projections for RoM using daily data

5.2.3.1. Projections of Future Changes in Annual and Seasonal Temperatures

The Figure 5-16, illustrate the temporal evolution over 1961-2100 years of annual mean air temperature throughout the RoM for 6 individual CMIP6 GCMs, the historical time period (black), and future time period SSP1-2.6 (blue), and

SSP5-8.5 (red) scenarios with multi-model range envelope (grey, blue, and pink shaded areas) for three RoM's AEZs: Northern (left), Central (middle), and Southern (right) mean, maximum and minimum of models spread over 1961-2100 years. Warming trends is observed in annual mean air temperature, for three RoM's AEZs, with larger increases under SSP5-8.5, and lower under SSP1-2.6 scenarios.

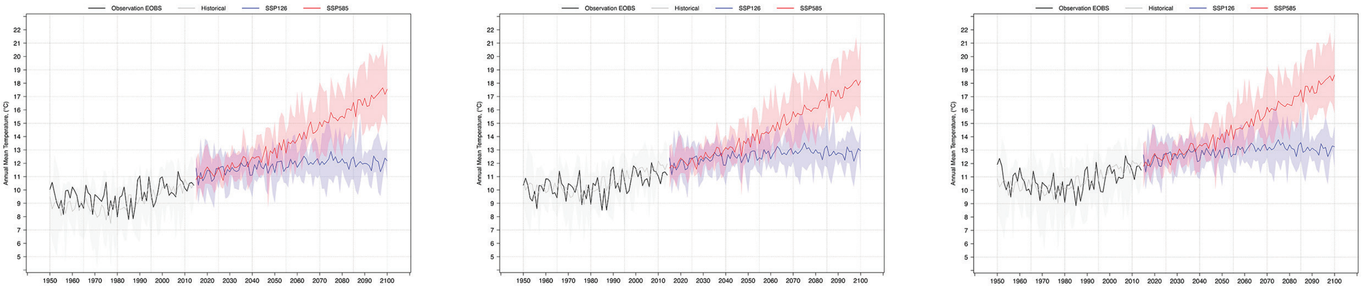


Figure 5-16: Averaged projected time-series (and uncertainty) from 1961 to 2100 for annual mean air temperature: historical time period (black), and future time period SSP1-2.6 (blue), and SSP5-8.5 (red) scenarios with multi-model range envelope (grey, blue, and pink shaded areas) for three Republic of Moldova's AEZs: Northern (left), Central (middle), and Southern (right).

The two analyzed SSPs project similar temperature in the near-term decades by +1.1-1.5°C in the RoM's AEZs. Only beginning around the 2060s the SSPs scenarios produce temperature patterns that are distinguishable from each other. This is due to both the large inertia of the climate system; it takes centuries for the full climate effects of greenhouse gas emissions to be felt and due to the fact that it takes time for the different emissions scenarios to produce large differences in greenhouse gas concentrations.

Annual changes for temperatures will be very homogeneous over the RoM's AEZs, according to CMIP6 6 GCMs ensembles. By the 2100s, the rate of warming will be higher under SSP5-8.5, from +6.2°C in Northern AEZ to +6.4°C in Southern AEZ, and smaller under the SSP1-2.6 scenarios, average would be +1.6-1.9°C, respectively, (see more in Table 5-15, Figure 5-17).

All CMIP6 6 GCM models used agree that for the three future periods (2021–2040, 2041–2060 and 2081–2100) there will be an increase of the mean winter temperature, with respect to the 1995–2014 baseline period. As it was expected, the magnitude of the positive found differences is increasing with increasing greenhouse gas forcing. It can be seen that the temperature rise will be larger over Northern parts of the country. The warming would be higher during winter up to +6.6°C in Northern, and +6.3°C in Central, and Southern AEZ's according to the SSP5-8.5 scenario by the 2100s. While the SSP1-2.6 scenario reveals less intense warming over the RoM's AEZs by +2.1-2.2°C, (Table 5-15, Figure 5-18).

Table 5-15: Projected CMIP6 6 GCMs Ensemble Annual and Seasons Mean Air Temperature Changes (ΔT, °C) Presented for Three 20 Year Time Periods in the Future (2021–2040, 2041–2060 and 2081–2100) for SSP126, and SSP585,[251] Relative to the 1995–2014 Climatological Baseline Period

Season	Scenario	Projected change by 2040	Projected change by 2060	Projected change by 2100
		Northern AEZ		
Annual	SSP1-2.6	1.1	1.4	1.6
	SSP5-8.5	1.3	2.6	6.2
DJF	SSP1-2.6	1.3	1.8	2.2
	SSP5-8.5	1.7	3.0	6.6
MAM	SSP1-2.6	0.9	1.1	1.3
	SSP5-8.5	0.8	1.8	4.8
JJA	SSP1-2.6	1.6	2.1	2.2
	SSP5-8.5	1.9	3.6	8.1
SON	SSP1-2.6	1.4	1.7	1.7
	SSP5-8.5	1.8	2.9	6.5
		Central AEZ		
Annual	SSP1-2.6	1.3	1.6	1.8
	SSP5-8.5	1.5	2.7	6.3
DJF	SSP1-2.6	1.3	1.8	2.1
	SSP5-8.5	1.6	2.9	6.3
MAM	SSP1-2.6	0.9	1.1	1.3
	SSP5-8.5	0.9	1.8	4.8
JJA	SSP1-2.6	1.6	2.1	2.2
	SSP5-8.5	1.9	3.5	8.0
SON	SSP1-2.6	1.4	1.6	1.7
	SSP5-8.5	1.8	2.8	6.4
		Southern AEZ		
Annual	SSP1-2.6	1.4	1.7	1.9
	SSP5-8.5	1.3	2.9	6.4
DJF	SSP1-2.6	1.6	1.7	2.1
	SSP5-8.5	1.6	2.9	6.3
MAM	SSP1-2.6	0.9	1.1	1.3
	SSP5-8.5	0.9	1.9	4.9
JJA	SSP1-2.6	1.6	2.0	2.1
	SSP5-8.5	1.9	3.5	8.0
SON	SSP1-2.6	1.4	1.6	1.6
	SSP5-8.5	1.7	2.8	6.4

[251] Each ScenarioMIP simulation in CMIP6 is made under a combination of an RCP and a Shared Socio-economic Pathway (SSP), outlined in Meinshausen et al. (2019), named for the SSP value then the RCP value. The RCPs, defined by the magnitude of enhanced radiative forcing at 2100 contain the same values as for CMIP5 but include some new ones: 1.9, 2.6, 3.4, 4.5, 6.0, 7.0 and 8.5 W m^{-2}. The five SSPs are summarized by the narrative headlines: **SSP1** - Sustainability: taking the green road; **SSP2** – Middle of the road; **SSP3** – Regional rivalry: a rocky road; **SSP4** – Inequality: a road divided; and **SSP5** – Fossil-fueled development: taking the highway.

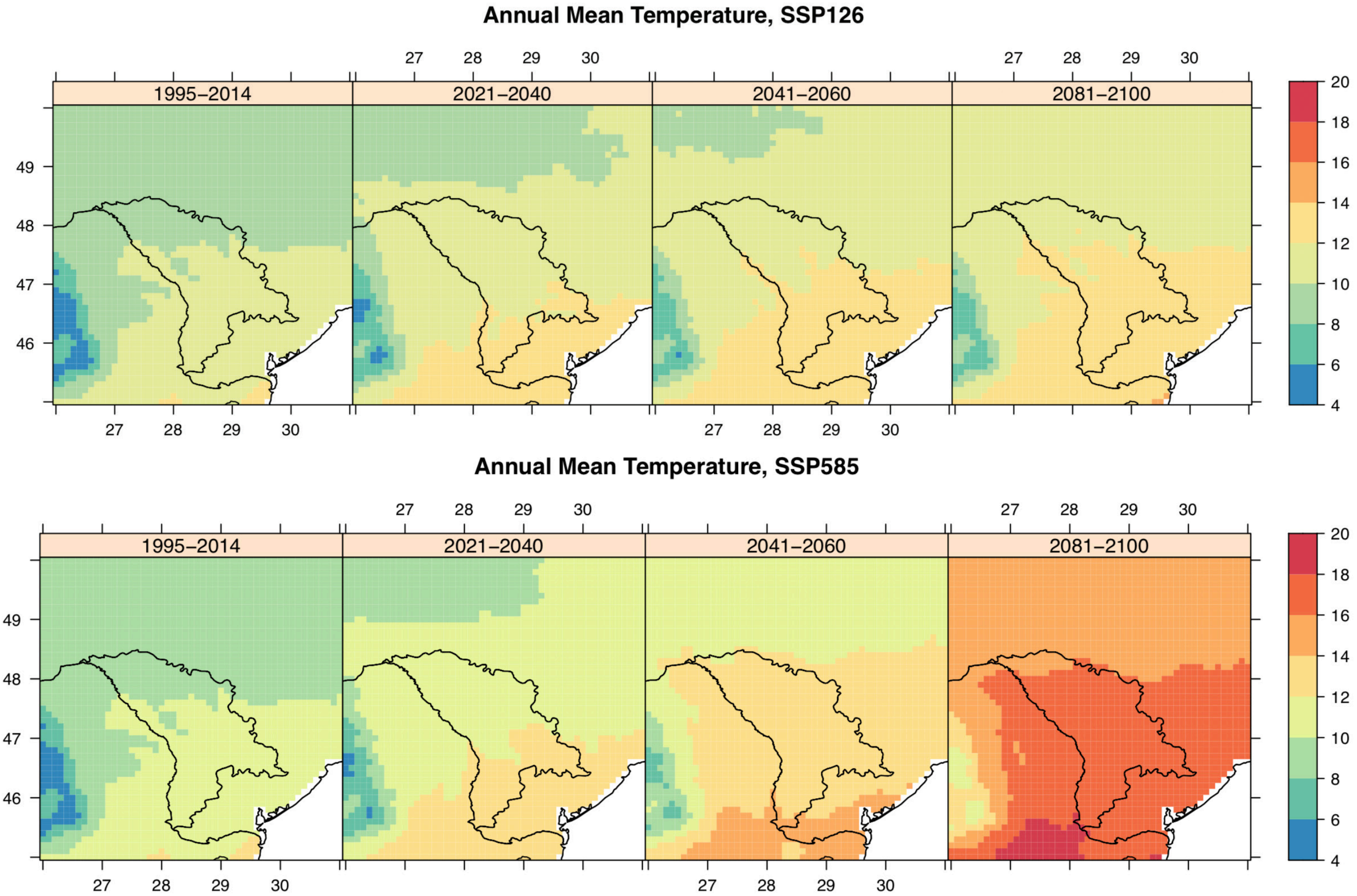


Figure 5-17: CMIP6 6 GCMs Ensemble Projections for Annual Mean Temperature, 1995-2014 Reference Period.

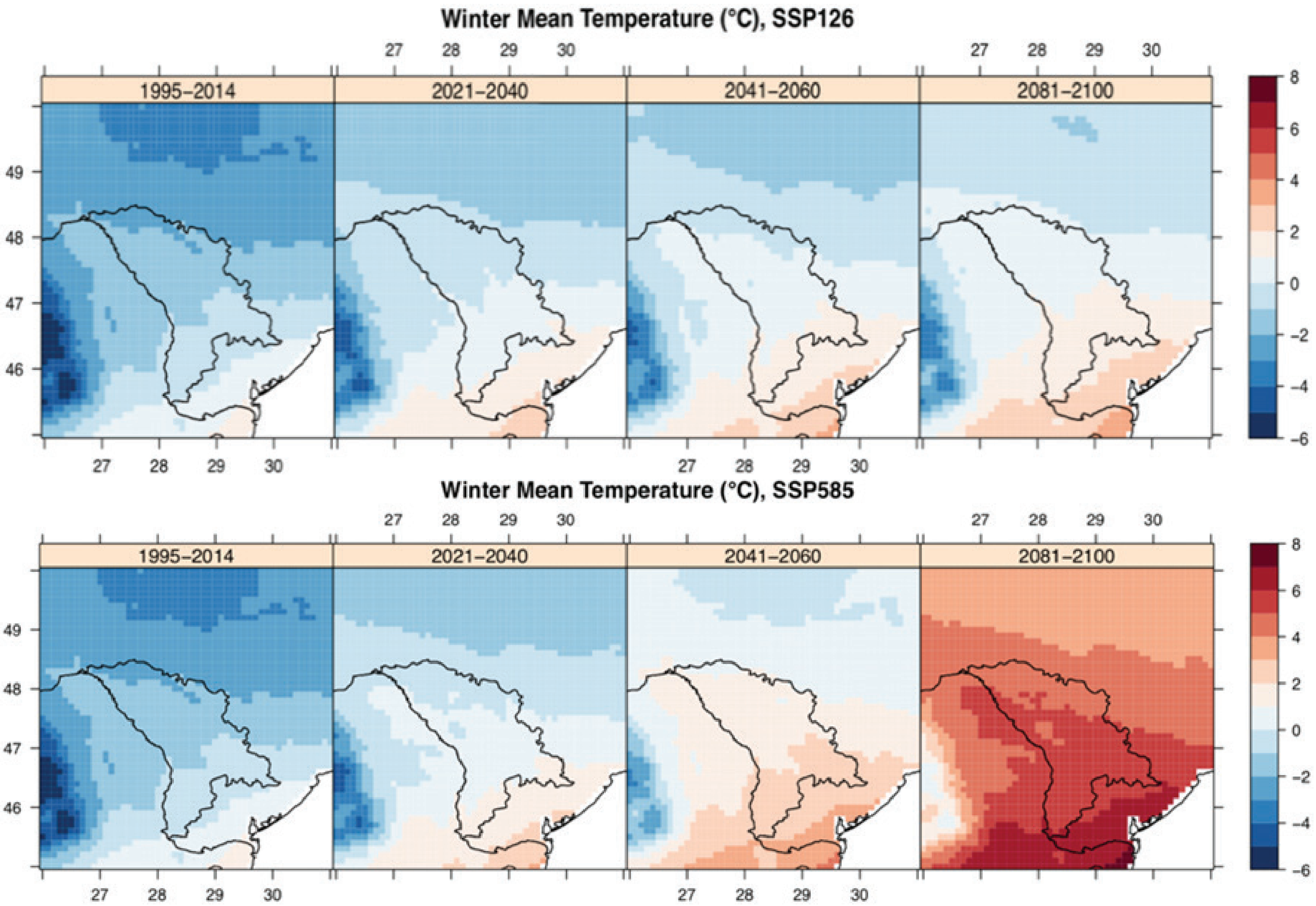


Figure 5-18: CMIP6 6 GCMs Ensemble Projections for Winter Mean Temperature, 1995-2014 Reference Period.

The summer warming is found to be even higher than in winter, but the spatial distribution of the changes is quite different. The strongest temperature rise occurs over Southern and Central AEZs. The ensemble, driven by SSP5-8.5 scenario, estimates that the RoM's AEZs will experience the most significant warming during summer from +8.1°C in Northern to +8.0°C in Southern AEZ's by 2100, comparative to 1995-2014 reference period. The pattern of change derived from the SSP1-2.6 scenario is quite similar, but the magnitude of change is lower by +2.2-2.1°C, (Figure 5-19).

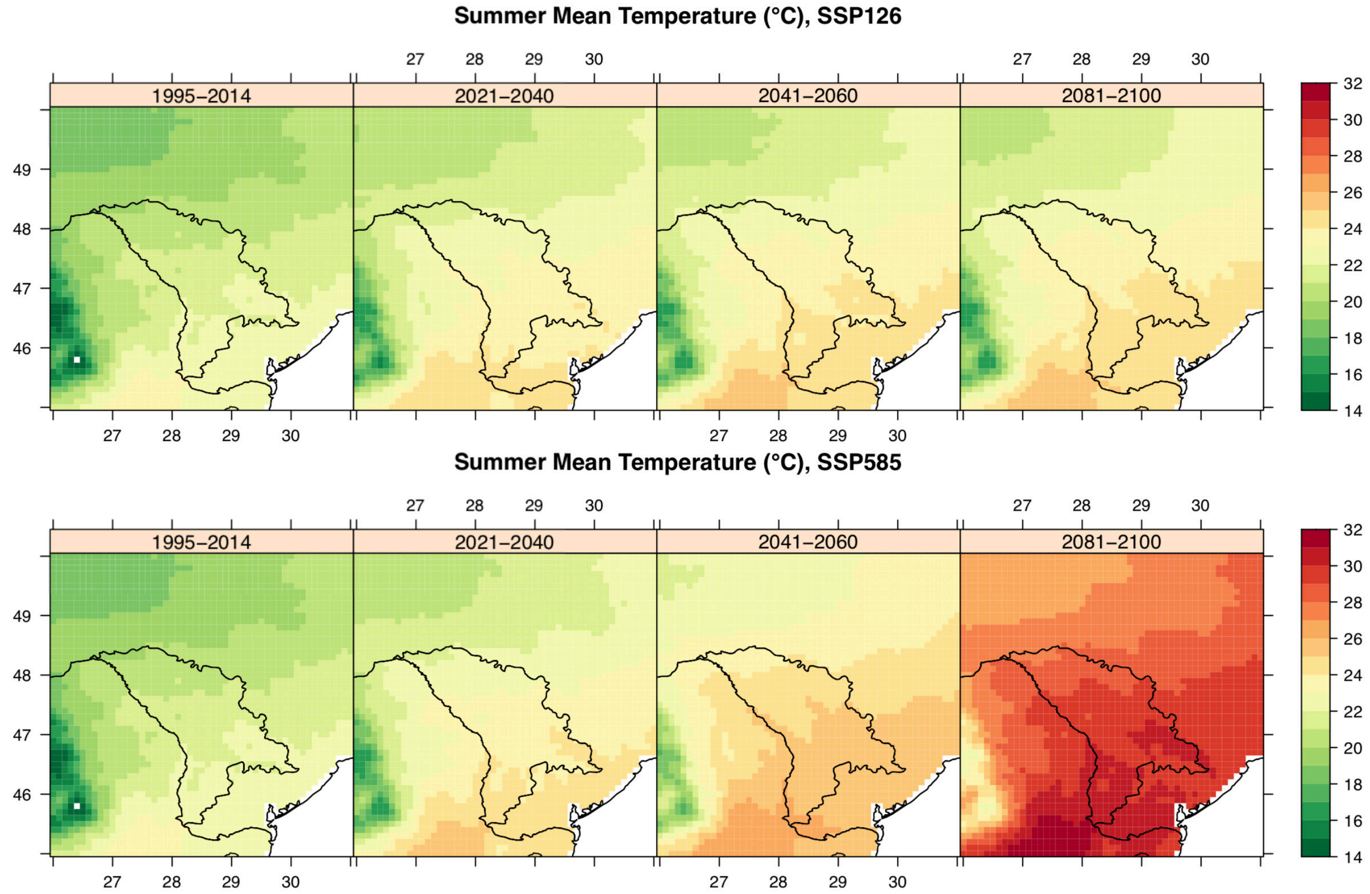


Figure 5-19: CMIP6 6 GCMs Ensemble Projections for Summer Mean Temperature, 1995-2014 Reference Period.

5.2.3.2. Projections of Future Changes in Annual and Seasonal Precipitation

The Figure 5-20, illustrate the temporal evolution over 1961-2100 years of annual precipitation throughout the RoM for 6 individual CMIP6 GCMs, the historical time period (black), and future time period SSP1-2.6 (blue), and SSP5-8.5 (red) scenarios with multi-model range envelope (grey, blue, and pink shaded areas) for three RoM's AEZs: Northern (left), Central (middle), and Southern (right) mean, maximum and minimum of models spread over 1961-2100 years. The slight decreasing trends is observed in annual precipitation, for three RoM's AEZs, with larger decreases under SSP5-8.5, and lower under SSP1-2.6 scenarios.

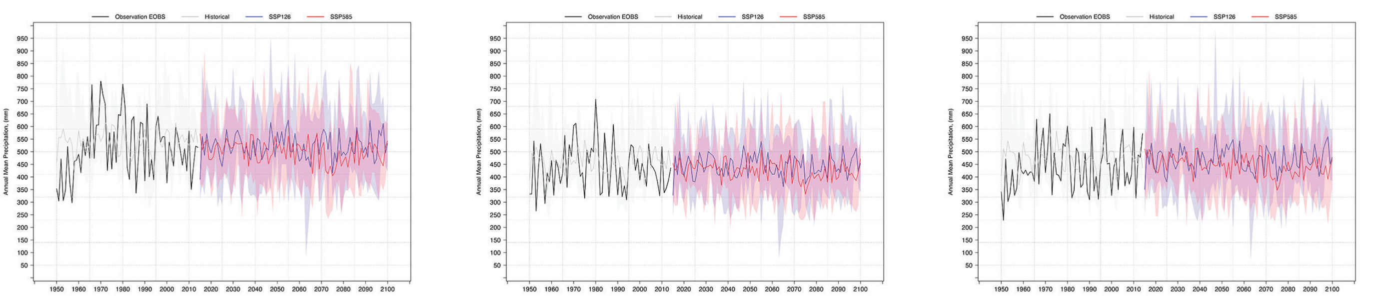


Figure 5-20: Averaged projected time-series (and uncertainty) from 1961 to 2100 for annual precipitation: historical time period (black), and future time period SSP1-2.6 (blue), and SSP5-8.5 (red) scenarios with multi-model range envelope (grey, blue, and pink shaded areas) for three Republic of Moldova's AEZs: Northern (left), Central (middle), and Southern (right).

The studied SSPs scenarios project the slight annual precipitation decrease from 1.9-2.2% in Northern to 2.5-2.9% over Southern AEZs by 2021-2040 time period, comparative to 1995-2014 reference period. Annual changes for precipitation became much more differentiated over the RoM's AEZs by the 2100. The CMIP6 6 GCM multi-model ensemble projections from the SSP5-8.5 scenario show that the RoM's AEZs would exhibit a general annual decrease in precipitation varying from 10.3% in Northern to 13.7% to Southern AEZs (see more in Table 5-16; Figure 5-21).

Table 5-16: Projected CMIP6 6 GCMs Ensemble Annual and Seasons Mean Precipitation Changes, (%) Presented for Three 20 Year Time Periods in the Future (2021–2040, 2041–2060 and 2081–2100) for SSP1-2.6, and SSP5-8.5, Relative to the 1995–2014 Climatological Baseline Period

Season	Scenario	Projected change by 2040	Projected change by 2060	Projected change by 2100
Northern AEZ				
Annual	SSP126	-1.9	-0.3	-0.6
	SSP585	-2.2	-7.6	-10.3
DJF	SSP126	0.8	4.7	0.7
	SSP585	-2.1	6.4	13.3
MAM	SSP126	3.5	3.2	4.8
	SSP585	5.7	2.7	7.9
JJA	SSP126	-1.7	-5.4	-2.6
	SSP585	-1.9	-14.3	-30.2
SON	SSP126	-9	-0.4	-3.5
	SSP585	-9.3	-19	-18.7
Central AEZ				
Annual	SSP126	-0.4	1.8	0.6
	SSP585	-1.3	-6.2	-9.7
DJF	SSP126	0.8	3.5	0.0
	SSP585	-2.3	5.4	8.8
MAM	SSP126	1.0	3.1	3.9
	SSP585	4.8	1.7	4.1
JJA	SSP126	2.3	-2.4	-0.7
	SSP585	-1.4	-9.7	-21.8
SON	SSP126	-5.5	3.6	-0.4
	SSP585	-5.5	-19	-18.5
Southern AEZ				
Annual	SSP126	-2.5	0.6	-0.2
	SSP585	-2.9	-8.5	-13.7
DJF	SSP126	-1.6	1.7	-0.3
	SSP585	-3.8	3.6	2.4
MAM	SSP126	-2.6	0.4	4.3
	SSP585	2.3	-0.9	0.4
JJA	SSP126	0.0	-3.9	-5.1
	SSP585	-1.7	-13.4	-28.5
SON	SSP126	-6	4.9	1.5
	SSP585	-8.4	-19.2	-22.3

The CMIP6 6 GCM ensemble projections from the SSP5-8.5, and SSP1-2.6 scenarios show that the RoM would exhibit a slight decrease of precipitation during winter and increase in spring. The winter precipitation decreases becomes progressively more intense towards the south, while the spring precipitation increase towards the north, during the 2021-2040 time period.

In detail, the 6 GCM ensemble projections from the SSP5-8.5 scenario show that the RoM's AEZs would exhibit a moderate winter decrease in precipitation varying from 2.1% in Northern to 3.8% in Southern AEZs. Conversely, in spring, the slight increase in precipitation is projected from 5.7% (SSP5-8.5) to 3.5% (SSP1-2.6) across Northern and from 1.0% (SSP1-2.6) to 4.8% (SSP5-8.5) across Central AEZs, relative to the reference time period 1995-2014.

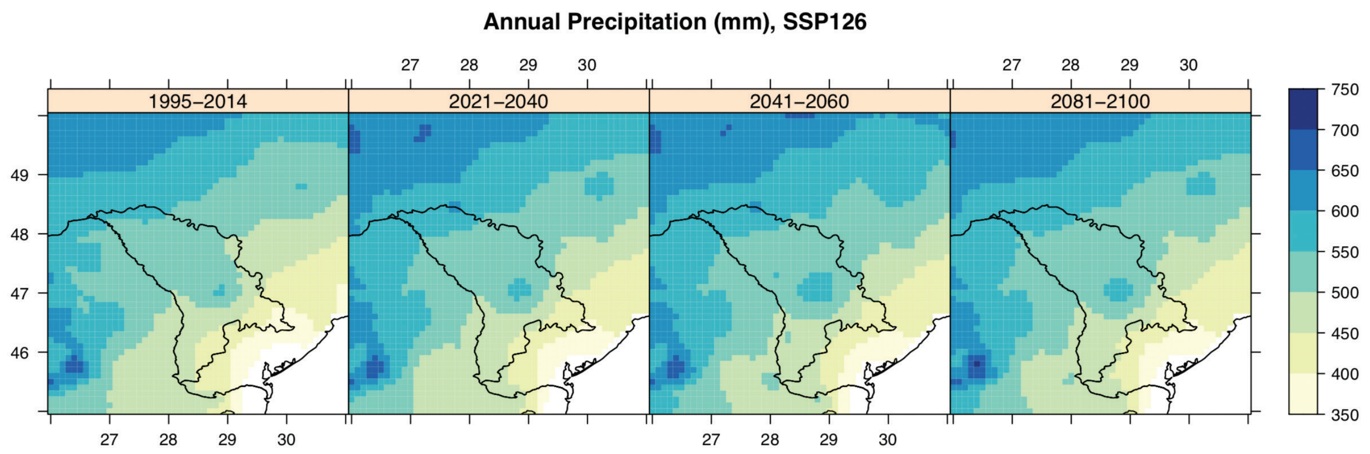
Winters are estimated to be wetter in the RoM by the end of the 21st century, the 6 GCM ensemble projections forced by the SSP5-8.5 scenario show the largest increase in winter precipitation from 13.3% (SSP5-8.5) over Northern and the lowest one 2.4% in Southern parts of the country by 2100, while there are not changes projected in winter precipitation according to SSP1-2.6 scenario, in comparison to the 1995 - 2014 reference time period (Figure 5-22).

In spring, the slight increase in precipitation is projected from 4.8% (SSP1-2.6) to 7.9 % (SSP5-8.5) across Northern, from 3.9% (SSP1-2.6) to 4.1% (SSP5-8.5) in Central, and by 4.3% (SSP1-2.6) across Southern AEZs, relative to the reference time period 1995-2014, (Table 5-16).

The ensemble averages for new SSPs scenarios agree that the precipitation reduction will be much more extended in the Republic of Moldova during summer and autumn. The drying conditions are expected to characterize all country regions by the 2081-2100 time period.

The 6 GCM ensemble projections forced by SSP5-8.5 scenario project the greatest summer rainfall reduction by 30.2% in Northern, and 28.5% in Southern, and the lowest one by 21.8% in Central AEZs. The pattern for ensemble projection forced by SSP1-2.6 scenario is different the magnitude of changes in summer rainfall reduction is lower from 2.6% in Northern to 5.1% over Southern, with minimum one by 0.7% over Central AEZs, relative to the 1995 - 2014 reference time period (Figure 5-23).

In autumn, the decrease in precipitation is projected from 3.5% (SSP1-2.6) to 18.7% (SSP5-8.5) across Northern, from 0.4% (SSP1-2.6) to 18.5% (SSP5-8.5) in Central, and by 22.3% (SSP5-8.5) across Southern AEZs, relative to the reference time period 1995-2014, (Table 5-16).



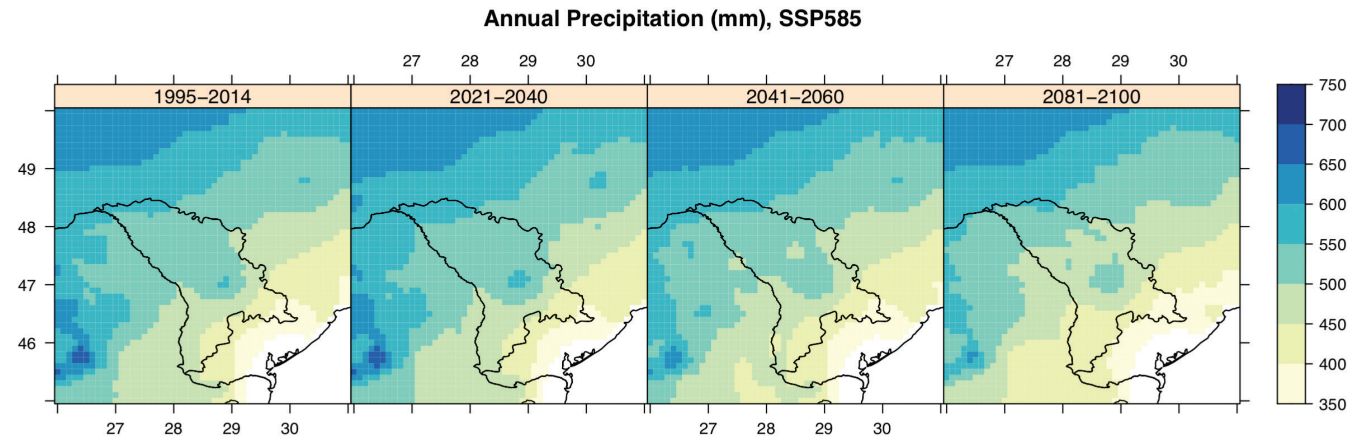


Figure 5-21: CMIP6 6 GCMs Ensemble Projections for Annual Mean Precipitation, 1995-2014 Reference Period.

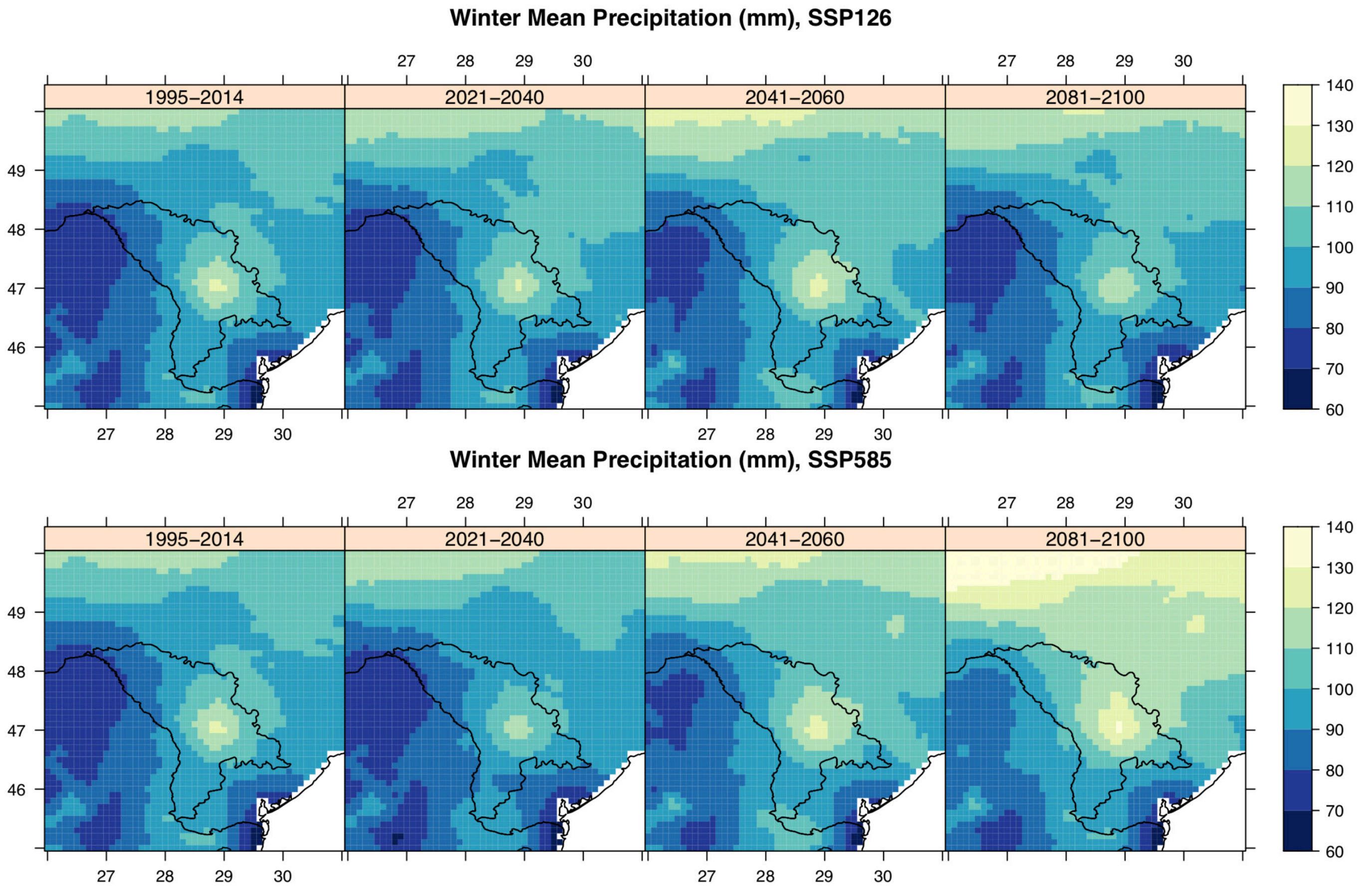
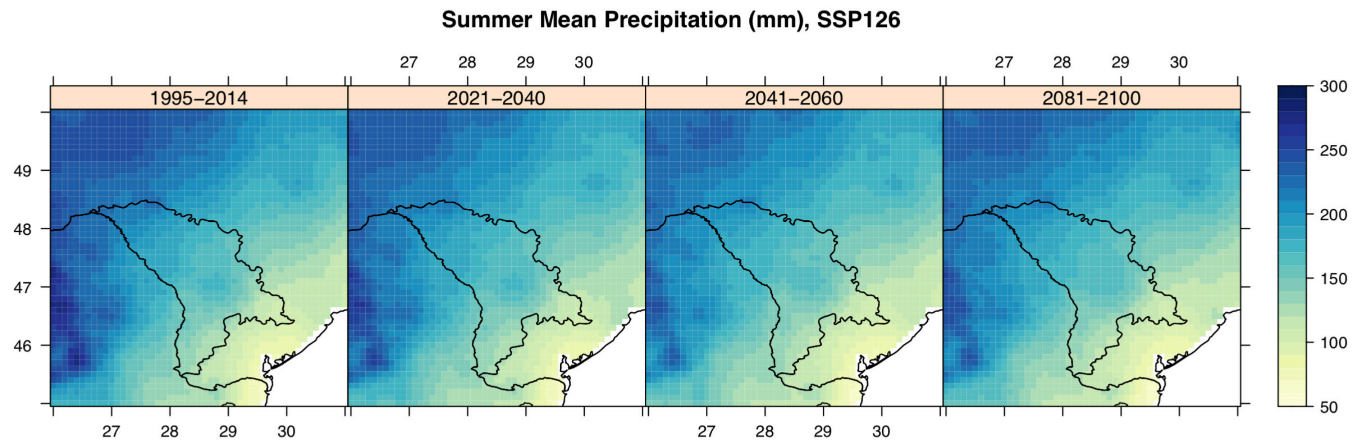


Figure 5-22: CMIP6 6 GCMs Ensemble Projections for Winter Mean Precipitation, 1995-2014 Reference Period.



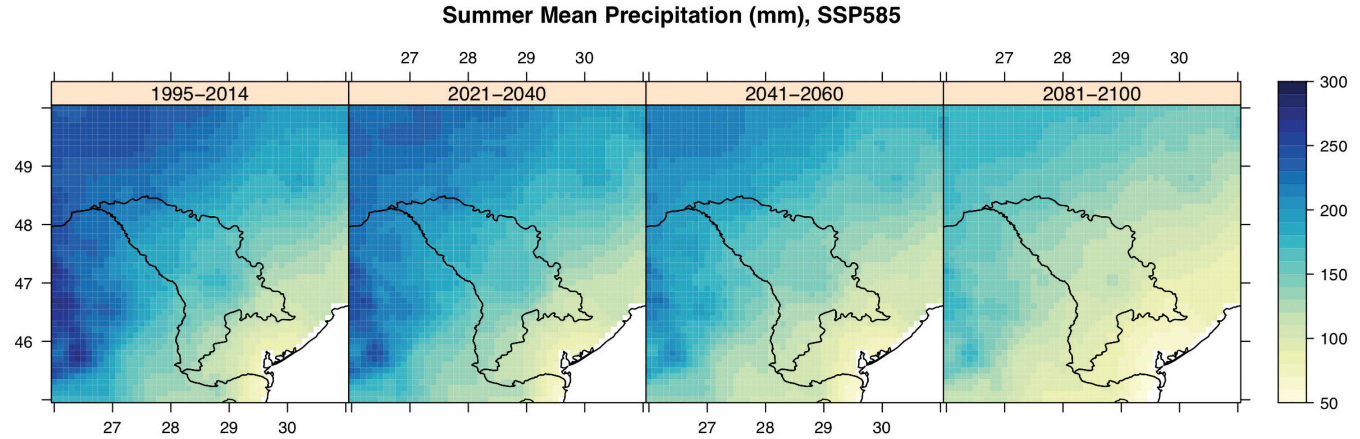


Figure 5-23: CMIP6 6 GCMs Ensemble Projections for Summer Mean Precipitation, 1995-2014 Reference Period.

5.2.4. Projections of Future Changes in Temperature and Precipitation Extreme Events

One of the main objectives that the RoM have for preparation of the NC5 to the UNFCCC (2022) is to assess and evaluate the vulnerability and impact of climate change. In order to do so, it is required to assess the observed and future climate change over the territory of RoM. This means to analyze the change in air temperature and level of precipitations between the base period and future projections. In order to do so, the output data for different scenarios of Coupled Model Intercomparison Project Phase 6 (CMIP6) is used for modelling of future climate change projections. At the same time, observation data of E-OBS datasets (European Ensemble observational gridded dataset)[252] are used to assess the climate of the past (historical) for the base (reference) period.

5.2.4.1. Data and Methods

Climate extremes indices have been calculated from daily precipitation and daily minimum and maximum temperatures using the Climpactv2 software (https://climpact-sci.org/get-started/)[253] for both observed data and CMIP6 GCM models.

These indices describe different aspects of precipitation and temperature extremes. Fewer CMIP6 GCM model outputs as a rule are available at the daily compared to the monthly scale, so only 6 CMIP6 models (GFDL-ESM4, NESM3, MPI-ESM1-2-LR, CNRM-ESM2-1, CNRM-CM6-1, and INM-CM5-0) were used in our study for calculation of climate extreme indices. Except for observational stations data, all GCMs' outputs are downloaded from esgf-node. Gridded observation data sets (E-OBS datafiles) are downloaded from Copernicus EU[254], and historical observation stations data are provided by the State Hydrometeorological Service.

5.2.4.2. Projections of Future Changes in Temperature Extremes Indices by the CMIP6 Multimodel Ensemble

5.2.4.2.1. Changes in Absolute and Threshold Indices

The annual minimum daily minimum temperature (TNn), for baseline climate 1995-2014 has been varied in average from -21.1°C (with min -28.0°C in 2006) in the north to -17.5°C (with min -22.7°C in 2006) in the south of the country. While the annual maximum daily maximum temperature (TXx) has been varied in average from +33.8°C (with max +37.4°C in 2012) in the north to +36.1°C (with max +39.4°C in 2007) in the south of the country.

[252] https://surfobs.climate.copernicus.eu/dataaccess/access_eobs.php#datafiles

[253] We acknowledge the World Meteorological Organization (WMO), the International Expert Team on Sector-specific Climate Indices (ET-SCI) that participated in elaborated the ClimPact2 tool: Lisa Alexander, Nicholas Herold, James Goldie, Enric Aguilar, Marc Prohom, the Pacific Climate Impacts Consortium (David Bronaugh, James Hiebert), Hongang Yang, Yang Feng, et al.

[254] We acknowledge the researchers elaborated the E-OBS dataset from the EU-FP6 project UERRA (https://www.uerra.eu) and the Copernicus Climate Change Service, and the data providers in the ECA&D project (https://www.ecad.eu).

Table 5-17: CMIP6 6 GCMs ensemble projections in temperature climate extreme indices, presented for three future time periods 2021-2040, 2041-2060, and 2081-2100 under two SSP126 and SSP585 scenarios, relative to 1995-2014 climatological baseline period

Period	Scenario	fd	su	id	tr	gsl	txx	tnx	txn	tnn	tn10p	tx10p	tn90p	tx90p	wsdi	csdi	dtr
Northern AEZ																	
2021-2040	SSP126	-12.4	14.1	-9.0	8.8	8.5	1.8	1.7	2.1	2.3	-3.0	-2.8	8.5	8.3	19.5	-3.6	0.1
	SSP585	-12.6	14.6	-8.1	9.9	9.4	1.9	1.9	1.6	2.1	-3.1	-2.8	9.4	8.3	21.2	-3.1	0.1
2041-2060	SSP126	-14.1	17.2	-10.6	10.9	16.1	2.4	2.2	2.2	2.4	-2.9	-3.0	10.1	10.5	25.2	-3.2	0.3
	SSP585	-24.5	27.3	-16.6	19.2	22.6	3.8	3.4	3.7	4.4	-4.3	-4.3	17.2	16.3	45.2	-3.7	0.2
2081-2100	SSP126	-12.7	15.7	-11.4	10.6	11.9	2.0	1.9	2.3	2.8	-3.3	-3.2	9.3	8.5	18.3	-3.8	0.1
	SSP585	-58.3	56.4	-35.6	53.9	60.1	8.1	7.7	8.0	9.8	-6.1	-6.1	40.2	36.2	119.4	-4.9	0.2
Period	Scenario	fd	su	id	tr	gsl	txx	tnx	txn	tnn	tn10p	tx10p	tn90p	tx90p	wsdi	csdi	dtr
Central AEZ																	
2021-2040	SSP126	-9.9	12.8	-6.2	13.0	10.4	1.7	1.8	1.6	1.7	-2.5	-2.5	8.8	8.0	19.7	-2.7	0.1
	SSP585	-9.6	13.4	-6.0	13.2	8.5	1.8	1.8	1.3	1.3	-2.5	-2.7	8.5	7.6	19.5	-2.0	0.1
2041-2060	SSP126	-12.2	15.4	-8.8	16.3	12.6	2.2	2.0	1.8	1.7	-2.5	-2.9	10.1	10.0	24.9	-2.4	0.2
	SSP585	-20.5	24.1	-12.7	28.3	22.2	3.6	3.4	3.3	3.7	-4.0	-4.2	17.7	16.1	43.9	-2.8	0.2
2081-2100	SSP126	-10.8	14.6	-8.6	16.6	10.8	1.9	1.9	1.8	2.0	-2.9	-3.0	9.8	8.9	20.6	-2.3	0.1
	SSP585	-51.9	49.5	-27.4	65.7	61.4	7.5	7.5	7.5	9.0	-5.7	-6.0	40.5	36.6	121.9	-4.1	0.2
Period	Scenario	fd	su	id	tr	gsl	txx	tnx	txn	tnn	tn10p	tx10p	tn90p	tx90p	wsdi	csdi	dtr
Southern AEZ																	
2021-2040	SSP126	-10.8	13.9	-6.5	12.8	11.4	1.7	1.7	1.5	1.4	-2.6	-2.6	9.4	8.8	20.7	-2.2	0.1
	SSP585	-10.0	14.5	-6.8	11.7	7.3	1.7	1.7	1.0	1.2	-2.6	-2.7	9.4	8.4	22.8	-1.8	0.1
2041-2060	SSP126	-13.0	15.7	-8.9	15.9	14.7	2.1	2.0	1.6	1.7	-2.7	-2.9	10.9	10.9	28.3	-2.3	0.2
	SSP585	-20.8	24.0	-11.5	28.2	25.9	3.7	3.5	2.9	3.1	-4.0	-4.3	18.7	16.7	46.0	-2.6	0.2
2081-2100	SSP126	-11.2	15.3	-8.8	16.0	10.8	2.1	1.9	1.7	1.6	-2.8	-2.9	10.5	9.4	20.9	-2.0	0.2
	SSP585	-50.8	44.0	-24.7	64.8	60.7	7.4	7.3	6.9	8.1	-5.8	-6.1	41.8	37.6	125.7	-4.1	0.2

In short term future time period 2021-2040, the projected CMIP6 6 GCMs ensemble mean increases in TNn could be from +2.3°C in Northern to +1.4°C in Southern AEZs, and in TXx from +1.8°C in Northern to +1.7°C in Southern AEZs under SSP1-2.6, and/or from +2.1°C to +1.2°C and from +1.9°C to +1.7°C, respectively under SSP5-8.5, scenarios, comparative to 1995-2014 reference period.

In 2041-2061 time period, the tendency to increase in TNn and TXx will persist, the projected CMIP6 6 GCMs ensemble mean increases in TNn will be from +2.4°C in Northern to +1.7°C in Southern AEZs and in TXx from +2.4°C in Northern to +2.1°C in Southern AEZs under SSP1-2.6, and/or from +4.4°C to +3.1°C and from +3.8°C to +3.7°C, respectively under SSP5-8.5, scenarios.

Relative to the reference period 1995-2014, the projected CMIP6 6 GCMs ensemble mean increases by the end of the twenty-first century will be in TNn from +2.8°C in Northern to +1.6°C in Southern AEZs and TXx from +2.0°C in Northern to +2.1°C in Southern AEZs under SSP1-2.6, and/or maximum increase from +9.8°C to +8.1°C and from +8.1°C to +7.4°C, respectively under SSP5-8.5 scenarios, see more in Table 5-17; Figures 5-24, 5-25.

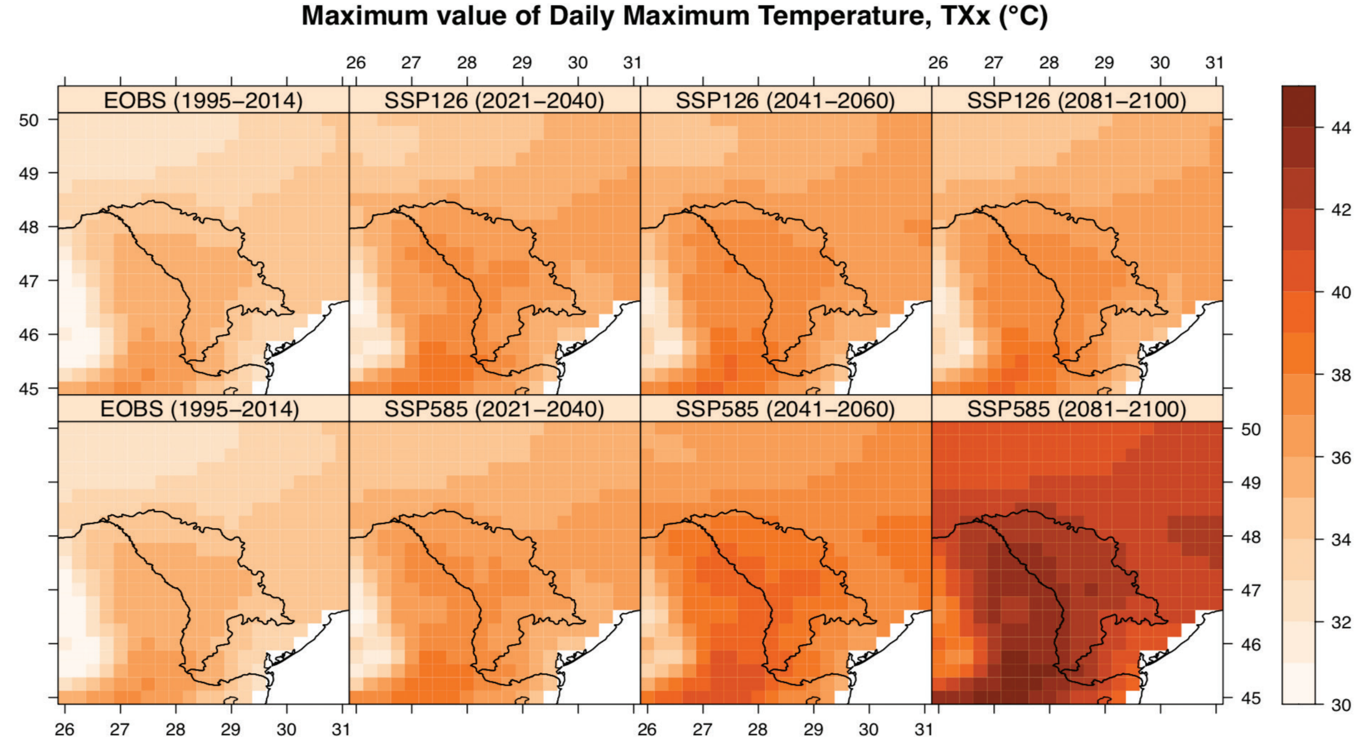


Figure 5-24: CMIP6 6 GCMs Ensemble Projections for TXx, 1995-2014 Reference Period.

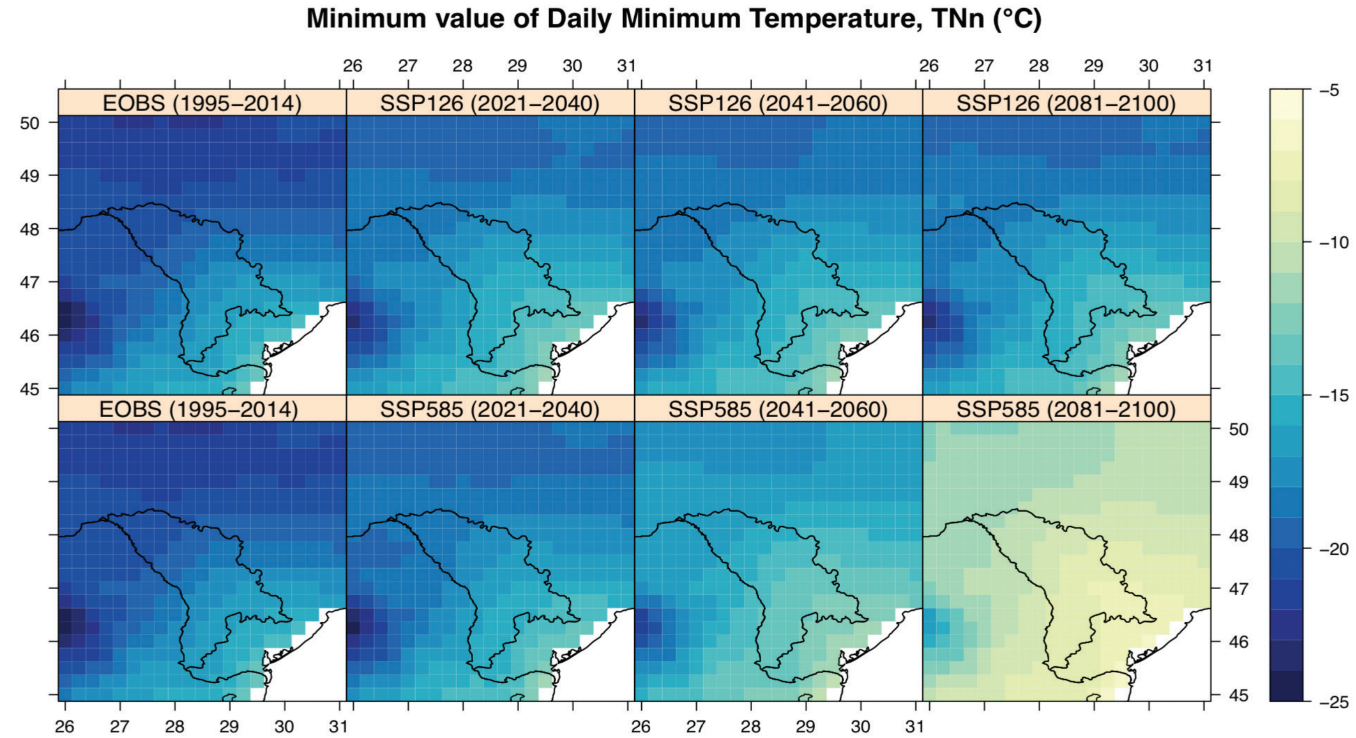


Figure 5-25: CMIP6 6 GCMs Ensemble Projections for TNn, 1995-2014 Reference Period.

Consistent changes are found in the temperature threshold indices; specially, these indices are frost days (FD) and tropical nights (TR), which are derived from daily minimum temperature, and ice days (ID) and summer days (SU), which are derived from daily maximum temperature.

The frost days (FD), for baseline climate 1995-2014 have been varied in average from 108 days (with max 131 days in 1997) in the north to 88 days (with max 109 days in 1997, and 2003) in the south of the country. While the ice days (ID) have been varied in average from 47 days (with max 84 days in 1996) in the north to 33 days (with max 72 days in 1996) in the south of the country.

The tropical nights (TR), for baseline climate 1995-2014 have been varied in average from 2 days (with max 6 days in 2010) in the north to 12 days (with max 33 days in 2012) in the south, with maximum by 14 days (with max 34 days in 2012) in center of the country. While the summer days (SU) have been varied in average from 64 days (with max 92 days in 2012) in the north to 93 days (with max 130 days in 2012) in the south of the country. Under both SSPs scenarios the decreases in FD and ID are projected, whereas increases in TR and SU are projected, with larger increases under SSP5-8.5, and lower under SSP1-2.6 scenarios.

In short term future time period 2021-2040, the projected CMIP6 6 GCMs ensemble mean decreases in FD and ID will be from 11 days in Southern up to 12 days in Northern to AEZs, and from 7 days in Southern up to 9 days in Northern AEZs, while that of TR and SU increase will be from 9 days to 13 days (with maximum in Central, and Southern AEZs) for TN and by 14-13 days for SU, respectively. Projected mean changes under SSP5-8.5 scenario are the similar than those under SSP1-2.6 scenario with a decrease of 10-13 days for FD and 6 - 8 days for ID, and an increase of 10-13 days for TR (with maximum in Central AEZ) and 13-15 days for SU, respectively, comparative to 1995-2014 reference period, see more in Table 5-17, Figures 5-26, 5-27, 5-28, and 5-29.

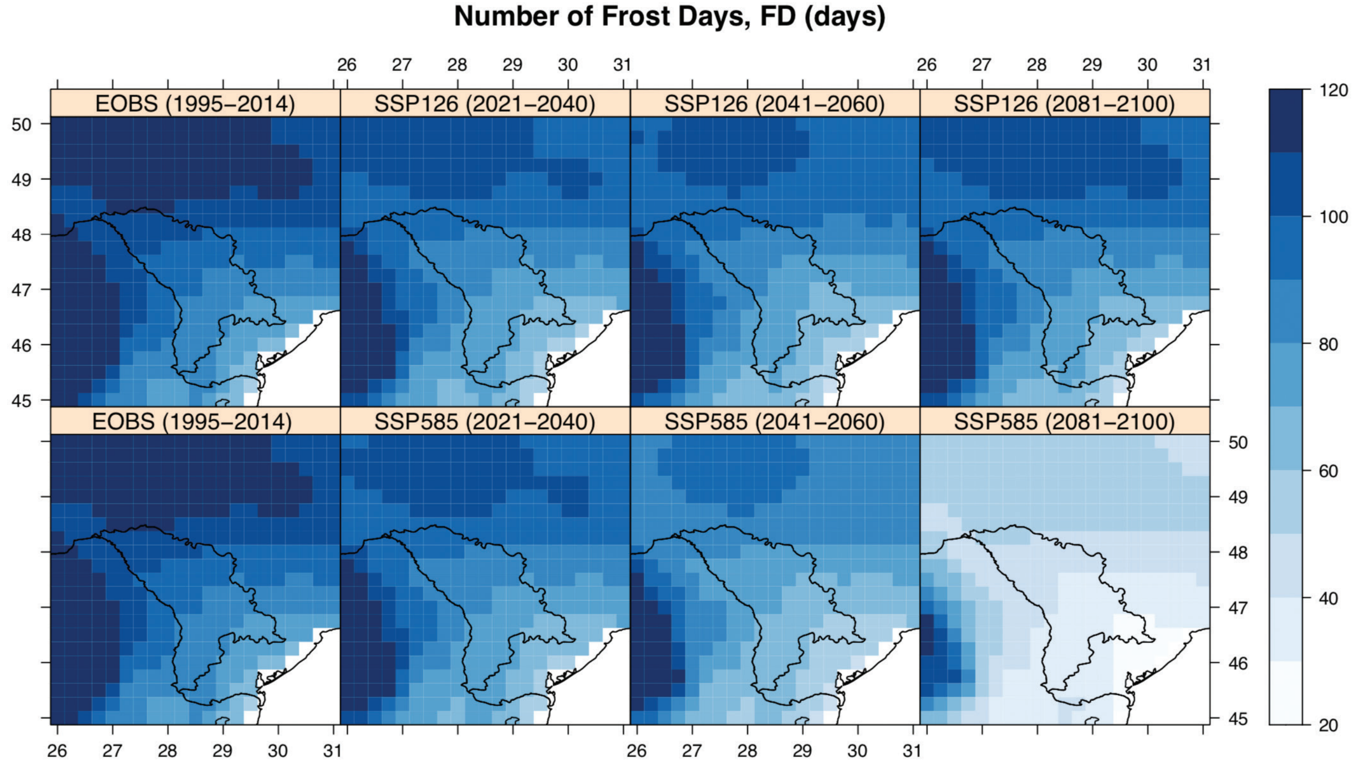


Figure 5-26: CMIP6 6 GCMs Ensemble Projections for FD, 1995-2014 reference period.

In 2041-2061 time period, the tendency to decrease in FD and ID will persist, the projected CMIP6 6 GCMs ensemble mean decrease in FD will be by 12-14 days, and in ID by 9-11 days under SSP1-2.6, and/or 20 - 25 days and 11-17 days, respectively under SSP5-8.5 scenarios.

The projected CMIP6 6 GCMs ensemble mean increase in TR could be by 11-16 days, and in SU by 15-17 days under SSP1-2.6, and/or 19-28 days and from 24-27 days, respectively under SSP5-8.5 scenarios Table 5-17, Figures 5-28, and 5-29.

By the end of the twenty-first century under SSP1-2.6 scenario, the projected ensemble mean of FD and ID decrease will be from 11 days in Southern up to 13 days in Northern to AEZs, and from 9 in Southern up to 11 in Northern AEZs, while that of TR and SU increase will be from 11 days to 17 days (with maximum in Central AEZ) for TR and by 16-15 days for SU, respectively.

Projected mean changes under SSP5-8.5 scenario are much larger than those under SSP1-2.6 scenario with a decrease of 51-58 days for FD and 25-36 days for ID, and an increase of 54-66 days for TR (with maximum in Central AEZ) and 44-56 days for SU, respectively, see more in Table 5-17, Figures 5-26, 5-27, 5-28, and 5-29.

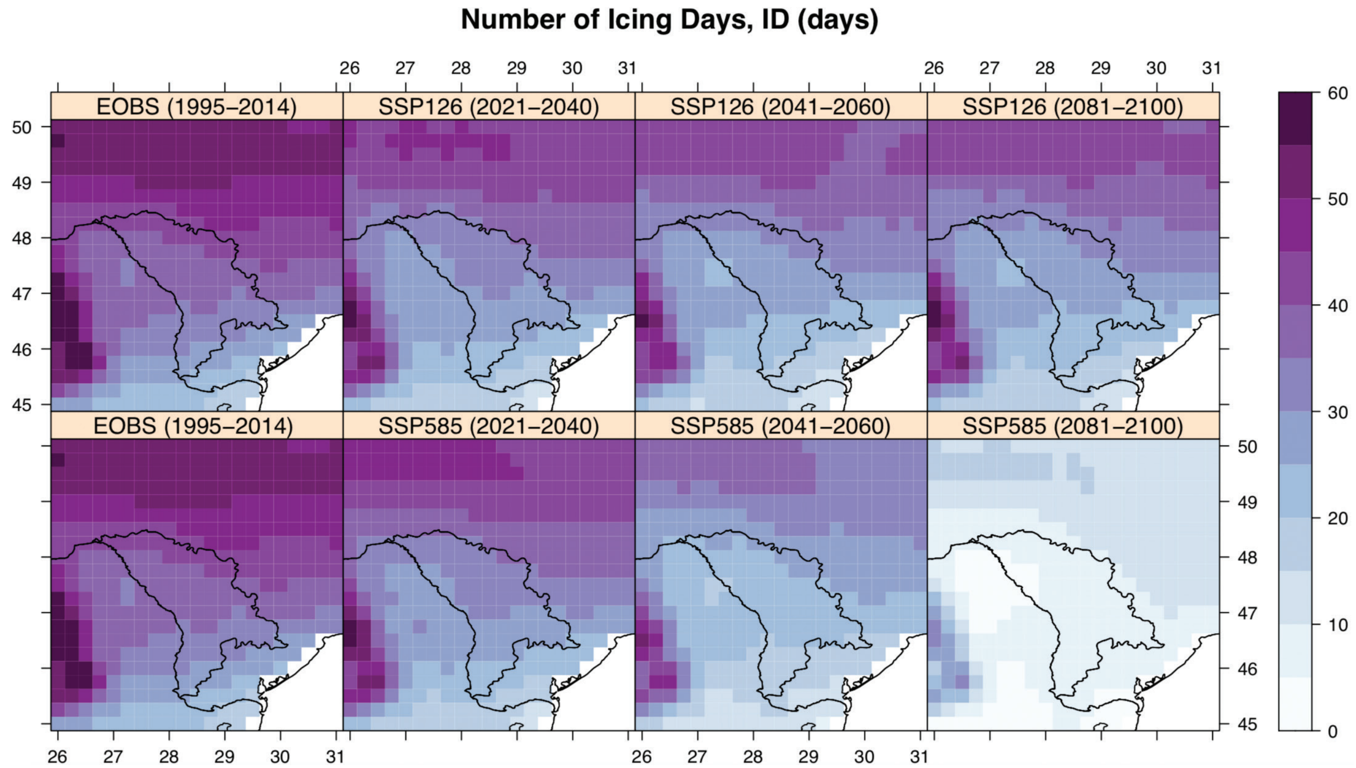


Figure 5-27: CMIP6 6 GCMs Ensemble Projections for ID, 1995-2014 Reference Period.

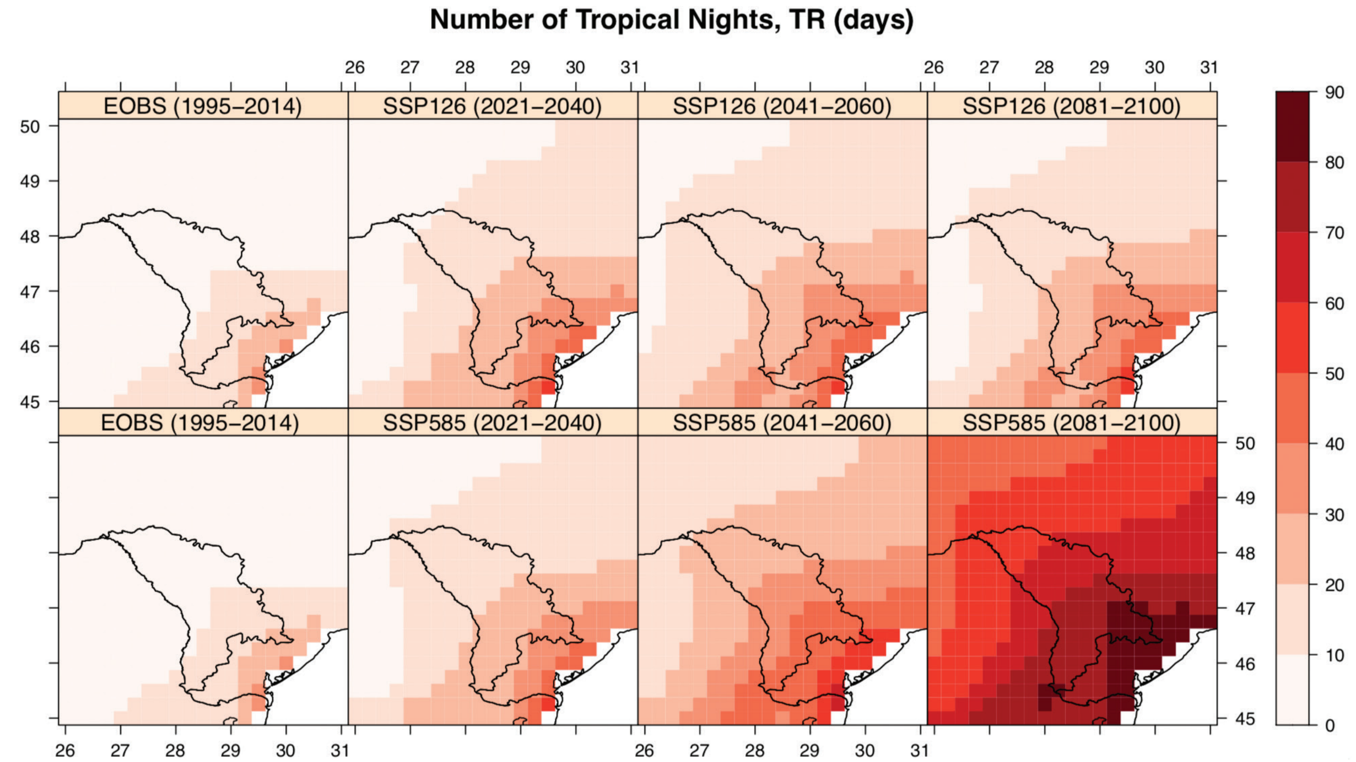


Figure 5-28: CMIP6 6 GCMs Ensemble Projections for Tropical Night (TR), 1995-2014 Reference Period

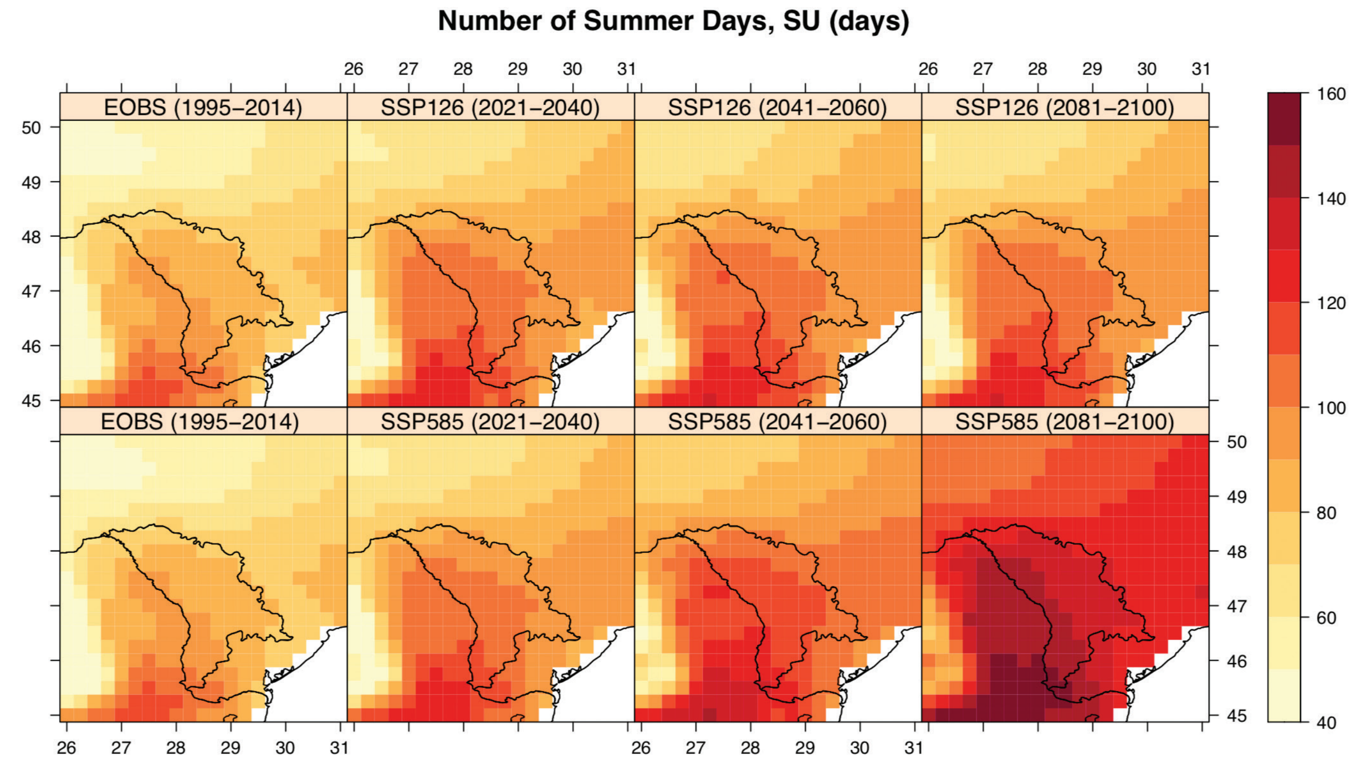


Figure 5-29: CMIP6 6 GCMs Ensemble Projections for Summer Days (SU), 1995-2014 Reference Period.

5.2.4.2.2. Changes in Duration and Percentile Indices

The annual cold spell duration index (CSDI), for baseline climate 1995-2014 has been varied in average from 7 days (with max 8 days in 1998) in the north to 8 days (with max 14 days in 2012) in the south of the country. While the warm spell duration index (WSDI) has been varied in average from 17 days (with max 52 days in 2012, and 42 days in 2007) in the north to 19 days (with max 62 days in 2012, and 60 days in 2007) in the south of the country.

In short term future time period 2021-2040, the projected CMIP6 6 GCMs ensemble mean increases in WSDI could be by 20-21 days under SSP1-2.6, and/or by 21-23 days, respectively under SSP5-8.5, scenarios, comparative to 1995-2014 reference period.

In 2041-2061 medium term time period, the tendency to increase in WSDI will persist, the projected CMIP6 6 GCMs ensemble mean increases in WSDI will be from 25 days in Northern to 28 days in Southern AEZs under SSP1-2.6, and/or by 45 - 46 days, respectively under SSP5-8.5 scenarios.

Relative to the reference period 1995-2014, the projected CMIP6 6 GCMs ensemble mean maximum increases in WSDI by the end of the twenty-first century will be from 119 days in Northern to 126 days in Southern AEZs under SSP5-8.5, and/or minimum increase by 18-21 days, respectively under SSP1-2.6 scenarios, see more in Table 5-17 and Figure 5-30.

The annual cold nights (TN10p), for baseline climate 1995-2014 have been varied in average from 5% (with max 9% in 1996) in the north to 7% (with max 14% in 1997) in the south of the country. While the annual cold days (TX10p) have been varied uniform throughout the Republic of Moldova in average by 8% (with max 18% in the north and 22% in the south of the country in 1996).

The annual warm nights (TN90p), for baseline climate 1995-2014 have been varied in average from 19% (with max 28% in 2007) in the north to 17% (with max 29% in 2012) in the south of the country. While the annual warm days (TX90p) have been varied in average from 16% (with max 26% in 2012) in the north to 17% (with max 29% in 2012) in the south of the country.

Consistent with warming and projections of the absolute and threshold temperature indices, a decrease in TN10p and TX10p, and an increase in TN90p and TX90p are projected.

In short term future time period 2021-2040, the projected CMIP6 6 GCMs ensemble mean slight decreases in TN10p and TX10p will be by 2.6–3.1% for both of SSPs scenarios, throughout the RoM AEZs, while that of TN90p and TX90p increase will be by 8.3-9.4%, respectively, comparative to 1995-2014 reference period, see more in Table 5-17; Figures 5-31, 5-32.

In 2041-2061 medium term time period, the tendency to slight decrease in TN10p and TX10p will persist, the projected CMIP6 6 GCMs ensemble mean decrease in TN10p will be by 2.5–2.9%, and in TX10p by 2.9–3.0% under SSP1-2.6, and/or 4.0–4.3% for both indices, under SSP5-8.5 scenarios, with maximum decrease in Northern AEZ.

The projected CMIP6 6 GCMs ensemble means increase in TN90p could be by 10.1–10.9%, and in TX90p by 10.5–10.9% under SSP1-2.6, and/or 17.2–18.7%, and 16.3–16.7%, respectively under SSP5-8.5 scenarios, with maximum increase in Southern AEZ.

By the end of the twenty-first century, under SSP1-2.6 scenario, the projected ensemble means of TN10p and TX10p decrease will be from 2.8-2.9% in Southern up to 3.3% in Northern to AEZs, while that of TN90p and TX90p increase will be from 9.3% to 10.5% for TN90p and by 8.5 – 9.4% for TX90p, with maximum increase in Southern AEZ.

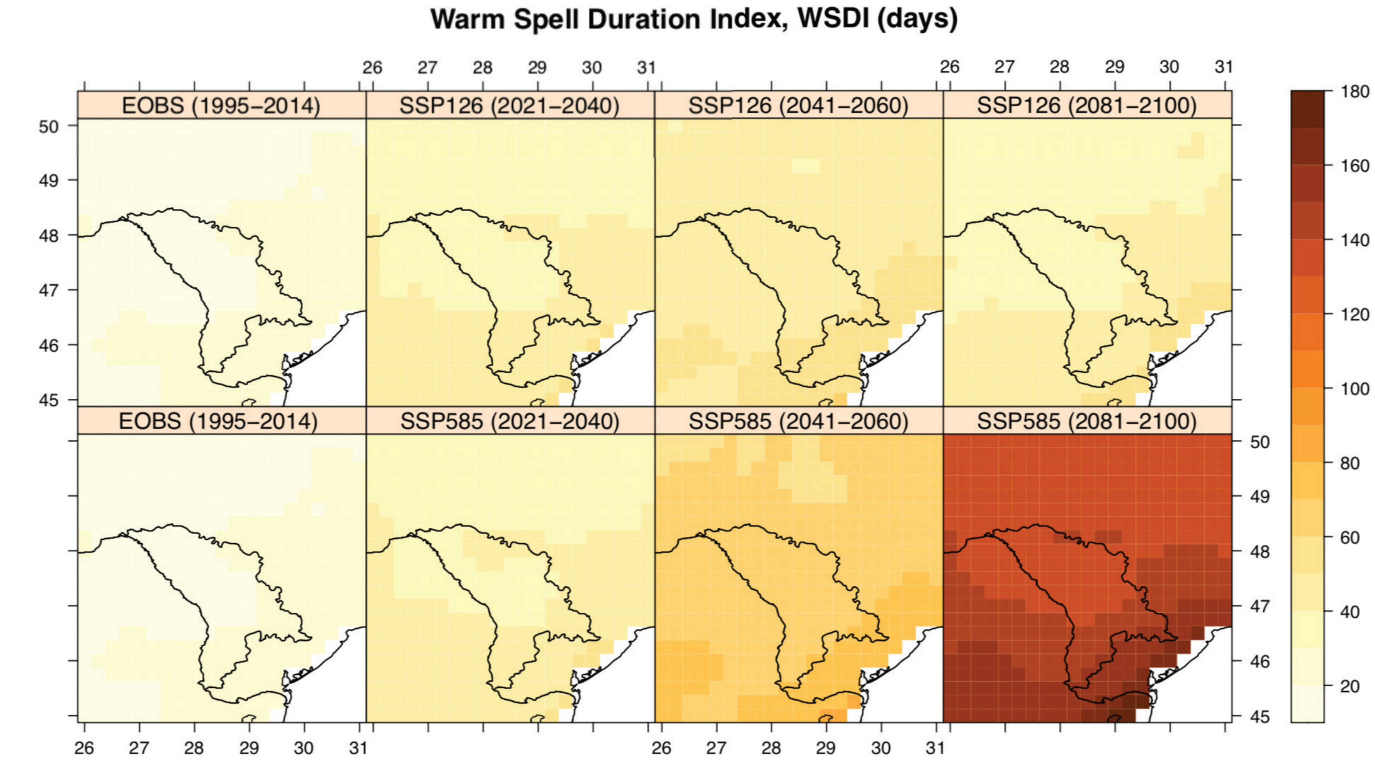


Figure 5-30: CMIP6 6 GCMs Ensemble Projections for WSDI, Days, 1995-2014 Reference Period.

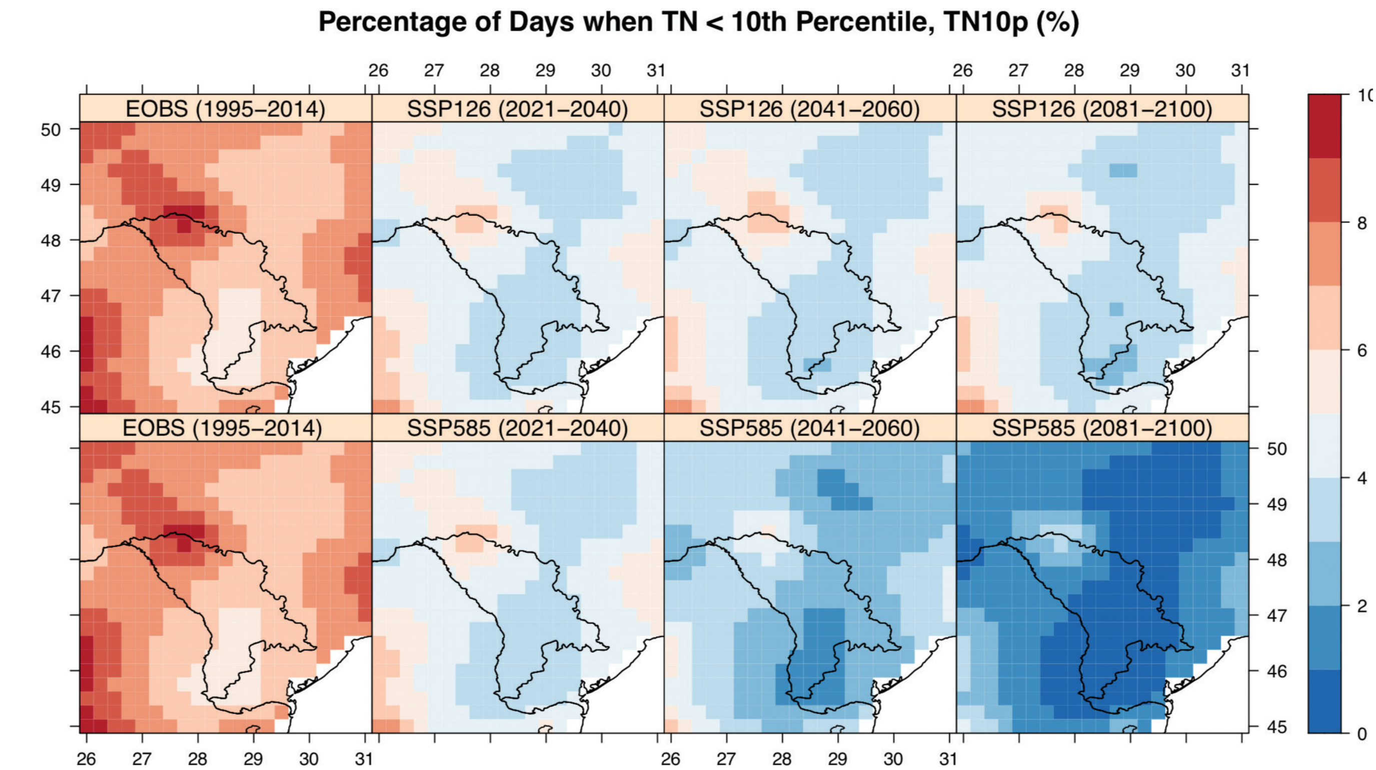


Figure 5-31: CMIP6 6 GCMs Ensemble Projections for TN10p, 1995-2014 Reference Period.

Projected mean CMIP6 6 GCMs changes under SSP5-8.5 scenario are much larger than those under SSP1-2.6 scenario with a decrease of 5.7–6.1% for TN10p and TX10p extreme indices, and an increase by 40.2–41.8% for TN90p, and of 36.2-37.6% for TX90p, with maximum increase in Southern AEZ, respectively, see more in Table 5-17; Figures 5-31, 5-32.

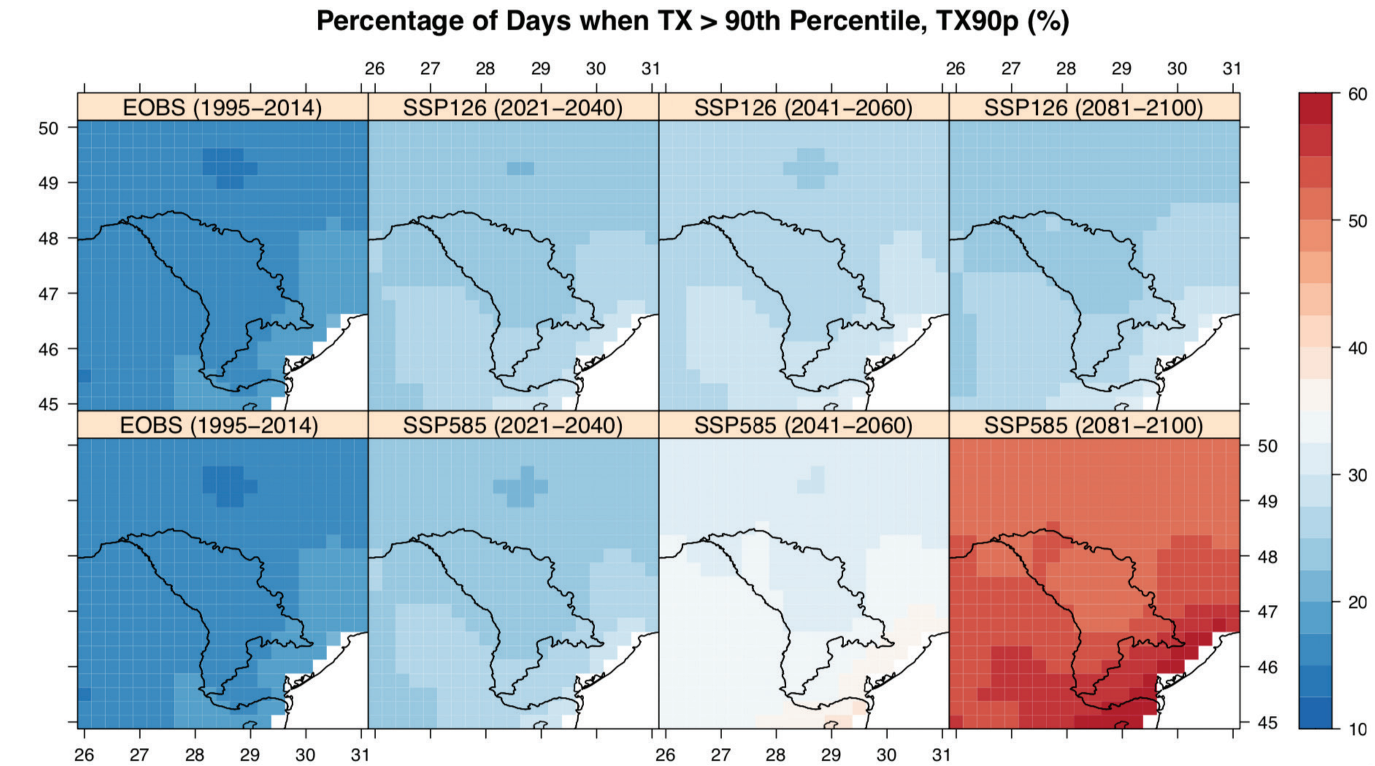


Figure 5-32: CMIP6 6 GCMs Ensemble Projections for TX90p, 1995-2014 Reference Period.

5.2.4.2.3. Projections of Future Changes in Precipitation Extremes Indices by the CMIP6 Multimodel Ensemble

The simple daily intensity index (SDII), for baseline climate 1995-2014 have been varied in average from 6.9 mm/day (with max 9.1 mm/day in 2014) in the north to 7.3 mm/day (with max 10.6 mm/day in 2013) in the south of the country.

In short term future time period 2021-2040, the projected CMIP6 6 GCMs ensemble mean increases in SDII could be by 0.1-0.2 mm/day under both SSPs scenarios, comparative to 1995-2014 reference period, see more in Table 5-18.

Table 5-18: CMIP6 6 GCMs ensemble projections in precipitation extreme indices, presented for tree future time periods 2021-2040, 2041-2060, and 2081-2100 under two SSP1-2.6 and SSP5-8.5 scenarios, relative to 1995-2014 climatological baseline period.

Period	Scenario	rx1day	rx5day	sdii	r10mm	r20mm	r30mm	cdd	cwd	r95p	r99p	r95ptot	r99ptot	prcptot
Northern AEZ														
2021-2040	SSP126	0.8	0.7	0.1	0.5	0.0	0.0	1.9	0.1	5.2	-1.0	0.2	-0.4	-0.2
	SSP585	1.8	-0.3	0.1	0.7	0.2	0.1	3.7	0.5	9.3	9.1	1.0	1.0	8.6
2041-2060	SSP126	3.8	1.3	0.2	0.4	0.5	0.2	4.1	0.4	20.6	15.7	2.9	2.7	4.3
	SSP585	3.1	1.6	0.2	0.4	0.3	0.2	5.8	-0.2	17.4	10.2	3.5	1.7	-11.9
2081-2100	SSP126	3.9	2.0	0.2	0.8	0.3	0.2	2.8	0.6	17.3	11.7	1.8	1.8	14.7
	SSP585	6.2	6.9	0.6	1.3	1.2	0.6	13.3	0.3	42.1	29.9	7.6	5.0	-9.3
Period	Scenario	rx1day	rx5day	sdii	r10mm	r20mm	r30mm	cdd	cwd	r95p	r99p	r95ptot	r99ptot	prcptot
Central AEZ														
2021-2040	SSP126	2.5	1.7	0.2	0.8	0.4	0.2	1.1	0.1	15.7	14.1	2.3	2.3	9.8
	SSP585	1.9	0.4	0.2	0.6	0.4	0.1	1.9	0.4	17.5	11.8	2.3	1.9	16.6
2041-2060	SSP126	2.8	3.2	0.3	1.1	0.8	0.3	2.8	0.4	28.0	20.0	4.5	3.4	13.9
	SSP585	2.9	2.8	0.3	0.6	0.3	0.3	6.4	-0.1	18.9	15.0	3.5	2.8	-8.9
2081-2100	SSP126	2.7	0.7	0.3	1.2	0.4	0.1	1.3	0.2	20.4	13.9	3.2	2.7	17.9
	SSP585	3.6	5.5	0.4	0.0	0.7	0.3	14.8	0.0	25.2	17.8	6.4	3.9	-34.3
Period	Scenario	rx1day	rx5day	sdii	r10mm	r20mm	r30mm	cdd	cwd	r95p	r99p	r95ptot	r99ptot	prcptot
Southern AEZ														
2021-2040	SSP126	1.5	-0.6	0.2	0.3	0.3	0.0	-0.6	0.0	7.6	7.3	0.8	1.2	2.1
	SSP585	1.0	-2.5	0.1	0.3	0.1	0.1	1.6	-0.2	2.3	8.2	0.0	1.2	4.7
2041-2060	SSP126	3.3	-0.4	0.2	0.5	0.5	0.2	1.4	0.1	17.6	13.6	2.8	2.4	6.4
	SSP585	0.8	-1.7	0.2	-0.2	0.3	0.0	8.6	-0.5	6.5	4.3	2.2	0.9	-25.8
2081-2100	SSP126	2.0	-0.1	0.2	0.4	0.5	0.1	3.0	-0.1	9.4	7.0	1.5	1.1	8.6
	SSP585	4.8	3.6	0.6	-0.5	0.7	0.4	16.0	-0.6	22.2	26.2	6.4	5.7	-42.1

In 2041-2061 medium term time period, the tendency to increase in SDII will persist, the projected CMIP6 6 GCMs ensemble mean increases in SDII will be by 0.2-0.3 mm/day, under both SSPs scenarios, with maximum increase in Central AEZ.

Relative to the reference period 1995-2014, the projected CMIP6 6 GCMs ensemble mean maximum increases in SDII by the end of the twenty-first century, in 2081-2100 time period, will be from 0.4 mm/day in Central to 0.6 mm/day in Northern, and Southern AEZs under SSP5-8.5, and/

or minimum increase by 0.2-0.3 mm/day, in case of SSP1-2.6 scenarios, comparative to 1995-2014 reference period.

The maximum 1-day precipitation (RX1day), for baseline climate 1995-2014 have been varied in average from 51.2 mm (with max 128.8 mm in 2013) in the south to 53.3 mm (with max 101.2 mm in 2005) in the north, with minimum by 47.3 mm (max 98.8 mm in 1998) in center of the country.

In short term future time period 2021-2040, the projected CMIP6 6 GCMs ensemble mean increases in RX1day will be from 1.0 mm in Southern to 1.8 mm in Northern AEZs under SSP5-8.5, and/or minimum increase from 0.8 mm in Northern to 2.5 mm in Central AEZs, in case of SSP1-2.6 scenarios, comparative to 1995-2014 reference period, see more in Table 5-18, Figures 5-33.

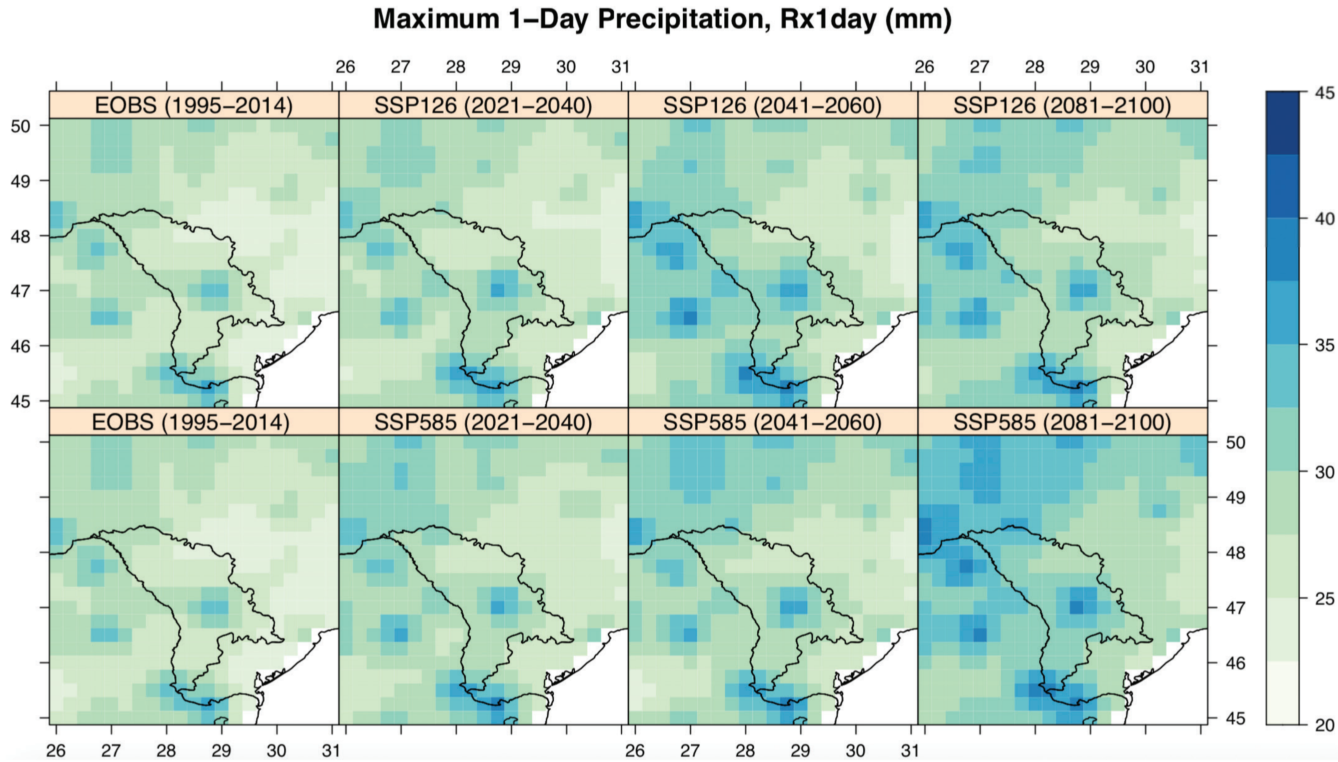


Figure 5-33: CMIP6 6 GCMs Ensemble Projections for RX1-day, 1995-2014 Reference Period.

In 2041-2061 medium term time period, the tendency to increase in RX1day will persist, the projected CMIP6 6 GCMs ensemble mean increases in RX1day will be from 0.8 mm in Southern to 3.1 mm in Northern AEZs under SSP5-8.5, and/or increase from 2.8-3.3 mm in Central, and Southern to 3.8 mm in Northern to AEZs, in case of SSP1-2.6, scenarios.

Relative to the reference period 1995-2014, by the end of the twenty-first century under SSP1-2.6 scenario, the projected CMIP6 6 GCMs ensemble mean of RX1day increase will be from 2.0 mm in Southern to 3.9 mm in Northern AEZs and/or from 3.6 mm in Central to 6.2 mm in Northern AEZs, respectively under SSP5-8.5 scenario.

In 2021-2040 time period, the CMIP6 6 GCMs ensemble mean is projected the slight decrease in RX5day from 0.3 mm in Northern to 2.5 mm in Southern AEZs under SSP5-8.5 scenario, while in case of SSP1-2.6 scenario controversially is expected the slight increase from 0.7 mm in Northern to 1.7 mm in Central AEZs.

In 2041-2061 time period, the tendency to increase in RX5day will persist, the projected CMIP6 6 GCMs ensemble mean increases in RX5day will be from 1.2-1.6 mm in Northern to 2.8- 3.2 mm in Central AEZs under both SSPs scenarios, while in Southern AEZ the slight decrease in RX5day by 0.4–1.7 mm is expected.

Relative to the reference period 1995-2014, by the end of the twenty-first century under SSP1-2.6 scenario, the projected CMIP6 6 GCMs ensemble mean of RX5day increase will be from 0.7 mm in Central to 2.0 mm in Northern AEZs and/or from 3.6 mm in Southern to 6.9 mm in Northern AEZs, respectively under SSP5-8.5 scenario, see more in Table 5-18, and Figure 5-34.

The heavy precipitation days, R10mm for baseline climate 1995-2014 have been varied in average from 14.0 days (with max 28 days in 1997, and 21 days in 2014) in the south to 18.8 days (with max 31 days in 2010, and 28 days in 1996) in the north of the country. In short term future time period 2021-2040, the CMIP6 6 GCMs ensemble mean is projected the slight increase in R10mm from 0.3 days in Southern to 0.5 days in Northern AEZs, with maximum increase by o.8 days in Central AEZ under SSP1-2.6 scenario, and /or in case of SSP1-2.6 scenario is expected the increase from 0.3 days in Southern to 0.7 days in Northern AEZs.

In 2041-2061 medium term time period, the tendency to increase in R10mm will persist, the projected CMIP6 6 GCMs ensemble mean increases in R10mm will be by 0.4-1.1 days for both SSPs scenarios over the RoM AEZs, except Southern AEZ where the slight decrease in R10mm by 0.2 days is expected.

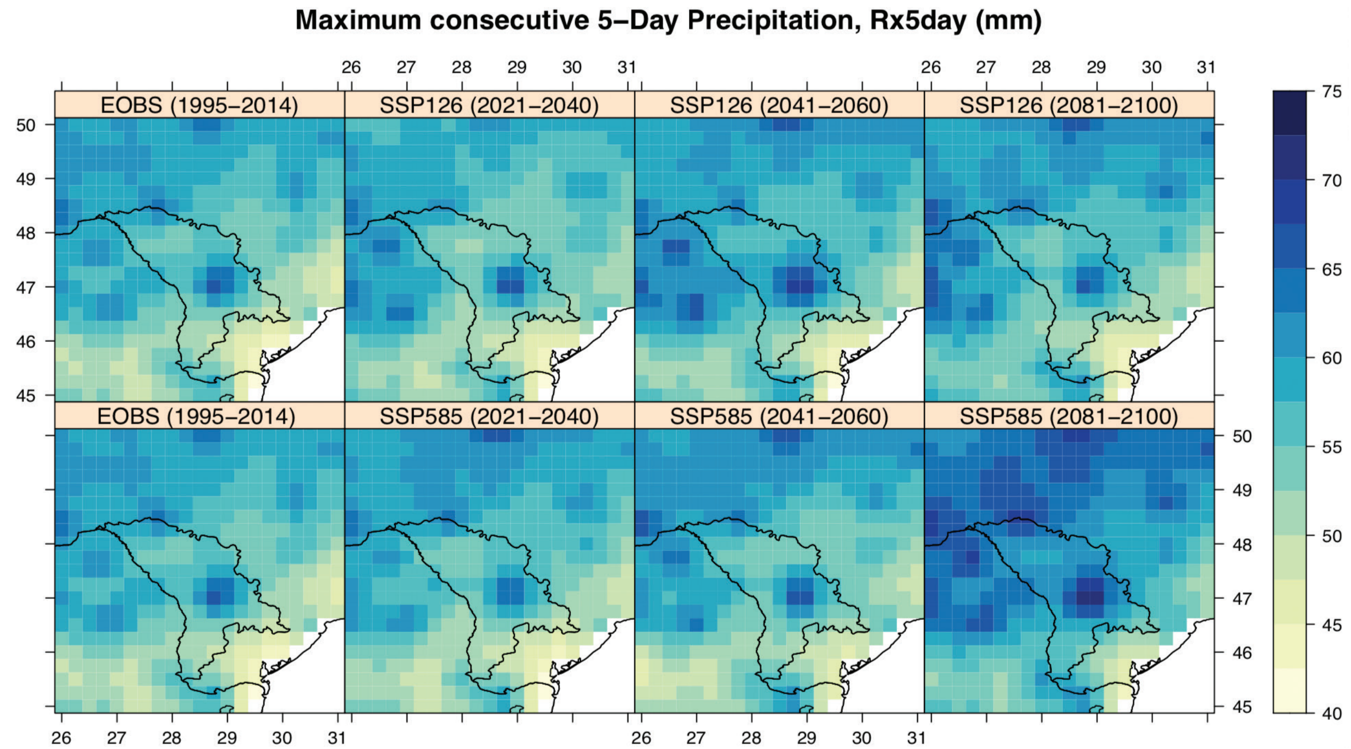


Figure 5-34: CMIP6 6 GCMs Ensemble Projections for Rx5-day, 1995-2014 Reference Period.

Relative to the reference period 1995-2014, by the end of the twenty-first century, under SSP1-2.6 scenario, the projected CMIP6 6 GCMs ensemble mean of R10mm increase will be from 0.8 days in Northern to 1.2 days in Central AEZs and/or by 1.3 days Northern AEZ, respectively under SSP5-8.5, see more in Table 5-18, and Figure 5-35.

The very heavy precipitation days (R20mm), for baseline climate 1995-2014 have been varied in average from 5 days (with maximum 13 days in 2010, and 10 days in 1998, and 2014) in the south to 6 days (with maximum 10 days in 1997, and 9 days in 2013) in the north of the country.

In short term future time period 2021-2040, the CMIP6 6 GCMs ensemble mean is projected the slight increase in R20mm by 0.1-0.4 days, under both SSPs scenarios, throughout the RoM, with maximum increase by 0.4 days in Central AEZ.

In 2041-2061 medium term time period, the tendency to increase in R20mm will persist, the projected CMIP6 6 GCMs ensemble mean increases in R20mm will be by 0.5-0.8 days for SSP5-8.5, and/or 0.3 days under SSP1-2.6, scenarios over the RoM AEZs.

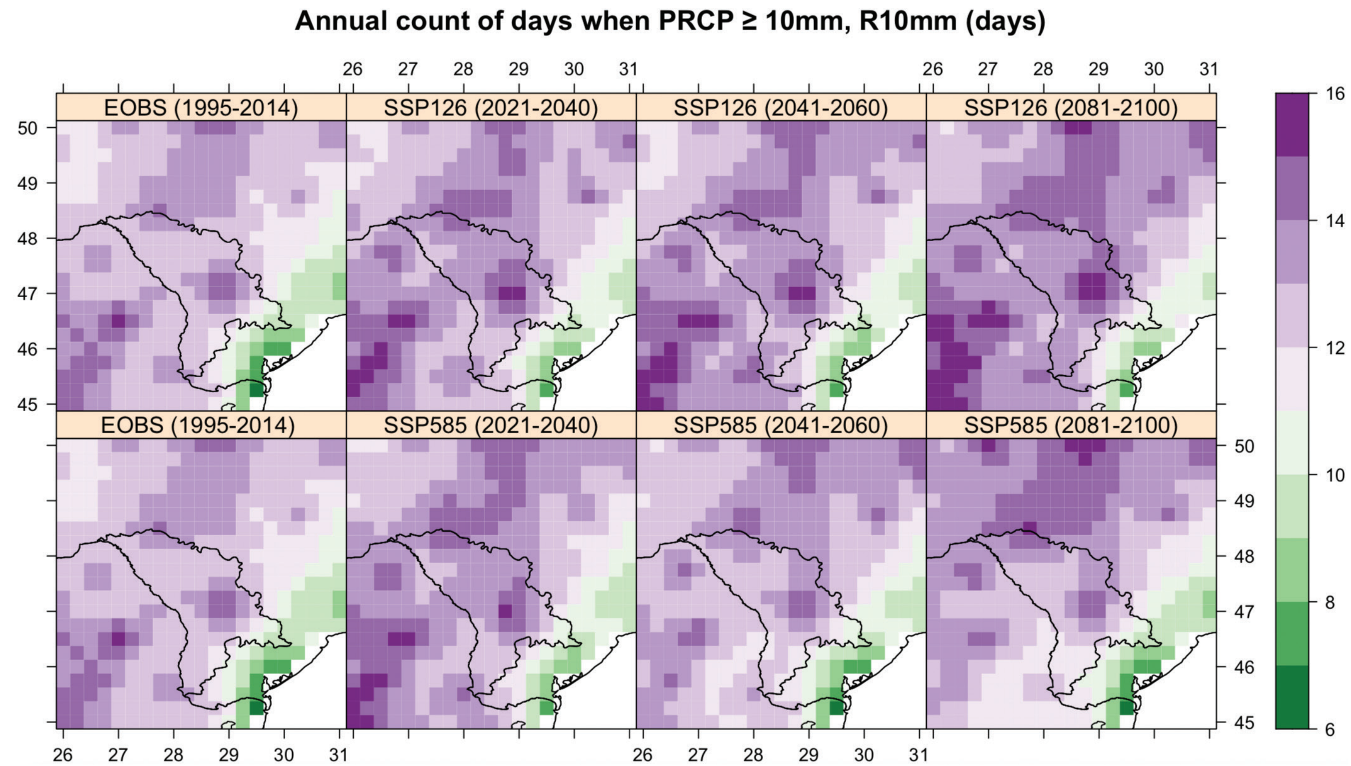


Figure 5-35: CMIP6 6 GCMs Ensemble Projections for R10mm, 1995-2014 Reference Period.

Relative to the reference period 1995-2014, by the end of the twenty-first century, under SSP1-2.6 scenario, the projected CMIP6 6GCMs ensemble mean of R20mm increase will be by 0.3-0.5 days and/or by 0.7-1.2 days, with maximum increase by 1.2 days in Northern AEZ, under SSP5-8.5, see more in Table 5-18, and Figure 5-36.

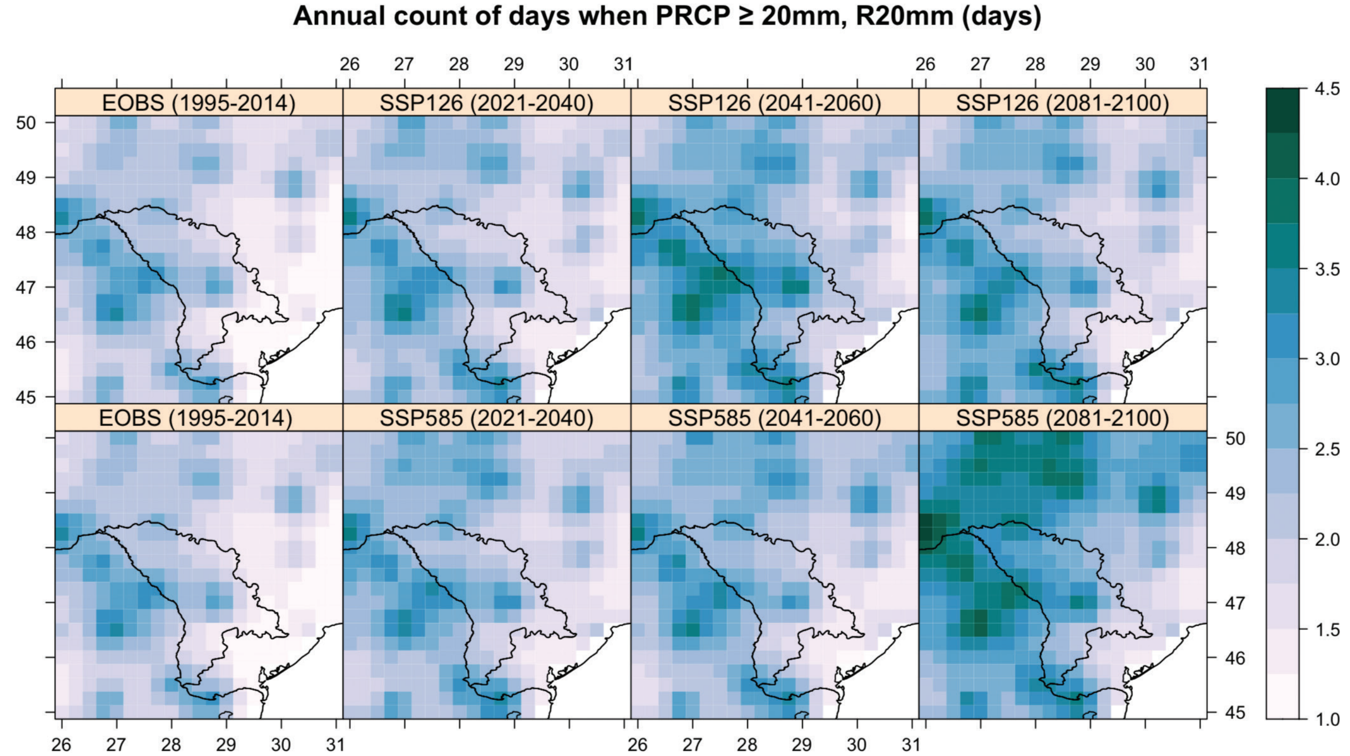


Figure 5-36: CMIP6 6 GCMs Ensemble Projections for R20mm, 1995-2014 Reference Period.

In short term future time period 2021-2040, the CMIP6 6 GCMs ensemble mean is projected the slight increase in R30mm by 0.1-0.2 days, under both SSPs scenarios, throughout the Republic of Moldova, with maximum increase in Central AEZ. In 2041-2061 medium term time period, the tendency to slight increase in R30mm will persist, the projected CMIP6 6 GCMs ensemble mean increases in R30mm will be by 0.2-0.3 days for both SSPs scenarios throughout the RoM AEZs, except the Southern AEZ. Relative to the reference period 1995-2014, by the end of the twenty-first century, under SSP1-2.6 scenario, the projected CMIP6 6 GCMs ensemble mean of R30mm increase will be by 0.1- 0.2 days and/or by 0.3 - 0.6 days under SSP5-8.5, with maximum increase by 0.6 days in Northern AEZ, see more in Table 5-18, and Figure 5-37.

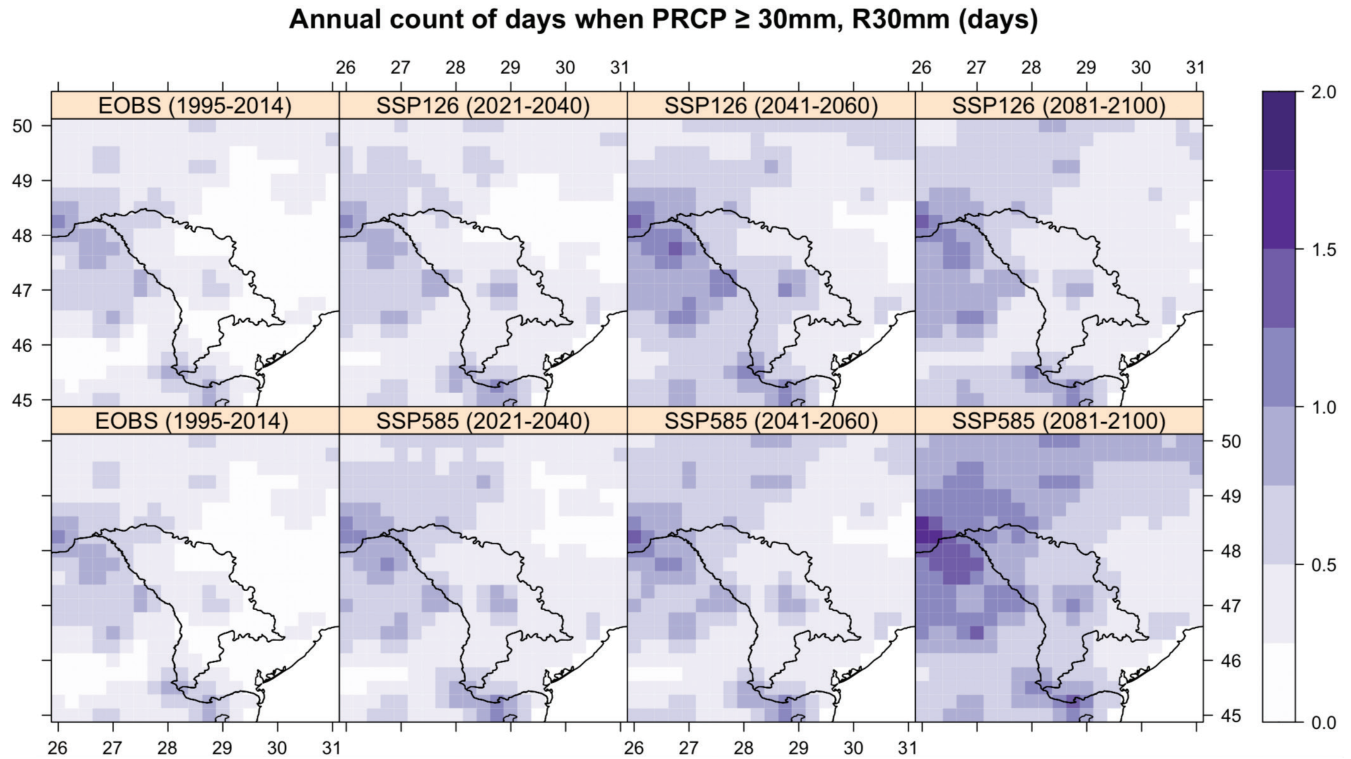


Figure 5-37: CMIP6 6 GCMs Ensemble Projections for R30mm, 1995-2014 Reference Period.

The total wet-day precipitation (PRCPTOT) for baseline climate 1995-2014 have been varied in average from 509.8 mm in the south (with max 796.4 in 1997, and min 292.6 mm in 2003) to 624.6 mm (with max 937.1 in 2010, and min 413.7 mm in 2011) in the north of the country. In short term future time period 2021-2040, the CMIP6 6 GCMs ensemble mean under SSP5-8.5 scenario is projected the increase in PRCPTOT will be from 4.7 mm in Southern to 8.6 mm in Northern AEZs, with maximum increase by 16.6 mm in Central AEZ.

In 2041-2061 medium term time period, the trend to increase in PRCPTOT under SSP5-8.5 scenario will change on opposite, the projected CMIP6 6 GCMs ensemble mean decrease in PRCPTOT will be from 11.9 mm in Northern to 25.8 mm in Southern AEZs, with minimum decrease by 8.9 mm in Central AEZ. Controversially, under SSP1-2.6 scenario the slight increase in PRCPTOT by 4.3 - 13.9 mm is excepted.

Relative to the reference period 1995-2014, in long term time period 2081-2100, under SSP1-2.6 scenario, the projected CMIP6 6GCMs ensemble mean of PRCPTOT increase will be from 8.6 mm in Southern to 14.7 mm in Northern AEZs, with maximum increase by 17.9 mm in Central AEZ. While under SSP5-8.5 scenario the tendency to decrease in PRCPTOT also will persist, the projected CMIP6 6 GCMs ensemble mean decrease will be from 9.3 mm in Northern to 42.1 mm in Southern AEZs, see more in Table 5-18, and Figure 5-38.

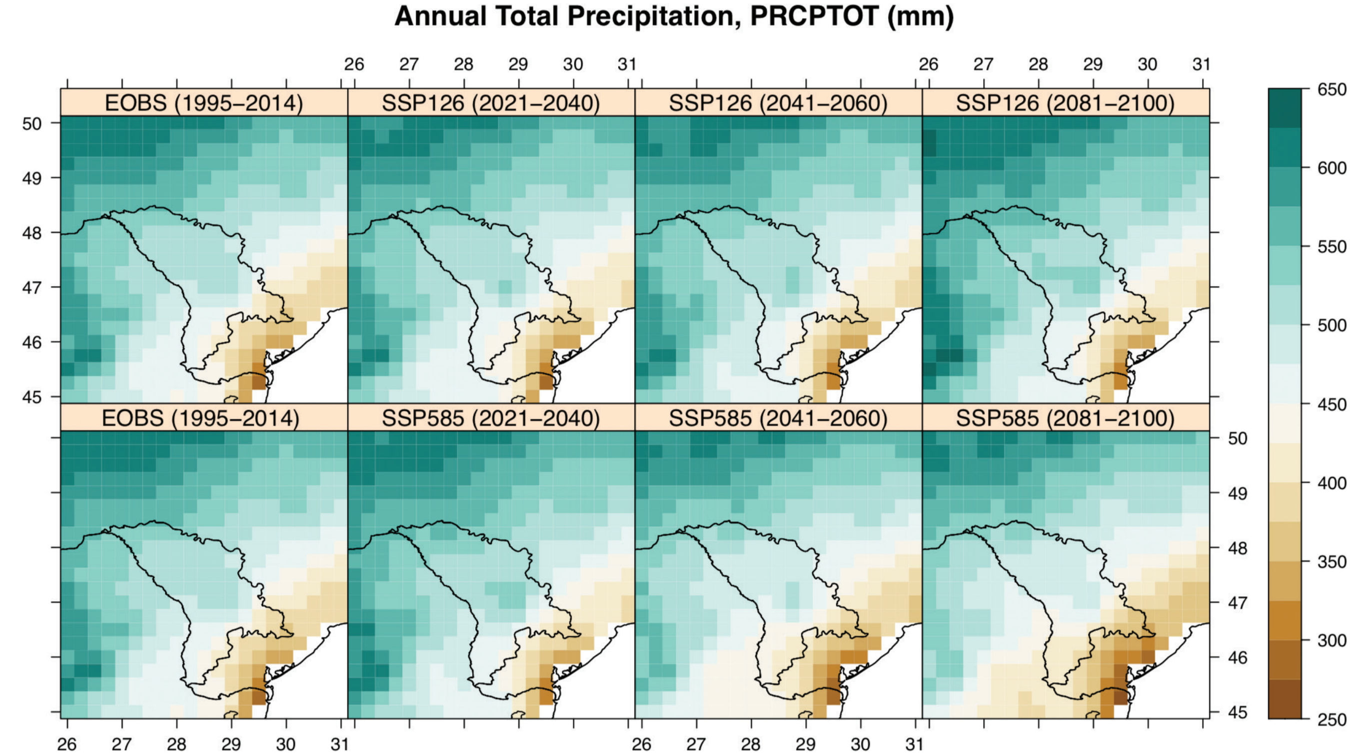


Figure 5-38: CMIP6 6 GCMs Ensemble Projections for PRCPTOT, 1995-2014 Reference Period.

The very wet days (R95p) for baseline climate 1995-2014 have been varied in average from 144.4 mm (with max 373.8 mm in 2013, and 257.5 mm in 2001) in the south to 189.7 mm (with max 389.6 mm in 1998, and 345.7 mm in 2014) in the north of the country.

In short term future time period 2021-2040, the CMIP6 6 GCMs ensemble mean under SSP5-8.5 scenario is projected the increase in R95p will be from 2.3 mm in Southern to 9.3 mm in Northern AEZs, with maximum increase by 17.5 mm in Central AEZ. According to SSP1-2.6 scenario is excepted increase in R95p will be from 7.6 mm in Southern to 5.2 mm in Northern AEZs, with maximum increase by 15.7 mm in Central AEZ.

In 2041-2061 medium term time period, the trend to increase in R95p will persist for both SSPs scenarios. The projected CMIP6 6 GCMs ensemble mean increase in R95p, under SSP1-2.6 scenario, will be from 17.6 mm in Southern to 20.6 mm in Northern AEZs, with maximum increase by 28.0 mm in Central AEZ. While according to SSP5-8.5 scenario is excepted lower increase in R95p from 6.5 mm in Southern to 17.4 mm in Northern AEZs, with maximum increase by 18.9 mm again in Central AEZ.

Relative to the reference period 1995-2014, in long term time period 2081-2100, under SSP5-8.5 scenario, the projected CMIP6 6 GCMs ensemble mean of R95p maximum increase will be from 22.2 mm in Southern to 42.1 mm in Northern AEZs, while under SSP1-2.6 scenario the tendency to increase in R95p will be lower, the projected CMIP6 6 GCMs ensemble mean increase could be from 9.4 mm in Southern to 17.3 mm in Northern AEZs, with maximum increase by 20.4 mm in Central AEZ, see more in Table 5-18, and Figure 5-39.

The extremely wet days (R99p), for baseline climate 1995-2014 have been varied in average from 97.0 mm in the south (with max 246.4 mm in 2013, and 225.1 mm in 2001) to 97.5 mm in the north (with max 236.7 mm in 1998, and 193.5 mm in 2014) of the country. In short term future time period 2021-2040, the CMIP6 6 GCMs ensemble mean under SSP5-8.5 scenario is projected the increase in R99p will be from 8.2 mm in Southern to 9.1 mm in Northern AEZs, with maximum increase by 11.8 mm in Central AEZ. According to SSP1-2.6 scenario is excepted increase in R99p will be from 7.3 mm in Southern to 14.1 mm in Central AEZs, while in Northern AEZ the slight decrease in R99p is excepted.

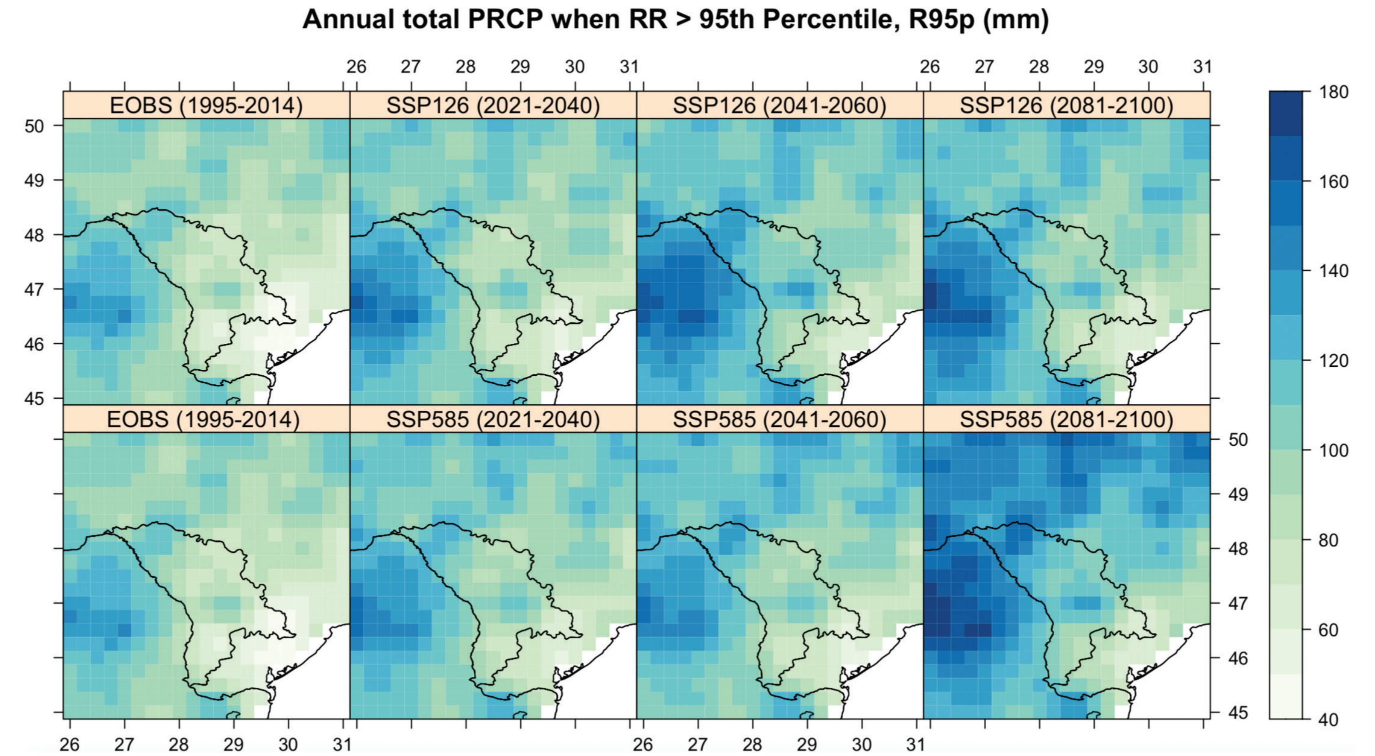


Figure 5-39: CMIP6 6 GCMs Ensemble Projections for R95p, 1995-2014 Reference Period.

In 2041-2061 medium term time period, the trend to increase in R99p will persist for both SSPs scenarios. The projected CMIP6 6 GCMs ensemble mean increase in R99p, under SSP1-2.6 scenario, will be from 13.3 mm in Southern to 15.7 mm in Northern AEZs, with maximum increase by 20.0 mm in Central AEZ. While according to SSP5-8.5 scenario is excepted lower increase in R99p from 4.3 mm in Southern to 10.2 mm in Northern AEZs, with maximum increase by 15.0 mm again in Central AEZ.

Relative to the reference period 1995-2014, in long term time period 2081-2100, under SSP5-8.5 scenario, the projected CMIP6 6 GCMs ensemble mean of R99p maximum increase will be from 26.2 mm in Southern to 29.9 mm in Northern AEZs, with minimum increase by 17.8 mm in Central AEZ, while under SSP1-2.6 scenario the tendency to increase in R99p will be lower, the projected CMIP6 6 GCMs ensemble mean increase could be from 7.0 mm in Southern to 11.7 mm in Northern AEZs, with maximum increase by 13.9 mm in Central AEZ, see more in Table 5-18, and Figure 5-40.

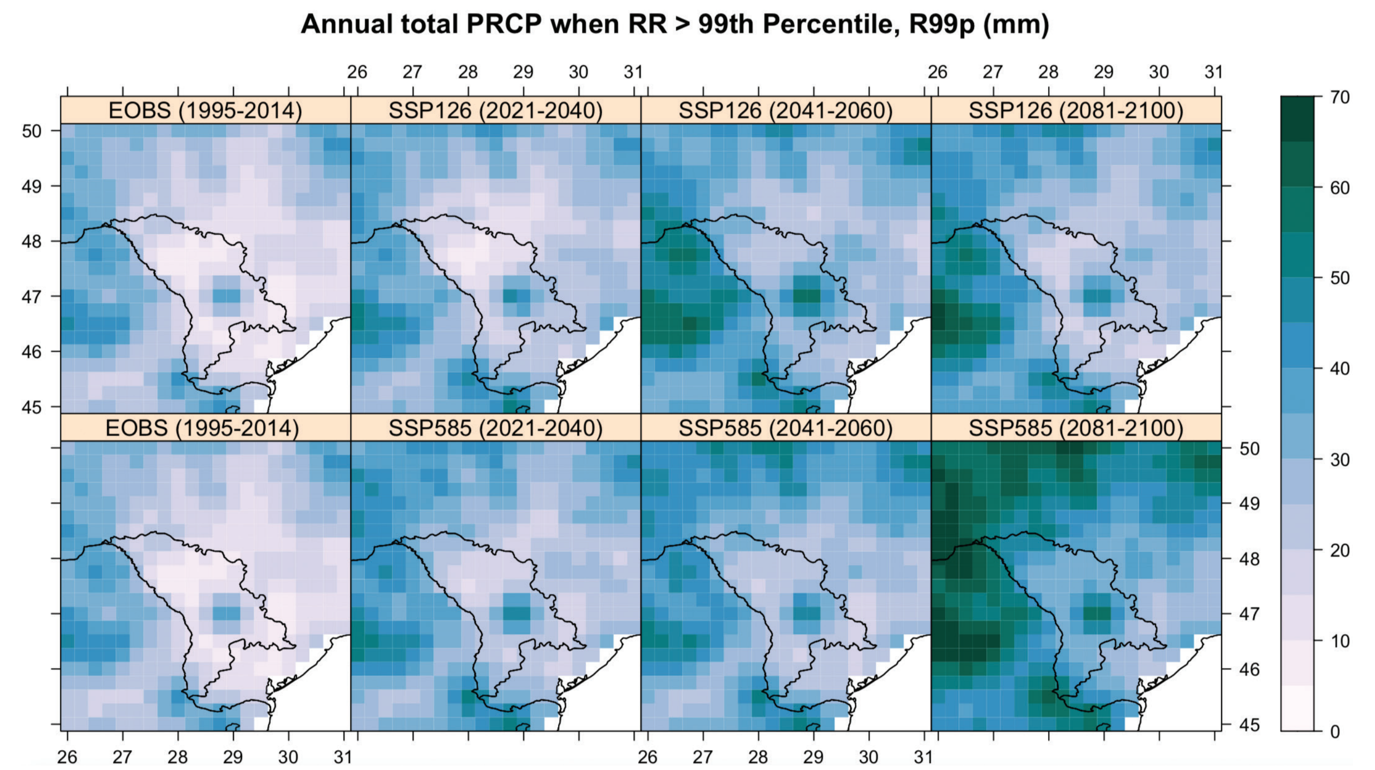


Figure 5-40: CMIP6 6 GCMs Ensemble Projections for R99p, 1995-2014 Reference Period.

The very wet days (R95pTOT) for baseline climate 1995-2014 have been varied in average from 26.4% in the south to 28.8% in the north of the country. In short term future time period 2021-2040, the CMIP6 6 GCMs ensemble for both SSPs scenarios are projected the slight increase in R95pTOT by 0.8 - 2.3% throughout the Republic of Moldova AEZs, with maximum increase in Central AEZ.

In 2041-2061 medium term time period, the trend to increase in R95pTOT will persist for both SSPs scenarios. The projected CMIP6 6 GCMs ensemble mean increase in R95pTOT, under SSP1-2.6 scenario, will be from 2.8-2.9% in Southern, and Northern AEZs, with maximum increase by 4.5% in Central AEZ. While according to SSP5-8.5 scenario is excepted increase in R95pTOT from 2.2% in Southern to 3.5% in Central, and Northern AEZs, relative to reference period 1995-2014.

Relative to the reference period 1995-2014, in long term time period 2081-2100, under SSP5-8.5 scenario, the projected CMIP6 6 GCMs ensemble mean of R95pTOT maximum increase will be from 6.4% in Southern, and Central to 7.6% in Northern AEZs, while under SSP1-2.6 scenario the tendency to increase in R95pTOT will be lower, the projected CMIP6 6 GCMs ensemble mean increase could be from 1.5% in Southern to 1.8% in Northern, with maximum increase by 3.2% in Central AEZ, relative to reference period 1995-2014, see more in Table 5-18.

The extremely wet days (99pTOT) for baseline climate 1995-2014 have been varied in average from 10.4% in the south to 11.1% in the north of the country. In short term future time period 2021-2040, the CMIP6 6 GCMs ensemble for both SSPs scenarios are projected the slight increase in R99pTOT by 1.0 - 2.3% throughout the Republic of Moldova AEZs, with maximum increase in Central AEZ.

In 2041-2061 medium term time period, the trend to increase in R99pTOT will persist for both SSPs scenarios. The projected CMIP6 6 GCMs ensemble mean increase in R99pTOT, under SSP1-2.6 scenario, will be by 2.4 -2.7% in Southern, and Northern AEZs, with maximum increase by 3.4% in Central AEZ. While according to SSP5-8.5 scenario is excepted increase in R99pTOT from 0.9% in Southern to 1.7% in Northern AEZs, with maximum increase by 2.8% in Central AEZ, relative to reference period 1995-2014.

Relative to the reference period 1995-2014, in long term time period 2081-2100, under SSP5-8.5 scenario, the projected CMIP6 6 GCMs ensemble mean of R99pTOT maximum increase will be from 5.0% in Northern to 5.7% in Southern AEZs, with minimum increase by 3.9% in Central AEZ, while under SSP1-2.6 scenario the tendency to increase in R99pTOT will be lower, the projected CMIP6 6 GCMs ensemble mean increase could be from 1.1% in Southern to 1.8% in Northern AEZs, with maximum increase by 2.7% in Central AEZ, relative to reference period 1995-2014, see more in Table 5-18.

The consecutive dry days (CDD) for baseline climate 1995-2014 have been varied in average from 23.4 days in the north to 32.1 days in the south of the country. In short term future time period 2021-2040, the CMIP6 6 GCMs ensemble for both SSPs scenarios are projected the slight increase in CDD from 1 - 2 days in Northern, and Central AEZs, and slight decrease by 1 day in Southern AEZ. While according to SSP5-8.5 scenario is excepted increase in CDD from 2 days in Central, and Southern to 4 days in Northern AEZs, relative to reference period 1995-2014.

In 2041-2061 medium term time period, the trend to increase in CDD will persist for both SSPs scenarios. The projected CMIP6 6 GCMs ensemble mean increase in CDD, under SSP1-2.6 scenario, will be from 1.4 days in Southern to 4.1 days in Northern AEZs. While according to SSP5-8.5 scenario is excepted increase in CDD could be from 6 days in Northern to 9 days in Southern in AEZs.

Relative to the reference period 1995-2014, in long term time period 2081-2100, under SSP5-8.5 scenario, the projected CMIP6 6 GCMs ensemble mean of CDD maximum increase will be from 13 days in Northern to 16 days in Southern AEZs, while under SSP1-2.6 scenario the tendency to increase in CDD will be lower, the projected CMIP6 6 GCMs ensemble mean increase could be by 3 days in Southern, and Northern AEZs, with minimum increase by 1 day in Central AEZ, relative to reference period 1995-2014, see more in Table 5-18, and Figure 5-41.

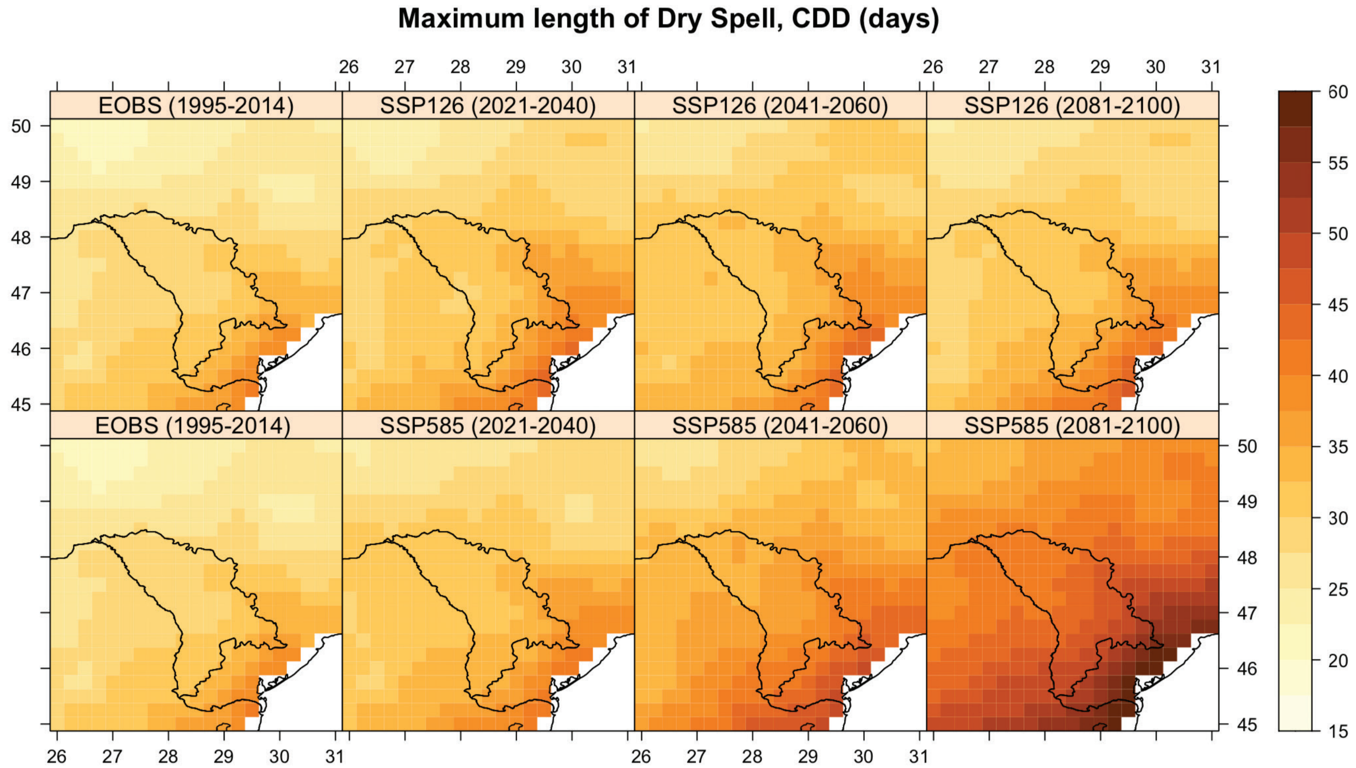


Figure 5-41: CMIP6 6 GCMs Ensemble Projections for CDD, 1995-2014 Reference Period.

The consecutive wet days (CWD) for baseline climate 1995-2014 have been varied in average from 4.8 days in the south to 5.8 days in the north of the country. In short term future time period 2021-2040, the CMIP6 6 GCMs ensemble for both SSPs scenarios are projected the slight increase in CWD from 0.1 – 0.4 days in Northern, and Central AEZs, and slight decrease by 0.2 day in Southern AEZ.

In 2041-2061 medium term time period, the projected CMIP6 6 GCMs ensemble mean increase in CWD, under SSP1-2.6 scenario, will be from 0.1 day in Southern to 0.4 days in Northern AEZs. While according to SSP5-8.5 scenario is excepted decrease in CWD could be from 0.2 days in Northern to 0.5 days in Southern in AEZs.

Relative to the reference period 1995-2014, in long term time period 2081-2100, under both SSPs scenarios, the projected CMIP6 6 GCMs ensemble mean of CWD increase by 0.3 – 0.6 days will be observed in Northern AEZ, while controversially the tendency to decrease in CWD by 0.1–0.6 days will be observed in Southern, relative to reference period 1995-2014, see more in Table 5-18, and Figure 5-42.

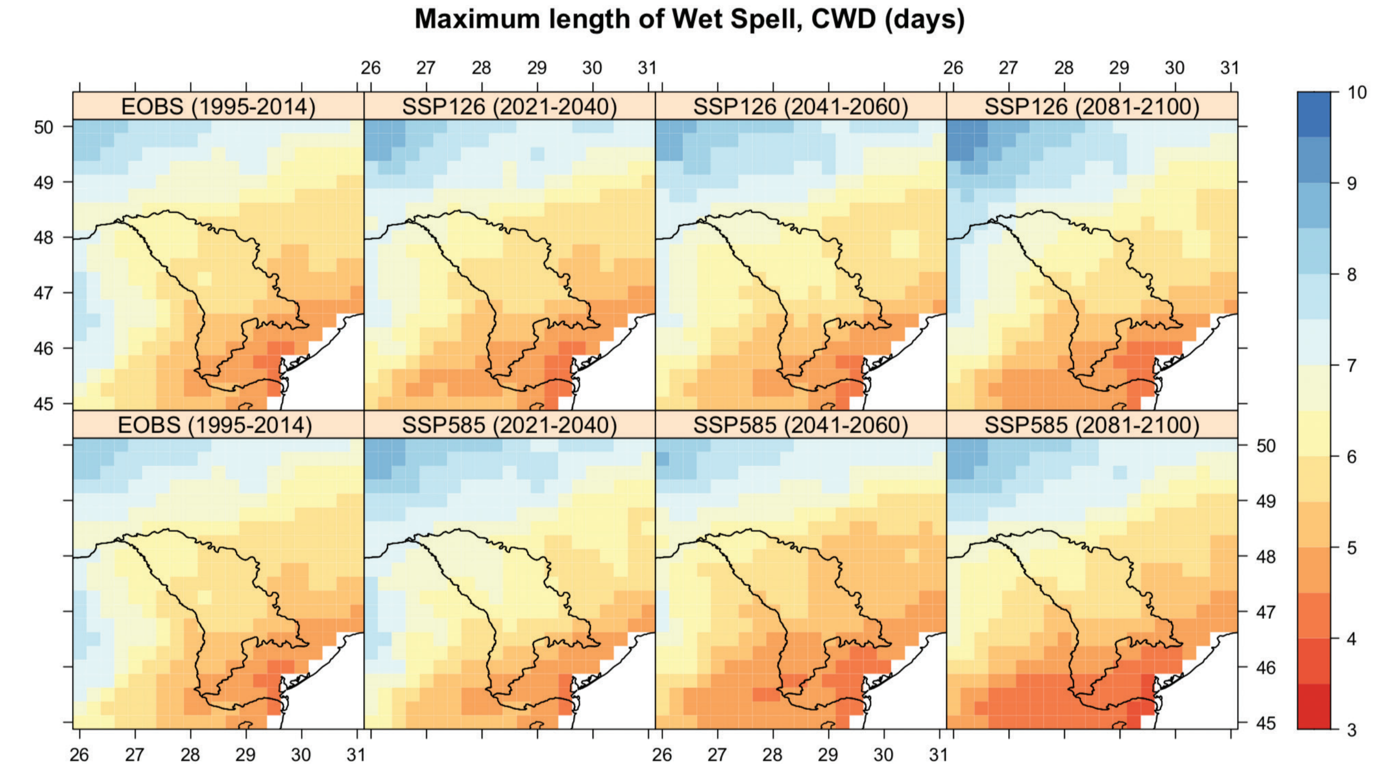


Figure 5-42: CMIP6 6 GCMs Ensemble Projections for CWD, 1995-2014 Reference Period.

5.3. Climate Change Vulnerability Index Case Study for the Republic of Moldova[255]

Climate change is affecting the various sectors, including agricultural sector, water resources, biodiversity and population health. The impact of climate change is the result of the interaction of climate hazards, exposure and vulnerability of society and the economy. Among these three factors, namely vulnerability can be determined by sensitivity and adaptation capacity, and can be applied to the development of state programs, strategies to overcome the negative impact of climate change.

5.3.1. Data and Methods

Vulnerability, in global practice, has traditionally been determined by indices, for example, indices of vulnerability to climate change focused on tourism (Moreno & Becken, 2009), agriculture (Monterroso, et al., 2014), health and vulnerability indices to climate risks (Pandey & Kumar, 2012). Most of these indices were developed based on socioeconomic and biophysical indicators transposed into indices of exposure, sensitivity and adaptive capacity. Such estimates can be made both for the country and for the region, distinctly, etc. Vulnerability can be presented using the Climate Vulnerability Index (CVI), which in turn includes both sensitivity to climate hazards (S) and adaptive capacity (AC):

$$CVI = f(S, AC), \quad (5.2)$$

The correlation between sensitivity, adaptive capacity and vulnerability is different. Vulnerability increases as sensitivity increases and vulnerability decreases as adaptive capacity increases. In the literature could be find the different opinions on the components of the Climate Vulnerability Index. In addition to the approach described in Equation 5.2, there is another view when CVI includes not only sensitivity and adaptive capacity, but also exposure (E) (Hahn, et al 2009):

$$CVI = f(E, S, AC), \quad (5.3)$$

This method has been used in similar assessments in previous studies in the Republic of Moldova (NC3, 2013; Corobov, et. al., 2013; Raileanu, et al., 2019), as a way to report vulnerability which illustrates the spatial distribution of exposure, sensitivity and adaptive capacity.

[255] This research has been undertaken in the frame of UNEP-GEF Project "Republic of Moldova: Preparation of the Fifth National Communication to the United Nations Framework Convention on Climate Change" We acknowledge with thanks the National Bureau of Statistics of the Republic of Moldova and the State Hydrometeorological Service of the Republic of Moldova for national statistical and climate data provided and used in the study, and we also thank the World Meteorological Organisation (WMO), the International Expert Team on Sector-specific Climate Indices (ET-SCI) that participated in elaboration of the ClimPact2 tool: Lisa Alexander, Nicholas Herold, James Goldie, Enric Aguilar, Marc Prohom, the Pacific Climate Impacts Consortium: David Bronaugh, James Hiebert, Hongang Yang, Yang Feng, et al.

Models of the combination of these three components applied in global practice for the assessment of the Climate Vulnerability Index are (Ahumada-Cervantes, et al., 2017):

$$\boldsymbol{CVI = E + S + AC}, \quad (5.4)$$

$$\boldsymbol{CVI = (E - AC) \times S}, \quad (5.5)$$

$$\boldsymbol{CVI = ((E + S + (1 - AC)) \div 3}, \quad (5.6)$$

Each of the CVI components in turn is composed of a set of indicators, the units of measurement of which are different. All indicators must be standardized in order to eliminate the difference mentioned above and to make them comparable (Gutium, T & Taranu L, 2021). One of the following two methods can be applied for this purpose (Hahn, et al 2009).

The first method of standardization:

$$\boldsymbol{Ix,i = (Xi - X) \div \Delta X}, \quad (5.7)$$

where: ***Ix, i*** – the standardized value of the indicator X for the district i; ***Xi*** – the observed value of the indicator X for the district i; ***X*** – the average value of the set of values of the indicator X for all districts; ***ΔX*** – standard deviation of the set of values of the indicator X for all districts.

The second standardization method:

$$\boldsymbol{Ix,i = (Xi - Xmin) \div (Xmax - Xmin)}, \quad (5.8)$$

$$\boldsymbol{Ix,i = (Xmax - Xi) \div (Xmax - Xmin)}, \quad (5.9)$$

where: ***Xmax*** – the maximum value of the indicator X; ***Xmin*** – the minimum value of the indicator X.

If indicator X has a direct impact on the Climate Vulnerability Index, the Equation 5.8 is applied for standardization, and when the correlation between indicator X and CVI is negative – the Equation 5.9 is applied.

Vulnerability studies could be developed both at the state level and at the administrative-territorial level, depending on the availability of statistical data necessary to perform the calculations. In our case study, the Climate Vulnerability Index was elaborated at the Administrative-Territorial Units (ATUs) level in the division of districts (32), Chisinau Municipality, Balti Municipality, A.T.U. Gagauzia. Vulnerability is conceptualized as an internal property of a system that can be expressed through a function, the endogenous variable of which is all the greater the less the adaptive capacity of the system to overcome its sensitivity to stressors. Therefore, the climate vulnerability of society and the ecosystem can be assessed in terms of their sensitivity to climate stress and its lack of adaptive capacity to overcome such sensitivity (Gutium & Taranu, 2021).

The ability to adapt to climate change is the ability of a system to adapt to changes caused by climate factors. In other words, after the climatic factors have acted and caused changes in the system, the latter will try to adapt to such changes in order to reduce the damage caused or to take advantage of such a change, or to respond to the consequences of the changes. Therefore, the adaptive capacity of a system facilitates it to reduce losses in the event of adverse climate change and helps the system to reap the beneficial changes.

5.3.2. Exposure Assessment

The Exposure Component of the Climate Vulnerability Index is assessed on the basis of indicators that describe the probable climate changes of the RoM, and which includes 16 extreme temperature and precipitation indices in the period 2008-2019. To facilitate the investigation of observed and projected changes, particularly in temperature and precipitation extremes, the Expert Team on Climate Change Detection and Indices (ETCCDI) defined a set of climate change indicators focusing on extreme events. These indicators describe “moderate extreme events with a recurrence time of 1 year or less, forming a balance between data availability and robustness of changes”.

The climate change indices have been widely used to analyze global and regional changes of extremes in recorded observations (Alexander, et al. 2006; Taranu, 2014; Taranu, et al., 2018) as well as in future climate projections (Sillmann & Roeckner, 2008; Orlowsky & Seneviratne, 2012; Zwiers, et al., 2013; Taranu, et al., 2018; Yeon-Hee Kim, et al., 2020). The climate extreme temperature and precipitation indices which are used in this study for development of E index are summarized in Table 5-19.

To assess the observed exposure to climate change, 16 indices from Table 5-19 have been recalculated from 0 to 1 using Equation 5.8. The normalized indicators were summed and divided by the number of exposure components to obtain the climate exposure integral index for 2008-2019 (Equation 5.10):

$$\boldsymbol{E = \Sigma\, XEi \div k}, \quad (5.10)$$

where: E – the exposure integral index; XEi – the ith normalized exposure variable (XE), k – the number of indicators in the exposure integral index.

Data analysis and statistical tests were done using Python, ClimPACT2 tool, R scripting (R Core Team) and Excel, (Gutium & Taranu, 2021).

Table 5-19: Climate extreme temperature and precipitation indices

Label	Name	Definition of the index	Units
TX_x	Max TX	Let TX_x be the daily maximum temperatures in month *k*, period *j*, then the maximum daily maximum temperature in each month is: $TX_{xkj} = max\ (TX_{xkj})$	C
TN_N	Min TN	Let TN_n be the daily minimum temperature in month *k*, period *j*, then the minimum daily minimum temperature in each month is: $TN_{nkj} = min\ (TN_{nkj})$	C
FD	Frost days	Let *TN* be the daily minimum temperature on day *i* in period *j*. Count the number of days where $TN_{ij} < 0°C$	Days
SU	Summer days	Let *TX* be the daily maximum temperature on day *i* in period *j*. Count the number of days where $TX_{ij} > 25°C$	Days
TR	Tropical nights	Let *TN* be the daily minimum temperature on day *i* in period *j*. Count the number of days where $TN_{ij} > 20°C$	Days

Label	Name	Definition of the index	Units
TN90p	Warm nights	Let TN_{ij} be the daily minimum temperature on day *i* in period *j* and let $TN_{in}90$ be the calendar day 90th percentile centred on a 5-day window. The percentage of days is determined where $TN_{ij} > TN_{in}90$	%
TX90p	Warm days	Let TX_{ij} be the daily maximum temperature on day *i* in period *j* and let $TX_{in}90$ be the calendar day 90th percentile centred on a 5-day window. The percentage of days is determined where $TX_{ij} > TX_{in}90$	%
WSDI	Warm spell duration	Let TX_{ij} be the daily maximum temperature on day *i* in period *j* and let $TX_{in}90$ be the calendar day 90th percentile centred on a 5-day window for the base period 1961–1990. Then the number of days per period is summed where, in intervals of at least 6 consecutive days: $TX_{ij} > TX_{in}90$	Days
GSL	Growing season length	Let *T* be the mean temperature *((TN+TX)/2)* on day *i* in period *j*. Count the number of days between the first occurrence of at least 6 consecutive days with *T > 5°C* and the first occurrence after 1st July *(NH)* or 1st January *(SH)* of at least 6 consecutive days with $T_{ij} < 5°C$	Days
PRCPTOT	Total wet-day precipitation	Let PR_{ij} be the daily precipitation amount on day *i* in period *j*, then: $PRCPTOT_j = \Sigma PR_{ij}$	mm
R10mm	Heavy precipitation days	Let PR_{ij} be the daily precipitation amount on day *i* in period *j*. Count the number of days where $PR_{ij} > 10mm$	Days
R20mm	Very heavy precipitation days	Let PR_{ij} be the daily precipitation amount on day *i* in period *j*. Count the number of days where $PR_{ij} > 20mm$	Days
R95ptot	Contribution from very wet days	*100 × r95p ÷ PRCPTOT* where: *r95p* – the 95th percentile of wet-day precipitation amounts	%
RX1day	Max 1-day precipitation	Let PR_{ij} be the daily precipitation amount on day *i* in period *j*. The maximum 1-day value for period *j* is: $RX1day_j = max\ (PR_{ij})$	mm
RX5day	Max 5-day precipitation	Let PR_{kj} be the precipitation amount for the 5-day interval ending *k*, period *j*. Then maximum 5-day values for period *j* are: $RX5day_j = max\ (PR_{kj})$	mm
SDII	Simple daily intensity	Let PR_{wj} be the daily precipitation amount on wet days, $PR \geq 1mm$ in period *j*. If *W* represents number of wet days in *j*, then: $SDII_j = \Sigma PR_{wj} \div W$	mm

According to Gutium & Taranu, 2021, the districts with the lowest standardized values of exposure to climate risks are: Cahul and Taraclia (0.4083), Straseni (0.4287), Criuleni (0.4223), Dubasari and Orhei (0.4307).

The highest values of exposure to extreme temperature and precipitation "very high degree of exposure" are attributed to the districts: Hincesti, Leova, Cantemir and Cimislia (0.4608); Balti Municipality, Ocnita, Riscani (0.4568); Chisinau Municipality, Anenii Noi and Ialoveni (0.4559); Nisporeni, Ungheni, Telenesti (0.4535); Drochia, Soroca (0.4525); and Falesti, Glodeni, Singerei (0.4517).

In Northern Region the highest values of exposure to climate change based on extreme temperature and precipitation indices are attributed to the districts: Balti Municipality, Ocnita and Riscani (0.4568), following by Drochia, Soroca (0.4525), and Falesti, Glodeni, Singerei (0.4517). The high exposure to climate change caused by extreme temperature and precipitation of Northern Region's districts during the 2008-2019 time period is mainly determined by high value in FD (0.56), TN90p (0.50), GSL (0.57) and R95ptot (0.55) in Balti Municipality, Ocnita and Riscani; and by TN90p (0.59), GSL (0.56), PRCPTOT (0.51) and R95ptot (0.51) in Drochia and Soroca.

A comparative analysis of exposure to climate change based on extreme temperature and precipitation indices of the districts of the Central Region have showed that Hincesti (0.4608), Chisinau, Anenii Noi, Ialoveni (0.4559), and Nisporeni, Ungheni, Telenesti (0.4535) have reached the highest degree of exposure caused by climate change during the 2008-2019 time period, while Criuleni (0.4223), Straseni (0.4287), Dubasari, and Orhei (0.4307) districts the lowest. This fact can be explained by high value in TNn (0.51), TN90p (0.53), PRCPTOT (0.58), R20mm (0.51), R95ptot (0.60), RX5day (0.50) in Hincesti, and TNn (0.53), SU (0.51), PRCPTOT (0.58), R20mm (0.50), R95ptot (0.57) in Chisinau Municipality, Anenii Noi, Ialoveni.

In Southern Region, the highest values of exposure to climate change caused by extreme temperature and precipitation are attributed to the districts: Cantemir, Cimislia, Leova (0.4608), and for Cahul, and Taraclia the lowest (0.4083). The high exposure to climate change caused by extreme temperature and precipitation in the districts of Southern Moldova during the 2008-2019 time period is mainly determined by high value in TNn (0.51), TN90p (0.53), PRCPTOT (0.58), R20mm (0.51), R95ptot (0.60), and RX5day (0.50), Figure 5-43 (A).

5.3.3. Sensitivity Assessment

Sensitivity defines the degree, to which the system is susceptible to direct or indirect climatic impacts. Based on the availability of regional statistical data, the period of 12 consecutive years 2008-2019 was used. The sensitivity pillar includes the Environmental Sensitivity Index (ESI) and Socio-Economic Sensitivity Index (SESI), which in turn are divided into 2 and 7 sub-indices, accordingly, (Table 5-20).

In the process of selecting the indicators, it has emerged from the availability of statistical data in territorial profile and degree of correlation between the indicators studied and climate change (Gutium & Taranu, 2021).

In the Table 5-20 is shown the list of finally selected indicators, which are grouped by sensitivity sub-indices. The correlation sign also is specified in the given table. In the case of the positive correlation (↑), Equation 7 will be applied for standardization (normalization), and in the case of the negative correlation (↓) – Equation 8.

Table 5-20: List of indicators grouped by sensitivity sub-indices

Sensitivity sub-indices	Indicators	Type of correlation
Environmental Sensitivity (ES)	Emissions of pollutants into the air from stationary sources of economic operators, tonnes	↑
	Formation of production and consumption waste, thousands of tons	↑
Sensitivity of Water and Sewerage Supply (SWSS)	Water capture, millions of cubic meters	↑
	Water use (without water used repeatedly and in closed circulation), millions of cubic meters	↑
	Water supply systems - Rural, units	↓
	Sewerage systems - Rural, units	↓
Demographic Sensitivity (DS)	Stable population at the beginning of the year - rural, people	↑
	Stable population at the beginning of the year - women, people	↑
	Population density, inhabitants per 1 km2	↑
	The coefficient of population aging, at the beginning of the year - urban, the number of people aged 60 and over per 100 inhabitants	↑
	Coefficient of population aging, at the beginning of the year - rural, Number of people aged 60 and over per 100 inhabitants	↑
	Coefficient of population aging, at the beginning of the year - men, number of people aged 60 and over per 100 inhabitants	↑
	Coefficient of population aging at the beginning of the year - women, number of people aged 60 and over per 100 inhabitants	↑
Labour Market Sensitivity (LMS)	Number of officially registered unemployed (at the end of the year), persons	↑
Social Security Sensitivity (SSS)	Number of pensioners registered with the social insurance bodies, persons	↑
Sensitivity of Public Health (SPH)	Average number of doctor visits per year per inhabitant, visits per 1 inhabitant	↑
	Requests for emergency medical assistance per 1000 inhabitants, persons per 1000 inhabitants	↑
	Population morbidity per 100,000 inhabitants - General incidence, cases per 100,000 inhabitants	↑
	Population morbidity per 100,000 inhabitants - General prevalence, cases per 100,000 inhabitants	↑
	Mortality rates at the beginning of the year - Diseases of the circulatory system, the number of deaths per 100,000 inhabitants	↑
	Mortality rates at the beginning of the year - Malignant tumours, the number of deaths per 100,000 inhabitants	↑
	Mortality rates at the beginning of the year - Diseases of the digestive tract, the number of deaths per 100,000 inhabitants	↑
	Mortality rates at the beginning of the year - Accidents, intoxications and traumas, number of deaths per 100,000 inhabitants	↑
Land Use Sensitivity (LUS)	Area sown on cereals and legumes on agricultural holdings and farms (hectares), hectares	↑
	Area sown on technical crops in agricultural enterprises and farms (farmers), hectares	↑
	Area sown on potatoes, vegetables and pumpkin crops on agricultural enterprises and farms (farmers), hectares	↑
	Area sown on fodder crops on agricultural holdings and farms (farmers), hectares	↑
	Fruit area of multi-annual seed plantations on agricultural enterprises and farms (farmers), hectares	↑
	Fruit area of multi-annual stone fruit plantations on agricultural enterprises and farms (farmers), hectares	↑
	Fruit area of vineyards in agricultural enterprises and farms (farmers), hectares	↑
Phytotechnical Sensitivity (PS)	Average harvest per 1 hectare of wheat (autumn and spring) in agricultural enterprises and peasant households (farmers) with an area of agricultural land of 10 hectares and over, quintals	↓
	Average harvest per 1 hectare of maize for grain in agricultural enterprises and farms (farmers) with an area of agricultural land of 10 hectares and over, quintals	↓
	Average harvest per 1 hectare of sunflower in agricultural enterprises and farms (farmers) with an area of agricultural land of 10 hectares and over, quintals	↓
	Average harvest per 1 hectare of sugar beet in agricultural enterprises and farms (farmers) with an area of agricultural land of 10 hectares and over, quintals	↓
	Average harvest per 1 hectare of grapes in agricultural enterprises and farms (farmers) with an area of agricultural land of 10 hectares and over, quintals	↓
Sensitivity of Animal Production (SAP)	Livestock, on January 1 cattle in all categories of households, heads	↑
	Livestock, on 1 January of pigs in all categories of households, heads	↑
	Livestock, on 1 January of sheep and goats in all categories of households, heads	↑

To assess sensitivity to climate change, have been used 38 indicators grouped into nine sub-indices (Table 2), which are calculated using the following formula:

$$\boldsymbol{SSIi = \Sigma\, Vi \div n}, \qquad (5.11)$$

where: SSIi – sensitivity sub-indices i (e.g., environmental sensitivity, water and sewerage sensitivity, demographic sensitivity, etc.); Vi – sensitivity variable (indicator) i; n – the number of component indicators of the sensitivity sub-indices.

The Integral Sensitivity Index (S) was calculated according to the following formula:

$$\boldsymbol{S = 0.5 \times ESI + 0.5 \times SESI}, \qquad (5.12)$$

$$\boldsymbol{ESI = 0.5 \times ES + 0.5 \times SWSS}, \qquad (5.13)$$

$$\boldsymbol{SESI = 0.5 \times SS + 0.5 \times EcS}, \qquad (5.14)$$

$$\boldsymbol{SS = 0.25 \times DS + 0.25 \times LMS + 0.25 \times SSS + 0.25 \times SPH}, \qquad (5.15)$$

$$\boldsymbol{EcS = (LUS + PS + SAP) \div 3}, \qquad (5.16)$$

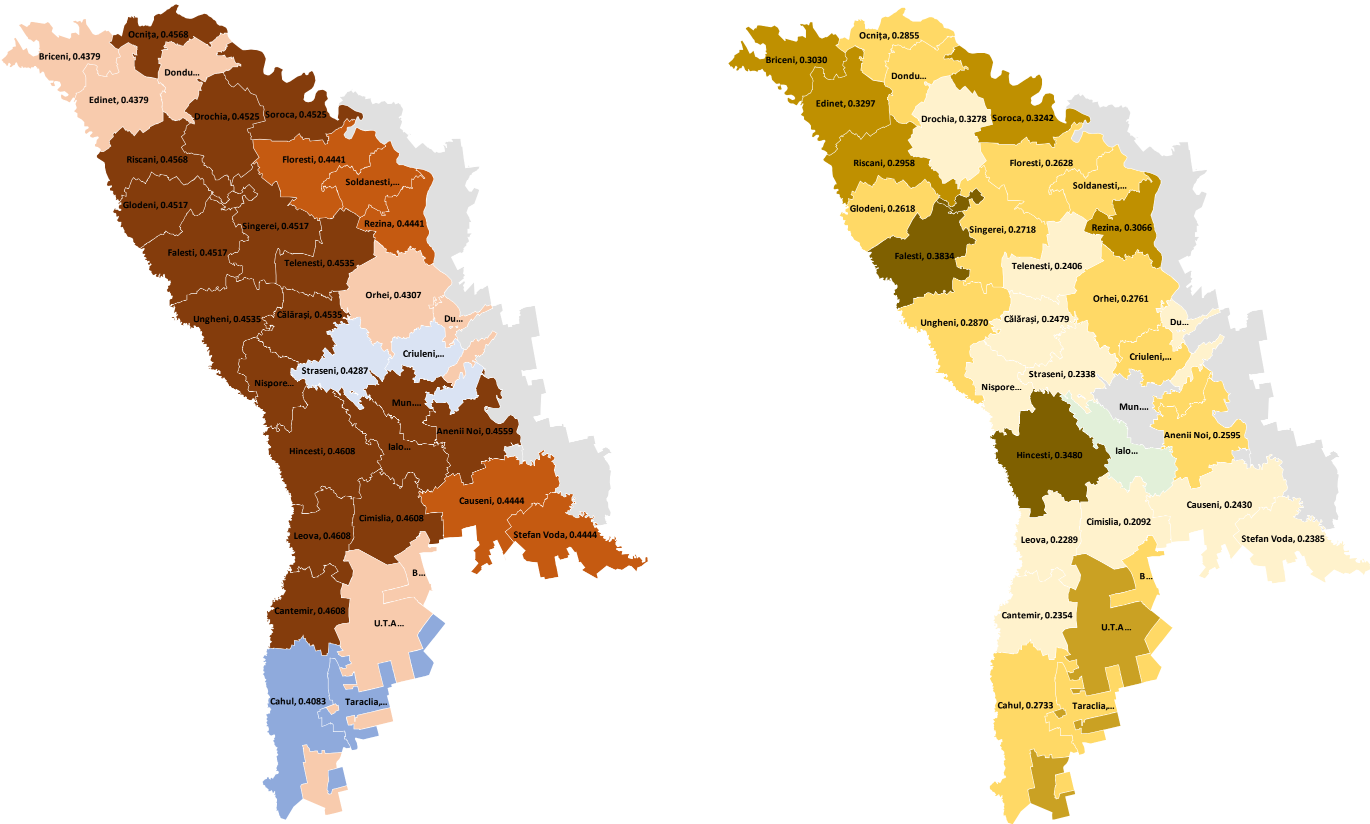
where: SS – Social Sensitivity; EcS – Economic Sensitivity.

Sensitivity is the degree of damage to society and the ecosystem caused by climate change. The effect can be direct (changes in crop yields in response to changes in environment or temperature variability) or indirect (damage caused by an increase in flood frequency).

According to Gutium & Taranu, 2021, the highest cumulative territorial sensitivity was registered by the Chisinau, A.T.U. Gagauzia, Falesti, Hincesti and Balti Municipality. Chisinau is in the top by sensitivity to climate change, because it recorded the highest volume (number) of: emissions of pollutants into the air from stationary sources of economic agents, production and consumption waste, water demand, officially registered unemployed, pensioners, visits to the doctor during the year to a resident, population morbidity per 100,000 inhabitants (both incidence and prevalence), and so on.

In Northern Region, the most sensitive to climate change is Falesti district, followed by Balti and Edinet municipalities, and the lowest level of sensitivity have reached Glodeni and Floresti districts. The high sensitivity of Falesti district is mainly determined by a large volume of production and consumption waste, the high level of emissions of pollutants into the air from stationary sources of economic agents, a large number of officially registered unemployed and relatively high numbers of goats and sheep.

The analysis of the value of the integral sensitivity index in the Central Region is highlighted that except of Chisinau, the most sensitive to climate change risks is Hincesti district, which recorded the high values at the same indicators as Falesti district. In addition, the increased sensitivity of the mentioned above district was also caused by other indicators: the number of pensioners, requests for emergency medical assistance per 100,000 inhabitants, mortality rate due to accidents, intoxications and traumas, the area sown for fodder crops on agricultural enterprises and farmer's households, the orchard and vineyards area, cattle herd, Figure 5-43 (B).



Legend: Exposure

	$0.4083 \leq E < 0.4188$ – very low degree of exposure
	$0.4188 \leq E < 0.4293$ – low degree of exposure
	$0.4293 \leq E < 0.4398$ – medium degree of exposure
	$0.4398 \leq E < 0.4503$ – high degree of exposure
	$0.4503 \leq E < 0.4608$ – very high degree of exposure

(A)

Legend: Sensibility

	$0.1643 \leq S < 0.2081$ – very low degree of sensibility
	$0.2081 \leq S < 0.2520$ – low degree of sensibility
	$0.2520 \leq S < 0.2958$ – medium degree of sensibility
	$0.2958 \leq S < 0.3396$ – high degree of sensibility
	$0.3396 \leq S < 0.3834$ – very high degree of sensibility

(B)

Figure 5-43: The Spatial Development of the Exposure Index (A) and Sensitivity Index (B), 2008-2019.

A comparative analysis of the sensitivity in Southern Region have shown that the A.T.U. Gagauzia has reached the highest degree of damage to ecosystem and society caused by climate change, and Cimislia district – the lowest. This fact can be explained by the ascending trends of: the emissions of pollutants in the atmospheric air from the stationary sources of the economic agents (during the years 2008-2016), water demand (2011-2019), population density (2008-2019), coefficient of aging of the urban population (2008-2019), number of pensioners (2008-2017), mortality rate due to malignant tumours (2008-2017), population morbidity per 100,000 inhabitants (2008-2017), average number of visits to the doctor during the year (2010-2016), the area sown with technical crops in agricultural enterprises and households (2008-2019), sheep and pig herd (2008-2019).

5.3.4. Assessment of Adaptive Capacity

The adaptive capacity describes the ability of the population, the economy and the ecosystem to adapt to climate change. In our study this pillar includes 7 sub-indexes. The list of 23 indicators, grouped into these seven sub-indices, that have used for the RoM's adaptive capacity assessment is presented in Table 5-21.

Table 5-21: List of indicators grouped by adaptive capacity sub-indices

Adaptive capacity sub-indices	Indicators	Type of correlation
Adaptive Capacity of Industry (ACI)	The value of manufactured industrial production (current prices), million lei	↑
	The value of the delivered industrial production, millions of leis	↑
	Volume of meat production, tons	↑
	Production volume of canned vegetables and fruits, tons	↑
	Flour production volume, tons	↑
	The volume of feed production ready for animal feed, tons	↑
	Production volume of bread and bakery products, tons	↑
	The production volume of natural grape wines, thousand dals	↑
Adaptive Capacity of Agricultural Production (ACAP)	Raising of live cattle and poultry on agricultural enterprises and farms,	↑
	Sale for slaughter of live cattle and poultry to agricultural enterprises and farms (quintals), quintals	↑
	Average annual quantity of milk, calculated per cow, on agricultural holdings and farms (kilograms), kilograms	↑
	Average annual egg production per laying hen on farms and (farmer's) farms, pieces	↑
Adaptive Capacity of Transport (ACT)	Length of local roads (end of year), kilometers	↑
	Length of national roads (end of year), kilometers	↑
	Goods transported, thousands of tons	↑
	Transported passengers, thousands of passengers	↑
Adaptive Capacity of Health Care (ACHC)	Number of doctors per 10,000 inhabitants, persons per 10,000 inhabitants	↑
	Average medical staff per 10,000 inhabitants, persons per 10,000 inhabitants	↑
Adaptive Capacity of Education (ACE)	Students in general primary and secondary education institutions, number	↑
	Students at a computer in primary and secondary schools, people	↑
Adaptive Capacity of Providing the Population with Living Space (ACPPLS)	Providing the population with living space - Urban localities, m_2 of total area per 1 inhabitant	↑
	Providing the population with living space - Rural localities, m^2 of total area per 1 inhabitant	↑
Adaptive Capacity of Tourism Sector (ACTS)	Existing capacity of collective tourist reception structures with accommodation functions, as of December 31, number of beds	↑

Sub-indices of adaptive capacity to climate change were assessed using the following formula:

$$ACSj = \Sigma Vj \div m, \quad (5.17)$$

where: *ACSj* – adaptive capacity sub-indices j (e.g., adaptive capacity: industry, adaptive capacity: agricultural production, adaptive capacity: transport, etc.); *Vj* – the variable (indicator) of adaptive capacity j; *m* – the number of component indicators of the adaptive capacity sub-indices.

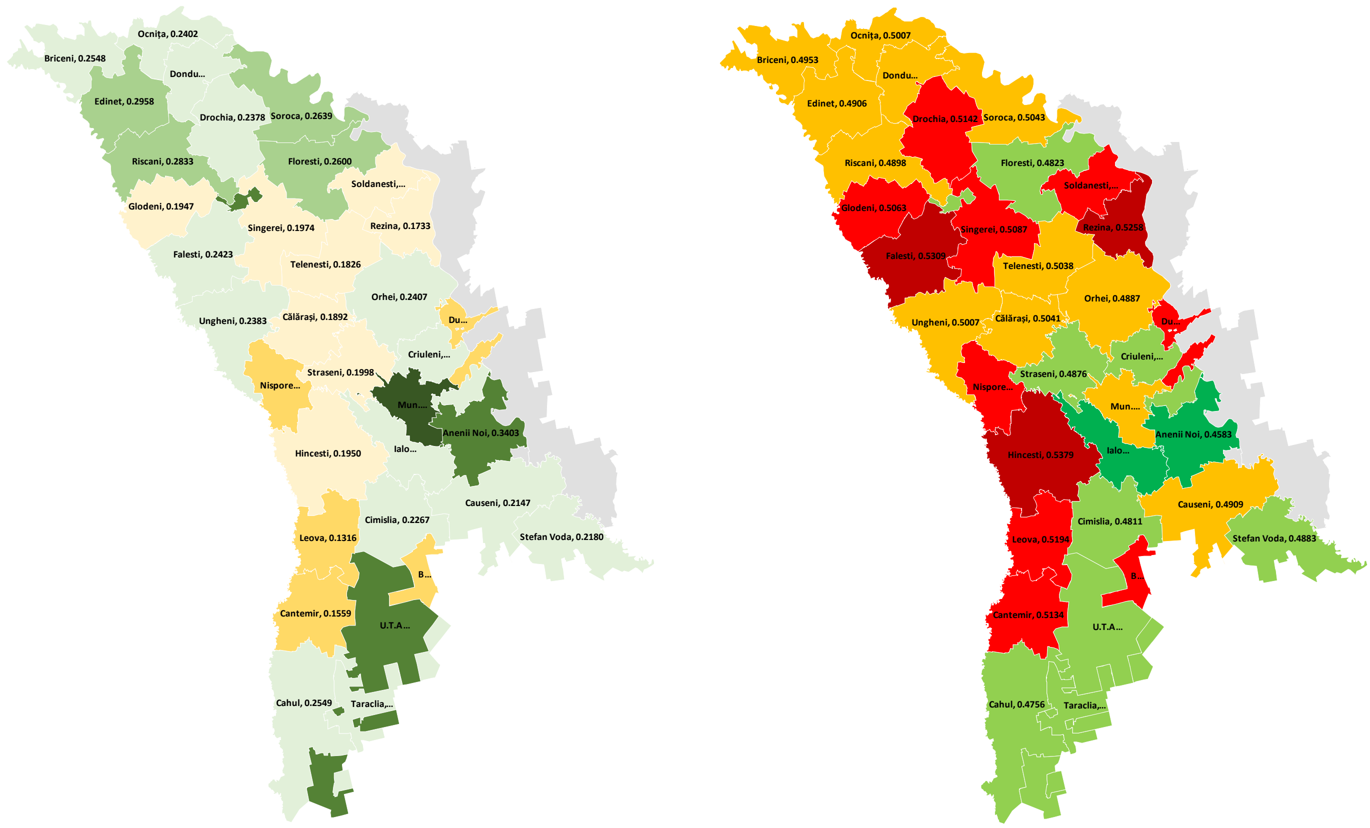
According to Gutium & Taranu, 2021, the highest level of cumulative adaptive capacity in the division of Administrative-Territorial Units (ATUs) was registered by the Chisinau Municipality, A.T.U. Gagauzia, Anenii Noi, Balti Municipality and Edinet and the smallest one in Dubasari, Leova, Nisporeni districts. Chisinau is on the top, because it recorded the highest values on most indicators: value of manufactured industrial production, production of main industrial products, road transport of goods, performed by enterprises and organizations, passenger transport by bus and minibus, number of students at general primary and secondary education institutions, number of computers in primary and general secondary education institutions, existing capacity of the tourist reception structures with accommodation functions, Figure 5-44 (A).

In Northern Region, the highest adaptive capacity was observed in Balti Municipality, Edinet and Riscani, and the lowest one in Glodeni and Singerei districts. Compared to other ATUs in the region, Mun. Balti recorded the highest value of manufactured and delivered industrial production, as well as high values for the following indicators: meat production including poultry, production of bread and bakery products, road transportation of goods, performed by enterprises and organizations, passenger transportation performed by buses and minibuses, number of doctors per 10,000 inhabitants, number of average medical staff per 10,000 inhabitants, number of students in primary and general secondary education institutions, and existing capacity of tourist reception structures with accommodation functions, Figure 5-44 (A).

Anenii Noi is presented the highest adaptive capacity in Central Region (except Chisinau Municipality), which is determined by high values of indicators: volume of meat production, raising cattle and poultry in live mass, sale for slaughter of cattle and birds, length of national roads, and providing population with living space (urban localities), etc.

The analysis of the value of adaptive capacity integral index in Southern Region's ATUs have shown that the A.T.U. Gagauzia has reached the highest degree of adaptive capacity to climate change, and Leova district - the lowest one. The high adaptive capacity of the A.T.U. Gagauzia was ensured by the high values recorded by the indicators: industrial production, industrial production delivered as for example - volume of flour production and volume of natural grape wines, raising of cattle and poultry, sale for slaughter of cattle and poultry, average annual quantity of milk, per cow, length of local roads, and national roads, volume of goods transported, number of doctors, per 10,000 inhabitants, number of average medical staff, per 10,000 inhabitants, etc.

Therefore, a weighting and aggregation methodology is needed that would incorporate the different distribution of ATUs in the assessment of adaptive capacity to climate change.



Legend: Adaptive Capacity

	$0.1078 \le AC < 0.1578$ – very low degree of adaptive capacity
	$0.1578 \le AC < 0.2077$ – low degree of adaptive capacity
	$0.2077 \le AC < 0.2576$ – medium degree of adaptive capacity
	$0.2576 \le AC < 0.3076$ – high degree of adaptive capacity
	$0.3076 \le AC < 0.3575$ – very high degree of adaptive capacity

(A)

Legend: Vulnerability

	$0.4557 \le CVI_i < 0.4721$ – very low degree of vulnerability
	$0.4721 \le CVI_i < 0.4886$ – low degree of vulnerability
	$0.4886 \le CVI_i < 0.5050$ – medium degree of vulnerability
	$0.5050 \le CVI_i < 0.5215$ – high degree of vulnerability
	$0.5215 \le CVI_i < 0.5379$ – very high degree of vulnerability

(B)

Figure 5-44: The Spatial Development of the Adaptive Capacity (a) and the Vulnerability (b) to climatic risks, 2008-2019.

5.3.5. Climate Vulnerability Assessment

IPCC AR4 (2007), defines climate vulnerability as a function of its components: exposure, sensitivity and adaptive capacity. In its Special Report on Extreme Events (IPCC, 2012) and in the AR5 (IPCC, 2014), the IPCC revised its understanding of vulnerability and converges with the approach of the newly introduced concept of 'climate risks' by defining it as "the propensity or predisposition to be adversely affected".

In our study the vulnerability is defined as the degree to which a system is susceptible to, or unable to cope with, the adverse effects of climate change. According to this definition, vulnerability is a function of three sub-domains: the exposure of a system to climate change, the system's sensitivity, and its adaptive capacity (IPCC, 2007; see also Fritzsche et al., 2014, and Becker et al., 2014; Gutium & Taranu, 2021).

Beside the differences in its definition, vulnerability assessments are increasingly regarded as an important tool to monitor and evaluate adaptation activities (Fritzsche, et al., 2014), contributing to National Adaptation Planning (NAP) process (Reporting, Monitoring and Review). Furthermore, with larger funds for adaptation measures, for instance through the Green Climate Fund the need for indicators to monitor and evaluate the success of adaptation measures in reducing risks and vulnerabilities is becoming increasingly prominent (Lamhauge, et al., 2012).

The Equation 5.6, mentioned above, have been used to assess observed vulnerability to climate change during the 2008-2019 in this study.

According to Gutium & Taranu, 2021 in Northern Region, the „high degree of vulnerability" is attributed to the ATUs - Drochia (0.5142), Glodeni (0.5063), and Singerei (0.5087), while „low degree of vulnerability" to climate risks is detected in Floresti (0.4823), and Balti Municipality (0.4861).

The districts with „high degree of vulnerability" to climate risks in Central Region during the 2008-2019 time period were Dubasari (0.5166), Nisporeni (0.5141), and Soldanesti (0.5094), but with „low degree of vulnerability" were Criuleni (0.4759), and Straseni (0.4876)

In Southern Region, the „high degree of vulnerability" of ATUs are detected in - Basarabeasca (0.5151), Cantemir (0.5134), and Leova (0.5194) districts, while „low degree of vulnerability" in Cahul (0.4753), Cimislia (0.4811), and A.T.U. Gagauzia (0.4742), Figure 5-44 (B).

5.3.6. Climate Change Projections of Future Exposure and Vulnerability to Climate Change

5.3.6.1. CMIP6 6 GCMs Ensemble Projections of Exposure Index, under Two SSP1-2.6 and SSP5-8.5 Scenarios, Comparative to 2008-2019 Reference Period

Combining socioeconomic and climate scenarios will be increasingly important for understanding the relative contributions of both changes in human factors (demography, economic development, urbanization) and climatic factors in generating future impacts. A key element for future work will be the inclusion of socioeconomic scenarios such as those developed using the Shared Socioeconomic Pathways (SSPs) or similar approaches (O'Neill et al., 2014).

While decades of climate research have led to a improved understanding of changes in the climate system, albeit with limitations regarding climate sensitivity and extremes, very little has been achieved so far to comprehend the future dynamics of human systems and its influence on future vulnerability (Lutz & Muttarak, 2017). Although projecting spatial socioeconomic characteristics of populations into the future is difficult (O'Neill & Gettleman, 2018), a number of methods have already been developed (Rohat, 2018) and the use of scenarios enables accounting for uncertainties in future socioeconomic development trends. Strader, et al. (2017) provide a rare example of vulnerability mapping incorporating future scenarios.

As such, the SSPs (O'Neill, et al. 2014) offer an unprecedented opportunity to integrate socioeconomic projections-and their uncertainties under varying level of socioeconomic development-within assessments of future climate change vulnerability (Wilbanks and Ebi 2014). The world is far more dynamic than most vulnerability mapping efforts portray. Mapping efforts need to consider incorporating stochastic elements, such as extreme climate events, conflict, or other shocks to the system. Mapping will also need to acknowledge the dynamic connections between indicators, as well as linkages across scales (Jurgilevich et al. 2017).

In order to estimate the possible changes in exposure to climate change risks of the RoM's three Socio-Economic Regions (Northern, Central and Southern), the projections of Exposure Index (E) based on 16 extreme temperature and precipitation indices (Warm nights (TN90p), Warm days (TX90p), Warm spell duration (WSDI), Maximum daily maximum temperature (TX_X), Minimum daily minimum temperature (TN_N), Frost days (FD), Summer days (SU), Tropical nights (TR), Growing season length (GSL), Max 1-day precipitation (RX1day), Max 5-day precipitation (RX5day), Simple daily intensity (SDII), Heavy precipitation days (R10mm), Very heavy precipitation days (R20mm), Contribution from very wet days (R95ptot), Total wet-day precipitation (PRCPTOT)) for four 20-year future time periods: 2021- 2040, 2041-2060, 2061-2080, and 2081-2100, in the 21st century, were modeled according to the CMIP6 6 GCMs ensemble for two socio-economic scenarios SSP1-2.6 and SSP5-8.5, comparative to 12-year observed baseline period (2008–2019).

The spatial assessment of exposure to future climate change risks of the RoM's territory, based on projections from CMIP6 6 GCMs ensemble for two Socio-Economic Scenarios SSP1-2.6, and SSP5-8.5, during four future time periods: near - term (2021- 2040), medium – term (2041-2060), 2061-2080, and long – term (2081-2100) is shown in Figure 5-45.

To address this task, the normalized average value's projections of vulnerability index for the RoM's administrative-territorial units were divided into five categories: *„very low degree of exposure"*, *„low degree of exposure"*, *„medium degree of exposure"*, *„high degree of exposure"*, and *„very high degree of exposure"*.

Thus, exposure maps highlight the areas, with high level of climate extreme risks, which are needed in the first priority implementation of the adaptation measures. To be mention, that by the end of century, over the future time period 2081-2100, all the RoM's administrative-territorial units will be among *„very high degree of exposure"*, and *„high degree of exposure"* categories and require special attention in policies dealing with climate change adaptation.

The following gradation was applied to divide the administrative-territorial units by the degree of exposure to extreme temperature and precipitation based on projections from CMIP6 6 GCMs ensemble for two socio-economic scenarios SSP1-2.6, and SSP5-8.5 during the four future time periods: 2021- 2040, 2041-2060, 2061-2080, and 2081-2100, comparative to the 2008-2019 reference period:

	0.3196≤E<0.3768 – very low degree of exposure
	0.3768≤E<0.4339 – low degree of exposure
	0.4339≤E<0.4911 – medium degree of exposure
	0.4911≤E<0.5482 – high degree of exposure
	0.5482≤E<0.6054 – very high degree of exposure

Over the period 2021-2040, according to the ensemble of CMIP6 6 GCMs for SSP1-2.6 scenario is expected the slight decrease from 0.9 to 5.6 per cent in the exposure to climate change risks across of Northern and Central AEZs (is mainly determined by lower value in TXx, GSL, PRCPTOT, R95ptot, rx1-day, rx5-day, and r20mm), while in Southern AEZ the increase by 10.9-15.4 per cent in exposure to climate change risks is projected (is mainly determined by high value in TXx, SU, FD, TR, GSL, R95ptot, rx1-day, rx5-day, and SDII), as compared with the reference period 2008-2019.

The greatest exposure to climate change risks, according to the SSP1-2.6 scenario, is expected in Cantemir, Cimislia and Leova (0.5076) in Southern AEZ, while the lowest is projected for Briceni, Donduseni, and Edinet (0.4145) in Northern AEZ.

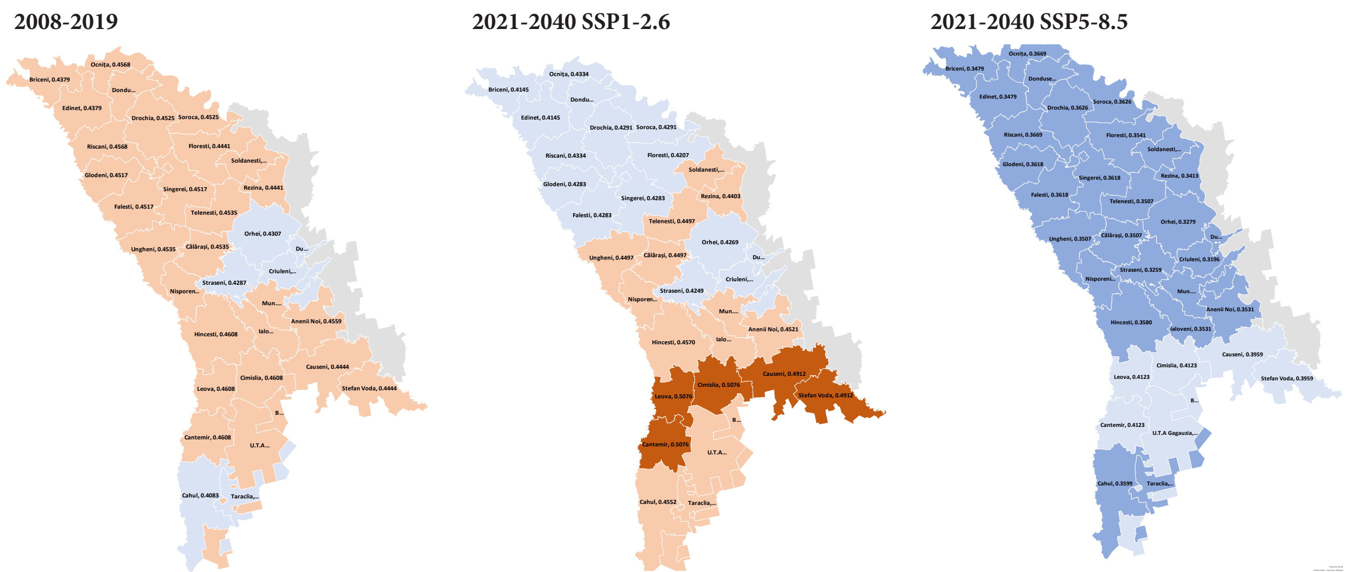
As compared with the reference period, 2008-2019, in 2021-2040, according to the ensemble of CMIP6 6 GCMs for SSP5-8.5 scenario, a differentiated decrease in the E index is expected, from 9.6 to 12.4 per cent (Southern AEZ) and from 19.5 to 20.6 per cent (Northern AEZ), with maximum decrease by 23.4-26.3 per cent in Central AEZ of the RoM.

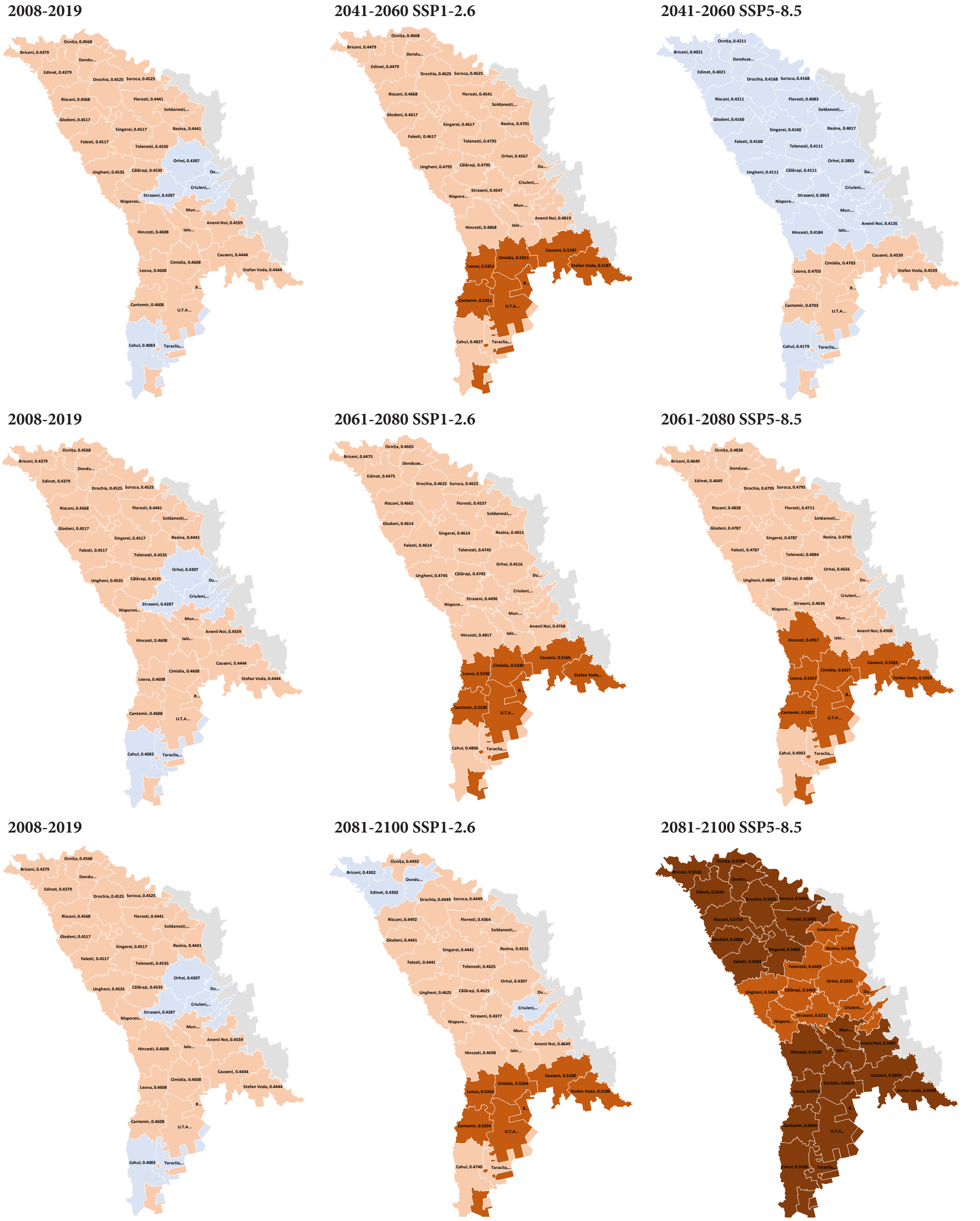
Table 5-22: Projections of Exposure Index (E) on the Republic of Moldova's ATUs Level, per cent of Change, Comparative to 2008-2019 Reference Period

District	2021-2040		2041-2060		2061-2080		2081-2100	
	SSP1-2.6	SSP5-8.5	SSP1-2.6	SSP5-8.5	SSP1-2.6	SSP5-8.5	SSP1-2.6	SSP5-8.5
Mun. Balti	**-4.5**	-20.1	2.8	-7.7	2.8	7.2	-1.1	26.9
Briceni	**-4.2**	-20.6	4.0	-7.3	3.9	8.8	-0.3	32.0
Donduseni	**-4.2**	-20.6	4.0	-7.3	3.9	8.8	-0.3	32.0
Drochia	**-4.8**	-19.5	2.7	-7.4	2.6	7.6	-1.2	28.0
Edinet	**-4.2**	-20.6	4.0	-7.3	3.9	8.8	-0.3	32.0
Falesti	**-5.0**	-20.6	2.7	-8.0	2.7	7.3	-1.4	27.9
Floresti	**-5.6**	-20.6	2.1	-8.2	1.8	6.6	-1.7	26.9
Glodeni	**-5.0**	-20.6	2.7	-8.0	2.7	7.3	-1.4	27.9
Ocnita	**-4.5**	-20.1	2.8	-7.7	2.8	7.2	-1.1	26.9
Riscani	**-4.5**	-20.1	2.8	-7.7	2.8	7.2	-1.1	26.9
Singerei	**-5.0**	-20.6	2.7	-8.0	2.7	7.3	-1.4	27.9
Soroca	**-4.8**	-19.5	2.7	-7.4	2.6	7.6	-1.2	28.0
Mun. Chisinau	**0.4**	-23.4	7.3	-8.8	6.4	9.9	3.5	24.7
Anenii Noi	**0.4**	-23.4	7.3	-8.8	6.4	9.9	3.5	24.7
Călărași	**0.2**	-24.2	7.3	-9.2	6.1	9.9	3.7	24.1
Criuleni	**-1.7**	-26.3	5.8	-11.3	4.1	7.4	1.6	21.4
Dubasari	**-0.9**	-24.8	6.3	-10.3	4.6	7.9	2.4	22.1
Hincesti	**0.3**	-23.8	7.5	-8.8	6.6	10.5	3.7	25.5
Ialoveni	**0.4**	-23.4	7.3	-8.8	6.4	9.9	3.5	24.7
Nisporeni	**0.2**	-24.2	7.3	-9.2	6.1	9.9	3.7	24.1
Orhei	**-0.9**	-24.8	6.3	-10.3	4.6	7.9	2.4	22.1
Rezina	**-1.1**	-24.3	5.7	-10.3	4.3	7.6	2.0	20.5
Straseni	**-0.9**	-24.9	6.6	-10.5	4.5	7.7	2.3	21.2
Soldanesti	**-1.1**	-24.3	5.7	-10.3	4.3	7.6	2.0	20.5
Telenesti	**0.2**	-24.2	7.3	-9.2	6.1	9.9	3.7	24.1
Ungheni	**0.2**	-24.2	7.3	-9.2	6.1	9.9	3.7	24.1
Basarabeasca	**10.9**	-12.3	17.9	2.1	17.8	20.5	15.5	36.5
Cahul	**15.4**	-9.6	22.9	5.8	22.5	25.5	20.6	42.4
Cantemir	**11.1**	-12.4	17.7	1.9	17.4	20.1	15.4	36.2
Causeni	**11.9**	-9.9	18.6	2.9	17.3	19.5	16.6	33.7
Cimislia	**11.1**	-12.4	17.7	1.9	17.4	20.1	15.4	36.2
Leova	**11.1**	-12.4	17.7	1.9	17.4	20.1	15.4	36.2
Stefan Voda	**11.9**	-9.9	18.6	2.9	17.3	19.5	16.6	33.7
Taraclia	**15.4**	-9.6	22.9	5.8	22.5	25.5	20.6	42.4
U.T.A Gagauzia	**10.9**	-12.3	17.9	2.1	17.8	20.5	15.5	36.5

The lower exposure to climate change risks caused by extreme temperature and precipitation according to the ensemble of CMIP6 6 GCMs for SSP5-8.5 scenario during the 2021-2040 time period is mainly determined by low value in TXx, SU, TR, TN90p, TX90p, WSDI, GSL, R95ptot, rx1-day, and rx5-day, see more in Table 5-22, and Figure 5-45.

In comparison with the observed reference period, 2008-2019, over the future 2041-2060 time period, according to the ensemble of CMIP6 6 GCMs SSP1-2.6 scenario, the exposure to climate risks is expected to increase from 2.1 to 22.9 per cent in different regions of the RoM. The maximum growth of the E index during 2041-2060, according SSP1-2.6 scenario, is possible, from 17.7 to 22.9 per cent in Southern AEZ, as compared to the reference period, 2008-2019.





LEGEND: Exposure

	$0.3196 \le E < 0.3768$ – very low degree of exposure
	$0.3768 \le E < 0.4339$ – low degree of exposure
	$0.4339 \le E < 0.4911$ – medium degree of exposure
	$0.4911 \le E < 0.5482$ – high degree of exposure
	$0.5482 \le E < 0.6054$ – very high degree of exposure

Figure 5-45: CMIP6 6 GCMs Ensemble Projections of Exposure Index, under Two SSP1-2.6 and SSP5-8.5 Scenarios, 2008-2019 Reference Period.

The greatest increase exposure to extreme temperature and precipitation, according to E index, is expected in Cantemir, Cimislia and Leova (0.5351), following by Causeni and Stefan Voda (0.5187), and Basarabeasca and Cahul (0.5083) in Southern AEZ (is mainly determined by high value in TXx, SU, FD, TR, TN90p, TX90p, WSDI, GSL, R95ptot, rx1-day, rx5-day, and SDII), while the lowest is expected in Criuleni (0.4483) Central AEZ, following by Briceni, Donduseni, and Edinet (0.4479) in Northern AEZ (is mainly determined by low value in TXx, GSL, WSDI, PRCPTOT, r20mm, R95ptot, rx1-day, and rx5-day).

Controversially, under the ensemble of CMIP6 6 GCMs for SSP5-8.5 scenario during 2041-2060 is expected the moderate decrease from 7.3 to 11.3 per cent in the exposure to climate change risks across of Northern and Central AEZs (is mainly determined by lower value in TXx, SU, TR, GSL, WSDI, PRCPTOT, rx1-day, rx5-day, and r20mm in Northern, and TXx, TNn, SU, TR, TX90p, WSDI, PRCPTOT, R95ptot, r20mm, rx1-day, and rx5-day Central AEZs), while in Southern AEZ the slight increase by 2.1-5.8 per cent in exposure to climate change risks is projected (is mainly determined by high value in TXx, SU, FD, TR, GSL, R95ptot, rx1-day, and rx5-day), as compared with the reference period 2008-2019, see more in Table 5-22, and Figure 5-45.

By the end of the century, over the period 2081-2100 on the territory of the RoM, according to the ensemble of CMIP6 6 GCMs for both socio-economic scenarios is expected differentiated from slight to moderate (in case of SSP1-2.6) and / or from moderate to high (in case of SSP5-8.5) increase in exposure to climate change risks in dependence from AEZ's region. The increase of the E index will vary, according to the SSP1-2.6 scenario, from 1.6-3.7 per cent (Central AEZ) to 15.4-20.6 per cent (Southern AEZ), while a slight decrease by 0.3-1.7 per cent in E is projected in Northern AEZ, and / or from 20.5-24.7 per cent (Central) up to 33.7-42.4 per cent (Southern AEZ), according to scenario SSP5-8.5, as compared to the 2008-2019 reference period.

The greatest increase of exposure to extreme temperature and precipitation, according SSP5-8.5 scenario, is expected in Cantemir, Cimislia and Leova (0.6054), following by Causeni and Stefan Voda (0.5890), and Basarabeasca and UTA Gagauzia (0.5787) in Southern AEZ (is mainly determined by extremely high increase in TXx, SU, TR, TN90p, TX90p, WSDI, GSL, and R95ptot, rx1-day, rx5-day, and SDII), while the lowest is expected, according SSP1-2.6 scenario, in Briceni, Donduseni, and Edinet (0.4302) in Northern AEZ (is mainly determined by low value in GSL, PRCPTOT, r20mm, R95ptot, rx1-day, and rx5-day), see more in Table 5-22, and Figure 5-45.

5.3.6.2. CMIP6 6 GCMs Ensemble Projections of Climate Vulnerability Index, under two SSP1-2.6 and SSP5-8.5 Scenarios, Comparative to 2008-2019 Reference Period

In order to estimate the possible changes in vulnerability to climate change risks of the RoM's three AEZs (Northern, Central, Southern) the projections of Exposure Index (E) based on 16 extreme temperature and precipitation indices (Warm nights (TN90p), Warm days (TX90p), Warm spell duration (WSDI), Maximum daily maximum temperature (TXX), Minimum daily minimum temperature (TNN), Frost days (FD), Summer days (SU), Tropical nights (TR), Growing season length (GSL), Max 1-day precipitation (RX1day), Max 5-day precipitation (RX5day), Simple daily intensity (SDII), Heavy precipitation days (R10mm), Very heavy precipitation days (R20mm), Contribution from very wet days (R95ptot), Total wet-day precipitation (PRCPTOT)) for four 20-year future time periods: 2021- 2040, 2041-2060, 2061-2080, and 2081-2100, in the 21st century, were modeled according to the CMIP6 6 GCMs ensemble for two socio-economic scenarios SSP1-2.6 and SSP5-8.5, comparative to 12-year observed baseline period (2008–2019).

The spatial assessment of vulnerability to future climate change risks of the RoM's territory, based on projections from CMIP6 6 GCMs ensemble for two Socio-Economic Scenarios SSP1-2.6, and SSP5-8.5, during four future time periods: near - term (2021- 2040), medium – term (2041-2060), 2061-2080, and long – term (2081-2100) is shown in Figure 5-46.

To address this task, the normalized average value's projections of vulnerability index for the RoM's administrative-territorial units were divided into five categories: *„very low degree of vulnerability"*, *„low degree of vulnerability"*, *„medium degree of vulnerability"*, *„high degree of vulnerability"*, and *„very high degree of vulnerability"*.

Thus, vulnerability maps highlight the areas, which are needed in the first priority implementation of the adaptation measures. To be mention, that by the end of century, over the future time period 2081-2100, almost all the administrative-territorial units will be among *„high degree of vulnerability"*, and *„very high degree of vulnerability"* categories and require special attention in policies dealing with climate change adaptation.

The following gradation was applied to divide the districts by the degree of vulnerability to climate change risks of the administrative-territorial units based on modeled projections from CMIP6 6 GCMs ensemble for two Socio-Economic Scenarios (SSP1-2.6, and SSP5-8.5) during the four future time periods: 2021-2040, 2041-2060, 2061-2080, and 2081-2100, comparative to the 2008-2019 reference period:

	– very low degree of vulnerability
	– low degree of vulnerability
	– medium degree of vulnerability
	– high degree of vulnerability
	– very high degree of vulnerability

Over the period 2021-2040, according to the ensemble of CMIP6 6 GCMs for SSP1-2.6 scenario is expected the slight decrease from 0.2 to 1.6 per cent in the vulnerability to climate change risks across of Northern and Central AEZ, while in Southern AEZ the increase by 3-3.3 per cent in vulnerability to climate change risks is projected, as compared with the reference period 2008-2019.

A comparative analysis of vulnerability to climate change based on exposure, sensitivity, and adaptive capacity assessment of the administrative-territorial units show that without application of adaptation measures the most vulnerable districts to climate change in the RoM in territorial aspect, according to the ensemble of CMIP6 6 GCMs for SSP1-2.6 scenario, would be the following districts: Hincesti (0.5367), and Rezina (0.5246) in Central AEZ; Leova (0.5350), Basarabeasca (0.5307), Cantemir (0.5290) in Southern AEZ; and Falesti (0.5231) in Northern AEZ, while the lowest vulnerability is projected for Ialoveni (0.4544), Anenii Noi (0.4571), and Criuleni (0.4746) in Central AEZ; and Floresti (0.4745) in Northern AEZ.

In comparison with the 2008-2019 reference period, according to the ensemble of CMIP6 6 GCMs for SSP5-8.5 scenario is expected the moderate decrease from 3.1 to 7.5 per cent in the vulnerability to climate change risks across the RoM AEZs, more pronounced in Northern and Central AEZs, while in Southern AEZ is projected the minimal decrease by 3.1-3.4 per cent.

The most vulnerable districts to climate change in the RoM in territorial aspect, according to SSP5-8.5 scenario, would be the following districts: Hincesti (0.5037) Rezina (0.5246) in Central AEZ; Leova (0.5032), Basarabeasca (0.4989); and Falesti (0.5009) in Northern AEZ, while the lowest vulnerability is projected for Ialoveni (0.4214), Anenii Noi (0.4241), and Criuleni (0.4416) in Central AEZ, see more in Table 5-23, and Figure 5-46.

In comparison with the observed reference period, 2008-2019, over the future 2041-2060, time period according to the ensemble of CMIP6 6 GCMs SSP1-2.6 scenario the vulnerability to climate risks is expected to increase from 0.6 to 5.2 per cent in different regions of the Republic of Moldova. The maximum growth of vulnerability index during 2041-2060, according SSP1-2.6 scenario, is possible, from 4.8 to 5.2 per cent in Southern AEZ, as compared to the reference period, 2008-2019.

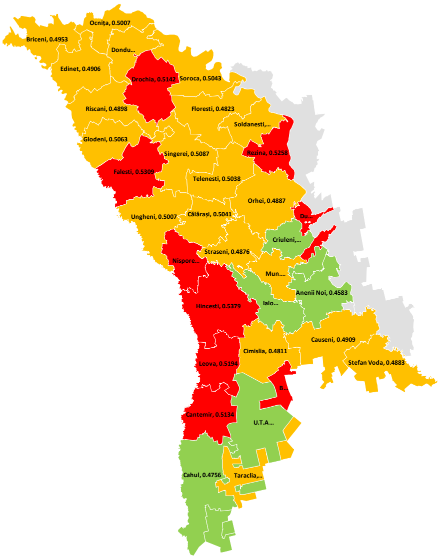
The most vulnerable districts to climate change in the RoM in territorial aspect, according to SSP1-2.6 scenario, would be the following districts: Hincesti (0.5466) Rezina (0.5345) in Central AEZ; Leova (0.5441), Basarabeasca (0.5398), Cantemir (0.5382) in Southern AEZ, while the lowest vulnerability is projected for Ialoveni (0.4643), Anenii Noi (0.4670) and Criuleni (0.4845) in Central AEZ.

Controversially, under the ensemble of CMIP6 6 GCMs for SSP5-8.5 scenario during 2041-2060 is expected the slight decrease from 2.2 to 3.1% in vulnerability to climate change risks across of Northern and Central AEZs, while in Southern AEZ the slight increase by 0.6-0.7% in vulnerability to climate change risks is projected, as compared with the reference period 2008-2019, see more in Table 5-23, and Figure 5-46.

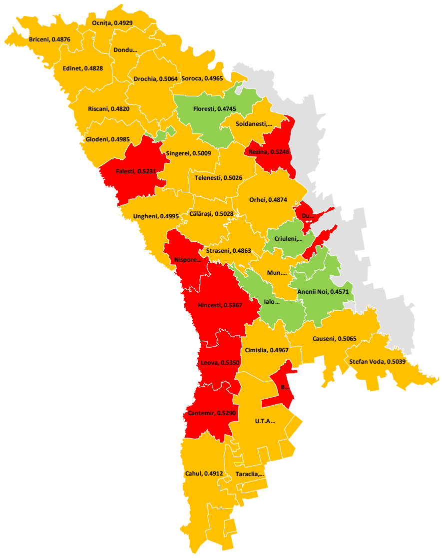
Table 5-23: Projections of Climate Vulnerability Index, (CVI) on the Republic of Moldova's ATUs Level, % of Change, Comparative to 2008-2019 Reference Period

District	2008-2019	Projected 2021-2040		Projected 2041-2060		Projected 2061-2080		Projected 2081-2100	
		SSP1-2.6	SSP5-8.5	SSP1-2.6	SSP5-8.5	SSP1-2.6	SSP5-8.5	SSP1-2.6	SSP5-8.5
Mun. Balti	0.4861	-1.6	-6.2	0.7	-2.5	0.7	1.9	-0.5	8.0
Briceni	0.4953	-1.6	-6.1	0.7	-2.4	0.6	1.8	-0.5	7.8
Donduseni	0.4897	-1.6	-6.1	0.7	-2.4	0.7	1.8	-0.5	7.9
Drochia	0.5142	-1.5	-5.8	0.6	-2.3	0.6	1.7	-0.5	7.6
Edinet	0.4906	-1.6	-6.1	0.7	-2.4	0.7	1.8	-0.5	7.9
Falesti	0.5309	-1.5	-5.6	0.6	-2.2	0.6	1.7	-0.5	7.3
Floresti	0.4823	-1.6	-6.2	0.7	-2.5	0.7	1.9	-0.5	8.1
Glodeni	0.5063	-1.5	-5.9	0.7	-2.4	0.6	1.8	-0.5	7.7
Ocnita	0.5007	-1.6	-6.0	0.7	-2.4	0.6	1.8	-0.5	7.8
Riscani	0.4898	-1.6	-6.1	0.7	-2.4	0.7	1.8	-0.5	7.9
Singerei	0.5087	-1.5	-5.9	0.7	-2.3	0.6	1.8	-0.5	7.6
Soroca	0.5043	-1.5	-5.9	0.7	-2.4	0.6	1.8	-0.5	7.7
Mun. Chisinau	0.4906	-0.3	-7.0	1.8	-2.9	1.4	2.4	0.6	6.3
Anenii Noi	0.4583	-0.3	-7.5	1.9	-3.1	1.5	2.5	0.7	6.8
Călărași	0.5041	-0.2	-6.8	1.7	-2.8	1.4	2.3	0.6	6.1
Criuleni	0.4759	-0.3	-7.2	1.8	-3.0	1.5	2.4	0.6	6.5
Dubasari	0.5166	-0.2	-6.6	1.7	-2.7	1.4	2.3	0.6	6.0
Hincesti	0.5379	-0.2	-6.4	1.6	-2.6	1.3	2.2	0.6	5.8
Ialoveni	0.4557	-0.3	-7.5	1.9	-3.1	1.5	2.6	0.7	6.8
Nisporeni	0.5141	-0.2	-6.7	1.7	-2.7	1.4	2.3	0.6	6.0
Orhei	0.4887	-0.3	-7.0	1.8	-2.9	1.4	2.4	0.6	6.3
Rezina	0.5258	-0.2	-6.5	1.6	-2.7	1.3	2.2	0.6	5.9
Straseni	0.4876	-0.3	-7.0	1.8	-2.9	1.4	2.4	0.6	6.3
Soldanesti	0.5094	-0.2	-6.7	1.7	-2.8	1.4	2.3	0.6	6.1
Telenesti	0.5038	-0.2	-6.8	1.7	-2.8	1.4	2.3	0.6	6.1
Ungheni	0.5007	-0.3	-6.8	1.7	-2.8	1.4	2.3	0.6	6.2
Basarabeasca	0.5151	3.0	-3.1	4.8	0.6	4.7	5.3	4.2	9.4
Cahul	0.4756	3.3	-3.4	5.2	0.7	5.1	5.7	4.6	10.1
Cantemir	0.5134	3.0	-3.1	4.8	0.6	4.7	5.3	4.3	9.4
Causeni	0.4909	3.2	-3.3	5.0	0.6	4.9	5.6	4.5	9.8
Cimislia	0.4811	3.2	-3.4	5.1	0.7	5.0	5.7	4.5	10.0
Leova	0.5194	3.0	-3.1	4.8	0.6	4.6	5.3	4.2	9.3
Stefan Voda	0.4883	3.2	-3.3	5.1	0.7	4.9	5.6	4.5	9.9
Taraclia	0.4864	3.2	-3.3	5.1	0.7	4.9	5.6	4.5	9.9
U.T.A Gagauzia	0.4742	3.3	-3.4	5.2	0.7	5.1	5.8	4.6	10.2

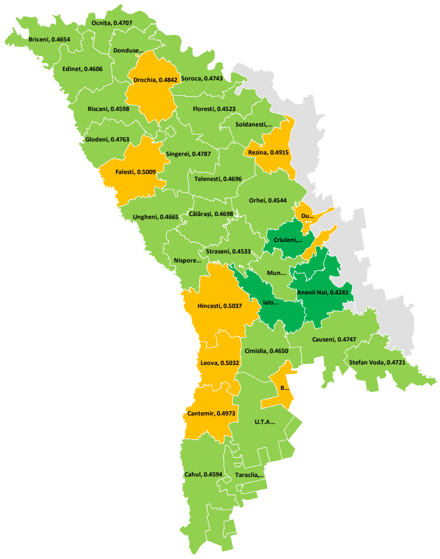
2008-2019



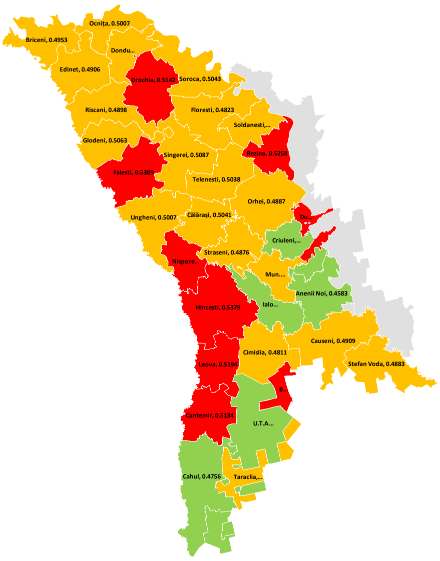
2021-2040 SSP1-2.6



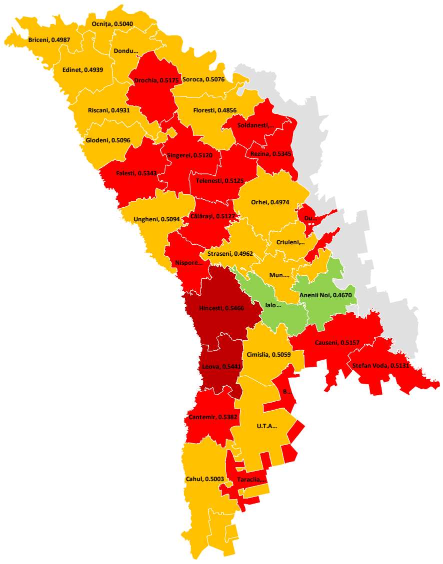
2021-2040 SSP5-8.5



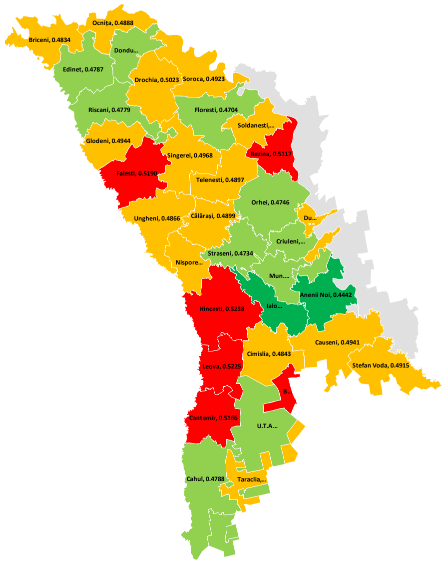
2008-2019



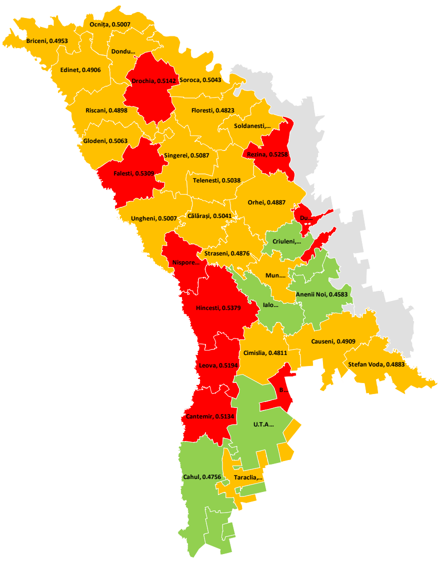
2041-2060 SSP1-2.6



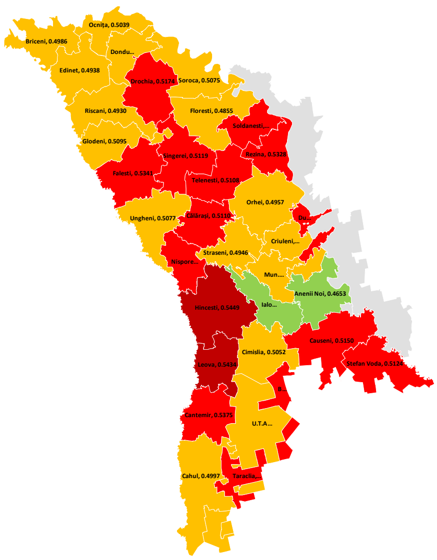
2041-2060 SSP5-8.5



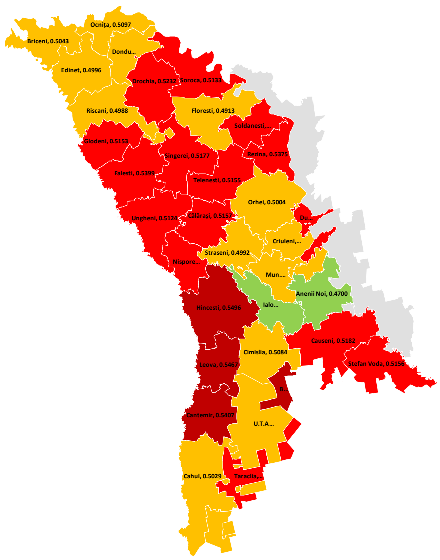
2008-2019

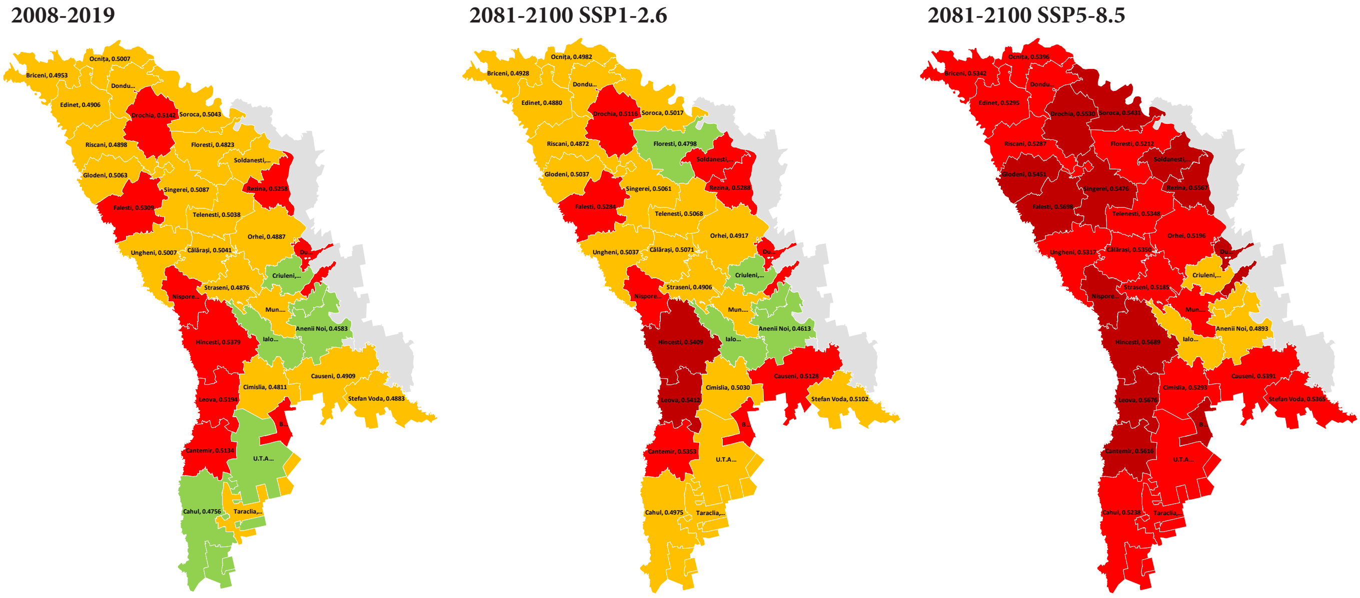


2061-2080 SSP1-2.6



2061-2080 SSP5-8.5





LEGEND: Vulnerability

	$0.4214 \le CVI_i < 0.4511$ – very low degree of vulnerability
	$0.4511 \le CVI_i < 0.4808$ – low degree of vulnerability
	$0.4808 \le CVI_i < 0.5104$ – medium degree of vulnerability
	$0.5104 \le CVI_i < 0.5401$ – high degree of vulnerability
	$0.5401 \le CVI_i < 0.5698$ – very high degree of vulnerability

Figure 5-46: CMIP6 6 GCMs Ensemble Projections of Climate Vulnerability Index, under two SSP1-2.6 and SSP5-8.5 scenarios, comparative to 2008-2019 reference period.

By the end of the century, over the future time period 2081-2100 on the territory of the RoM, according to the ensemble of CMIP6 6 GCMs for both socio-economic scenarios is expected differentiated from slight (in case of SSP1-2.6) and/or moderate (in case of SSP5-8.5) increase in vulnerability to climate change risks in dependence from AEZ's region. The increase of the vulnerability climate change index will vary, according to the SSP1-2.6 scenario, from 0.6-0.7 per cent (Central AEZ) to 4.2-4.6 per cent (Southern AEZ), while a slight decrease by 0.5 per cent in vulnerability is projected in Northern AEZ, and / or increase from 7.6-8.1 per cent (Central) up to 9.3-10.1 per cent (Southern AEZ), according to scenario SSP5-8.5, as compared to the 2008-2019 reference period.

The most vulnerable districts to climate change in the RoM in territorial aspect, according to SSP5-8.5 scenario, during the 2081-2100 time period would be the following districts: Hincesti (0.5689), Rezina (0.5567) in Central AEZ; Leova (0.5676), Basarabeasca (0.5633), Cantemir (0.5616) in Southern AEZ; and Falesti (0.5698), Drochia (0.5530) in Northern AEZ, while the lowest vulnerability is projected, according SSP1-2.6 scenario, for Ialoveni (0.4587) and Anenii Noi (0.4613) in Central AEZ.

5.4. Climate Change Impacts and Vulnerabilities in the Republic of Moldova

5.4.1. Climate Change and Water Resources

5.4.1.1. Activity Data, Evaluation Methodologies and Summary of Observed Trends

Assessment of risks and vulnerability indices for the most likely climatic risks of water resources in the Republic of Moldova is best done through the analysis of climate flow forecast.

According to the water balance equation, where the discharge component is expressed as a difference between the net precipitation X_0 and the overall evaporation $\overline{E}_{US}$, the used formula of the water balance in the receiving basin, normalized with the maximum evaporation, can be entered as follows:

$$\beta_Y = \beta_X - (1 + \beta_X^{-n})^{-\frac{1}{n}} \quad (5.18)$$

where $\beta_Y = \overline{Y}_{CL} / \overline{E}_{max}$ and $\beta_X = X_0 / \overline{E}_{max}$.

The transition from the values normed after presented from equation (5.18), to the equivalent values of the characteristics of the hygrothermal balance is achieved by the co-relation:

$$\overline{Y}_{cl} = \overline{X} - \overline{E}_{max}\left[1 + \left(\frac{\overline{X}}{\overline{E}_{max}}\right)^{-3}\right]^{-\frac{1}{3}} \quad (5.19)$$

Finally, the expression (5.19) will look like the usual balance:

$$\overline{Y}_{cl} = \overline{X} - \overline{E}_{US} \quad (5.20)$$

Here $\overline{X}$, $\overline{E}_{max}$ and $\overline{E}_{US}$ – respectively, the multiannual average values of annual precipitation, the hydrothermal equivalent and global evaporation, mediated by the surfaces of the reception basins.

Finally, equation (5.20) contains the components of the hygrothermal balance and, therefore, describes only the climatic characteristics, which allows us to refer to them $\overline{Y}_{cl}$ in "climatic leakage", or "climatic water resources". The realization of equation (5.19) requires the use of global evaporation $\overline{E}_{US}$ and precipitation values $\overline{X}$.

The determination of evaporation and evapotranspiration are rather complicated processes, which require a lot of input data (parameters), which are often very difficult to obtain. The simpler, more generalized procedure consists in determining the maximum possible evaporation or potential evaporation, which in itself already contains both values.

Potential evaporation or potential evaporotranspiration $\overline{E}_m$ is defined as the volume of evaporation that would occur if a sufficient source of water was available. If actual evapotranspiration is considered the net result of atmospheric humidity conditions on a surface and the surface's ability to provide moisture, then potential evaporation is a combination of these. All this is affected by the surface and air temperatures, insolation and wind. A dry land is a place where the annual evaporation potential exceeds the annual rainfall. It should be mentioned that the potential (or maximum possible $\overline{E}_m$) evaporation is not an accurate physical value, but it is widely applied for hydrological and meteorological synthesis and regionalization (Bejenaru, et al., 2020).

For the territory of Ukraine and the Republic of Moldova (Gopcenco & Loboda, 2005; Loboda, 2005) three empirical functions are proposed, which are described by the equations:

$$\overline{E}_m = 13{,}3\, \Sigma_V^{IX}\, \overline{t_l} - 307, \qquad (5.21)$$

$$\overline{E}_m = 0{,}244\, \Sigma_V^{IX}\, \overline{t}_{>10} + 226, \qquad (5.22)$$

$$\overline{E}_m = 0{,}209\, \Sigma_V^{IX}\, \overline{t}_{>0} - 179. \qquad (5.23)$$

Here $\overline{t_l}$ – the multiannual average value of the air temperature, cumulated for the warm period of the year (V-IX); $\Sigma_V^{IX}\, \overline{t}_{>10}$ – the multiannual sum of the air temperature above 10°C; $t_{>0}$ – the sum of the multiannual average air temperatures above 0°C. Of those proposed (Eq. 5.21-5.23), the model (5.21) which provides the best results for the Republic of Moldova was applied.

The model (5.21) was applied thereafter for the evaluation of the maximum possible evaporation. By applying this model, the maximum possible evaporation on the territory of the Republic of Moldova for the 1995-2014 reference period was calculated (Figure 5-47).

Model (5.20) was used to calculate the climatic leakage $\overline{Y}_{cl}$ for the reference period 1995-2014 (Figure 5-48).

In the case of the spatial analysis of the flow, the measurement units expressed in the flow layer (mm) are preferred, which can then be expressed in units of volume – flow rates or volumes of flow.

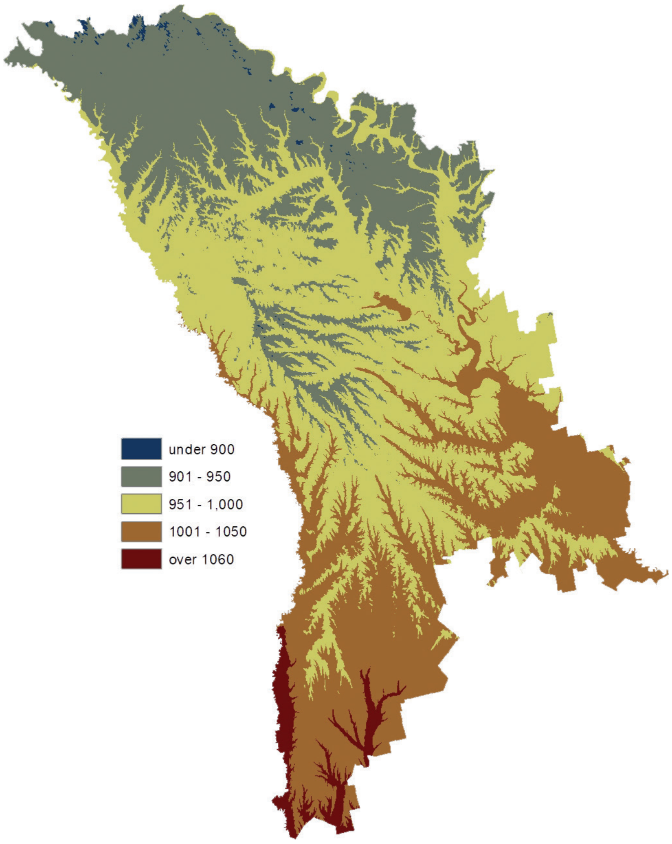


Figure 5-47: Maximum possible evaporation $\overline{E}_m$ for the reference period 1995-2014.

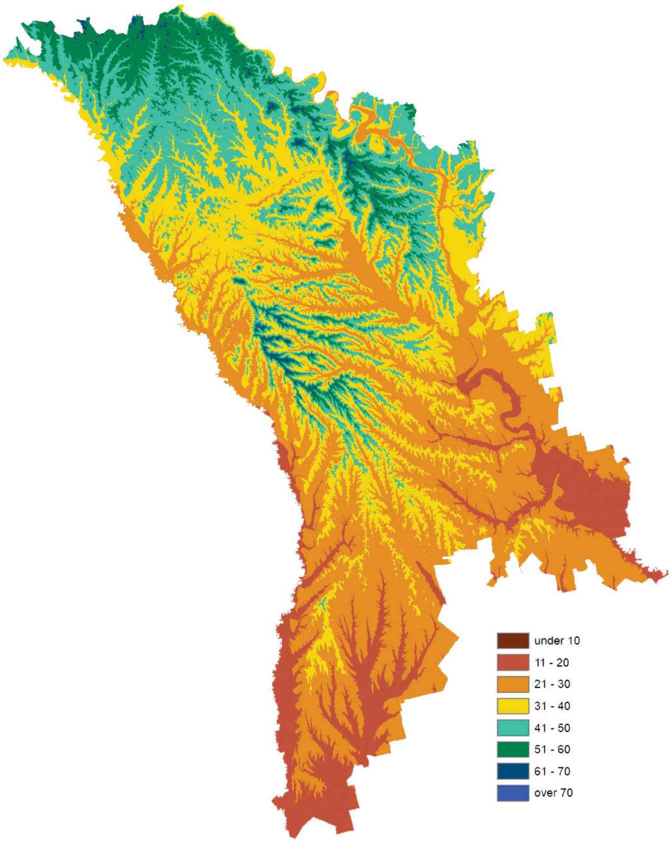


Figure 5-48: Climate flow $\overline{Y}_{cl}$ for the reference period 1995-2014.

The spatial analysis of the maximum possible evaporation $\overline{E}_m$ and climatic flow $\overline{Y}_{cl}$ indicates an obvious dependence on the geographical latitude and the country's relief. Thus, the highest values $\overline{E}_m$ are recorded in the south of the country, and the lowest in the north. The highest values of the climatic flow $\overline{Y}_{cl}$ – are characteristic of the north of the country, and the lowest in the south and south-east of the country, (Table 5-24).

For the calculation of the contemporary norm of the annual flow, the water balance formula (model) Mezentsev, 1976, is widely used. In Cazac & Lalykin version, 2005 this model has the following aspect:

$$\overline{Y}_{pr} = (\overline{X} \mp \Delta\overline{X}) - \overline{E}_m(1+\varepsilon_2\Delta\overline{t}) \left\{1 + \left[\frac{\overline{E}_m(1+\varepsilon_2\Delta\overline{t})}{(\overline{X} \mp \Delta\overline{X})}\right]^n\right\}^{-\frac{1}{n}} \quad (5.24)$$

Here $\overline{Y}_{pr}$ - the estimated value of the annual average flow, mm; $\overline{X}$ and $\overline{E}_m$ - the contemporary values of annual precipitation and maximum possible evaporation, mm; $\Delta\overline{X}$ and $\Delta\overline{t}$ - the predicted average changes of the annual amount of precipitation and air temperature; ε_2 - coefficient, which represents relative changes of the maximum possible evaporation at 1°C of the annual air temperature increase and equal to 0.04, in accordance with the Water Law Nr. 272/2011[256]; n – parameter, equal to 3.

Table 5-24: Distribution of maximum possible evaporation $\overline{E}_m$ and climatic leakage on agro-ecological zones, mm

AEZ	$\overline{E}_m$	$\overline{Y}_{cl}$
North	945	40.8
Center	989	28.9
South	1021	22.5

5.4.1.2. Projections of Future Changes in Annual Runoff/ Flow

Future projections of climate change cover the 2021-2040, 2041-2060 and 2081-2100 time periods, compared to the reference period 1995-2014, for SSPs (SSP1-2.6; SSP2-4.5 and SSP5-8.5). The impact of climate change on water resources is easier to analyze in terms of their distribution on AEZs (Taranu, 2014; Taranu, et al., 2018), (Tables 5-25, 5-26).

Table 5-25: Change in climate flow, $\overline{Y}_{cl}$ mm, modelled according to the shared socio-economic scenarios SSP1-2.6, SSP2-4.5 and SSP5-8.5 for the periods 2021-2040, 2041-2060 and 2081-2100, compared to the reference period 1995-2014

AEZ	SSP	Climatic flow $\overline{Y}_{cl}$, mm			
		1995-2014	2021-2040	2041-2060	2081-2100
North	SSP1-2.6	40.8	39.7	39.6	40.3
	SSP2-4.5		40.2	34.7	30.8
	SSP5-8.5		41.2	28.8	17.5
Centre	SSP1-2.6	28.9	28.2	28.2	28.8
	SSP2-4.5		28.7	24.5	21.6
	SSP5-8.5		29.4	20.0	11.8
South	SSP1-2.6	22.5	22.0	22.0	22.5
	SSP2-4.5		22.4	19.0	16.7
	SSP5-8.5		23.1	15.4	8.9

Compliance with basic physical-geographical laws (influence of latitude and altitude) is evident in the spatial variation of leakage in general and climatic leakage in particular. This regularity is also observed when modelling the climate leakage according to the scenarios chosen for the proposed time frames.

[256] Water Law Nr. 272 of 23.12.2011, as amended by Law Nr. 249 of 15-11-2018.

The period of 2021-2040 as overall throughout the country will be characterized by very small differences, below 3% compared to the reference period. It is curious that the change of temperatures and precipitations according to the harshest scenario (SSP5-8.5) shows an increase of the climatic leakage in the range of 1.0-2.6% compared to the reference period. In other words, until 2040 the water resources of the Republic of Moldova will not undergo considerable changes conditioned by climate change.

The period of 2041-2060 is much more speckled in terms of spatial distribution of the flow according to the scenarios. The north of the country undergoes essential changes in the direction of reducing the flow from -3% in the case of the SSP1-2.6 scenario; 14.9% - SSP2-4.5 and 29.5% - SSP5-8.5. The center of the country will be more affected within the limits of similar values (from -2.5% to -30.7%) compared to the reference period, depending on the scenario. The southern part of the country will suffer the most, where the climate flow shows a decrease to 31.6% according to the SSP5-8.5 scenario, compared to the reference period of 1995-2014, Table 5-26.

The period 2081-2100 continues the general trend outlined by the previous period. In the case of the favorable scenario SSP1-2.6 in the north of the country, the annul flow will not change considerably – it will only decrease by -1.2% of the annual runoff of the reference period. However, the rest of the scenarios SSP2-4.5 and SSP5-8.5 even in the north of the country show a dramatic decrease of the flow up to -57.2% compared to the runoff of 1995-2014 in the case of the harsh scenario SSP5-8.5.

The center of the country will be more affected by the reduction of the annual flow – from 25.2% (SSP2-4.5) to -59.1% (SSP5-8.5). The southern AEZ will suffer the most from the reduction of water resources only in the case of SSP5-4.5 and SSP5-8.5 scenarios – from -25.7% to -60.6, respectively. The favorable scenario (SSP1-2.6) indicates even a small increase of the annual runoff – by 0.2% compared to the reference period, Table 5-26.

Table 5-26: Change in climate flow, $\overline{Y}_{cl}$ %, compared to the 1995-2014 reference period modelled, according to the SSP1-2.6, SSP2-4.5 and SSP5-8.5 scenarios for the periods 2021-2040, 2041-2060 and 2081-2100

AEZs	SSP	Climatic flow $\overline{Y}_{cl}$, % relative to the reference period			
		1995-2014	2021-2040	2041-2060	2081-2100
North	SSP1-2.6	40.8	-2.8	-3.0	-1.2
	SSP2-4.5		-1.4	-14.9	-24.5
	SSP5-8.5		1.0	-29.5	-57.2
Centre	SSP1-2.6	28.9	-2.4	-2.5	-0.4
	SSP2-4.5		-0.9	-15.4	-25.2
	SSP5-8.5		1.9	-30.7	-59.1
South	SSP1-2.6	22.5	-2.1	-2.0	0.2
	SSP2-4.5		-0.4	-15.7	-25.7
	SSP5-8.5		2.6	-31.6	-60.6

The application of GIS technologies allowed the spatial assessment of the RoM's climate water resources according to the SSP1-2.6, SSP2-4.5 and SSP5-8.5 scenarios (Figure 5-49).

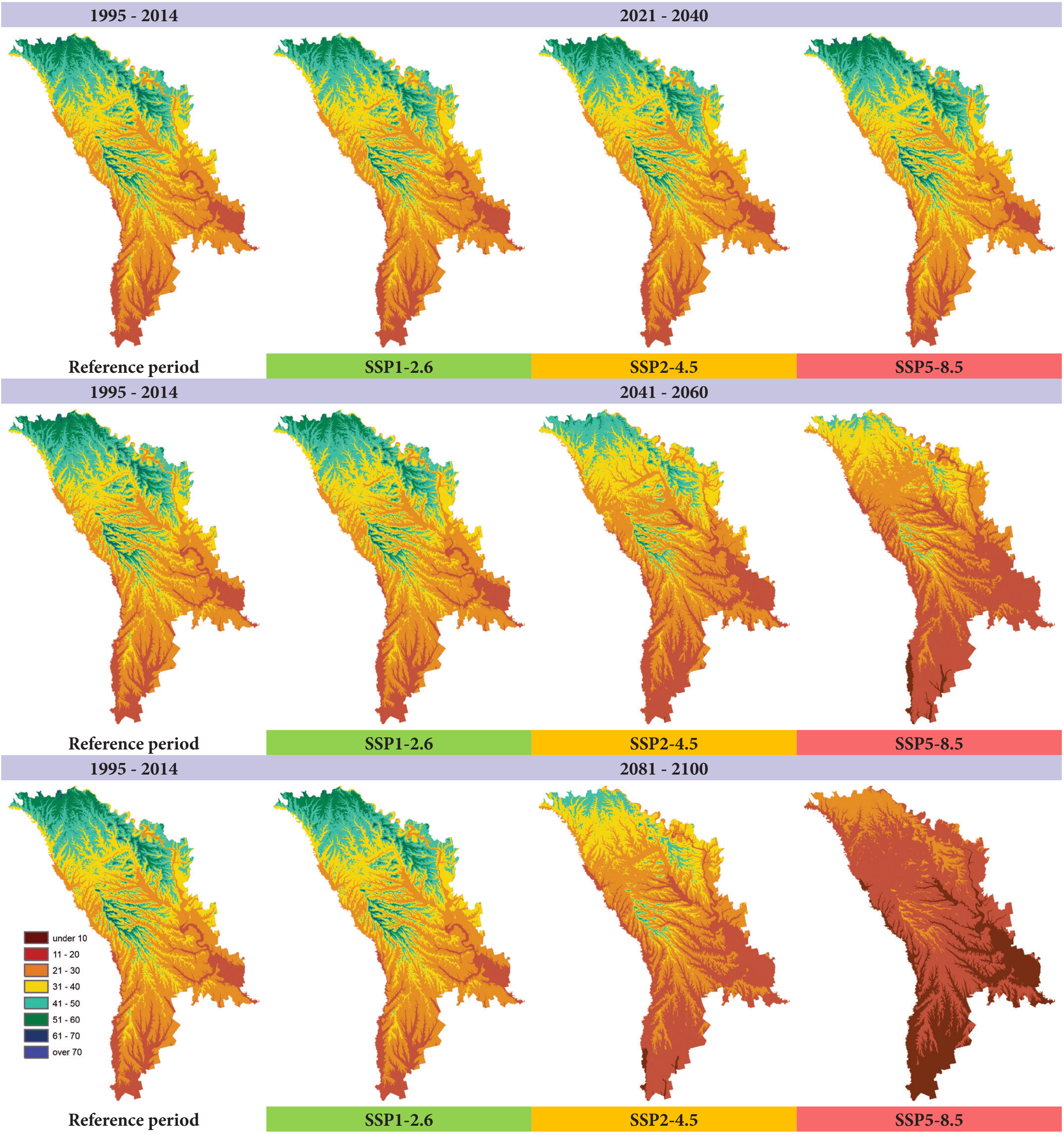


Figure 5-49: Climate flow, $\overline{Y}_{cl}$ mm, according to SSP1-2.6, SSP2-4.5 and SSP5-8.5 scenarios.

5.4.2. Climate Change and Energy Sector

Heating degree day (HDD) index is a weather-based technical index designed to describe the need for the heating energy requirements of buildings. Cooling degree day (CDD) index is a weather-based technical index designed to describe the need for the cooling (air-conditioning) requirements of buildings.

- **HDD index:** the severity of the cold in a specific time period taking into consideration outdoor temperature and average room temperature (in other words the need for heating). The calculation of HDD relies on the base temperature, defined as the lowest daily mean air temperature not leading to indoor heating. The value of the base temperature depends in principle on several factors associated with the building and the surrounding environment.
- **CDD index:** the severity of the heat in a specific time period taking into consideration outdoor temperature and average room temperature (in other words the need for cooling). The calculation of CDD relies on the base temperature, defined as the highest daily mean air temperature not leading to indoor cooling. The value of the base temperature depends in principle on several factors associated with the building and the surrounding environment.

5.4.2.1. Data and Methods

The indices was calculated by R package, Climpact2[257], using observed daily temperature data of 14 meteorological stations for the period of 1961-2019, obtained from the State Hydrometeorological Service. These indices are included in standardized set recommended by the Expert Team on Sector-Specific Climate Indices (ET-SCI)[258]. The standardization of these indices allows researchers to compare results across time periods, regions and source datasets.

Cooling Degree Days, (CDDcoldn) is a measure of the energy demand needed to cool a building calculated as an annual sum of TM - n (where n is a user-defined location-specific base temperature and TM > n), n=18˚C. Heating Degree Days, (HDDheatn) is a measure of the energy demand needed to heat a building calculated as an annual sum of n - TM (where n is a user-defined location-specific base temperature and TM < n), n=18˚C[259].

We applied the trend tests for both the entire historical record (i.e., 1961–2019) and future projections including the reference period 1995–2014 (i.e., 1961–2100). Trends were quantified for Heating and Cooling Degree Days indices in annual basis and displayed in decadal units.

This study encompasses three the RoM AEZs (Northern, Central and Southern) for historical records and future projections (see more in Taranu, 2014; Taranu, et. al., 2018). We used the observed daily maximum and minimum temperature data of 14 meteorological stations for 1961-2019 time period, obtained from the SHS of RoM.

For future projections, gridded downscaled daily temperature data (minima and maxima) were used over the RoM AEZs. Six GCMs from the Coupled Model Intercomparison Project Phase 6 – CMIP6 (Eyring et al., 2016) were statistically downscaled for the historical reference period (1995-2014) and two scenarios: SSP1-2.6 and SSP5-8.5 for four future time periods: 2021- 2040, 2041-2060, 2061-2080, and 2081-2100, see list of selected GCM models in Table 5-27.

Data analysis, statistics and figures were done using Python (van Rossum, 1995), ClimPACT2 tool, and R scripting (R Core Team, 2020).

For each of the CMIP6 6 global model downscaled simulations we calculated the representative 20-year averages for Heating and Cooling degree days indices for two scenarios SSP1-2.6, and SSP5-8.5, and then have been extracted regional averages for the RoM AEZs.

Table 5-27: List of selected CMIP6 models with daily climate data

Model Name	Institute, Country	Variant Label
GFDL-ESM4	Geophysical Fluid Dynamics Laboratory, USA	r1i1p1f1
NESM3	Nanjing University, China	r1i1p1f1
MPI-ESM1-2-LR	Max-Planck Institute, Germany	r1i1p1f1
CNRM-ESM2-1	National Centre for Meteorological Research, France	r1i1p1f2
CNRM-CM6-1	National Centre for Meteorological Research, France	r1i1p1f2
INM-CM5-0	Institute of Numerical Mathematics, Russia	r1i1p1f1

[257] https://climpact-sci.org/get-started/.
[258] https://www.wmo.int/pages/prog/wcp/ccl/ccl17/focusarea/fa3/CCl-17FA3ET-SCIWMO.php.
[259] https://climpact-sci.org/indices/

5.4.2.2. Summary of Observed trends in Cooling Degree Days, (CDDcold18) and Heating Degree Days, (HDDheat18)

Space heating and cooling is responsible for a large fraction of RoM energy use. Heating degree days (HDDs) and cooling degree days (CDDs) are proxies for the energy demand needed to heat or cool, respectively, a home or a business. Both variables are derived from measurements of outside air temperature. The heating and cooling requirements for a given structure at a specific location are considered, to some degree, proportional to the number of HDDs and CDDs at that location. However, they also depend on various other factors, such as building design and insulation, availability and type of heating and cooling systems, energy prices and income levels, and behavioral aspects.

A decrease in the demand for space heating can significantly decrease overall energy use in Europe, but this gain can be offset in part or completely by an increase in cooling demand. Furthermore, heating is delivered to end users in different ways (individual boilers fueled by oil, gas and coal, and electricity and district heating), whereas cooling is delivered currently almost exclusively through electricity. As a result, a given change in cooling demand is generally associated with larger costs, a larger change in primary energy demand and larger impacts on the peak capacity of supply networks than the same change in heating demand (IPCC, 2014a; IPCC, 2014c).

The observed trends in Cooling Degree Days, (CDDcold18) and Heating Degree Days, (HDDheat18) indices over the RoM AEZs are calculated by linear regression analysis and their statistical significance of change (p-value) for two time periods 1961-1990 and 1991-2019 are shown in Figures 5-50, 5-51, more details are provided in Table 5-28.

As can be seen from Table 5-28 and Figure 5-50 that before the 90's years of 20th century a slight decrease in Cooling Degree Days, (CDDcold18) from -13.4 (Northern AEZ) to -25.4 (Southern AEZ) degree-days per decade statistically not significant is observed, followed by sharp increasing trend in the last three decades (1991-2019) from +63.5 (Northern AEZ) to +91.8 (Southern AEZ) degree-days per decade with a very high degree of certainty.

During the 1991-2019, have observed high decreasing trend in Heating Degree Days, (HDDheat18) over the RoM. The CLTS values of the HDDheat18 index on the entire territory of the RoM were statistically significant, had a negative sign and varied from -158.7 (Central AEZ), -203.9 (Northern AEZ) to -232.2 (Southern AEZ)) degree-days per decade, R^2 was from 36% to 54%, which shows a gradual decrease in the HDDheat18 in the region, relative to 1961-1990 time period when the tendency statistical not significant to decrease in HDDheat18 by -52.1 degree-days per decade was observed only in Northern AEZ, Table 5-28, Figure 5-51.

Table 5-28: Comparison of the annual Cooling Degree Days, (CDDcold18)[260] and Heating Degree Days (HDDheat18)[261], (degree-days/10 year), linear trends, R^2, statistical significance of change (p-value) for two time periods 1961-1990 and 1991-2019

AEZ	Time period	CDDcold18, degree-days			HDDheat18, degree-days		
		Trend	R^2	p-value	Trend	R^2	p-value
Northern	*1961-1990*	-13.4	4	0.2661	-52.1	2	0.4326
	1991-2019	+63.5	42	**0.0001**	-203.9	45	**0.0000**
Central	*1961-1990*	-20.4	5	0.2150	+22.7	0.4	0.7184
	1991-2019	+81.9	37	**0.0004**	-158.7	36	**0.0006**
Southern	*1961-1990*	-25.4	8	0.1210	+36.9	2	0.5178
	1991-2019	+91.8	45	**0.0000**	-232.2	54	**0.0000**

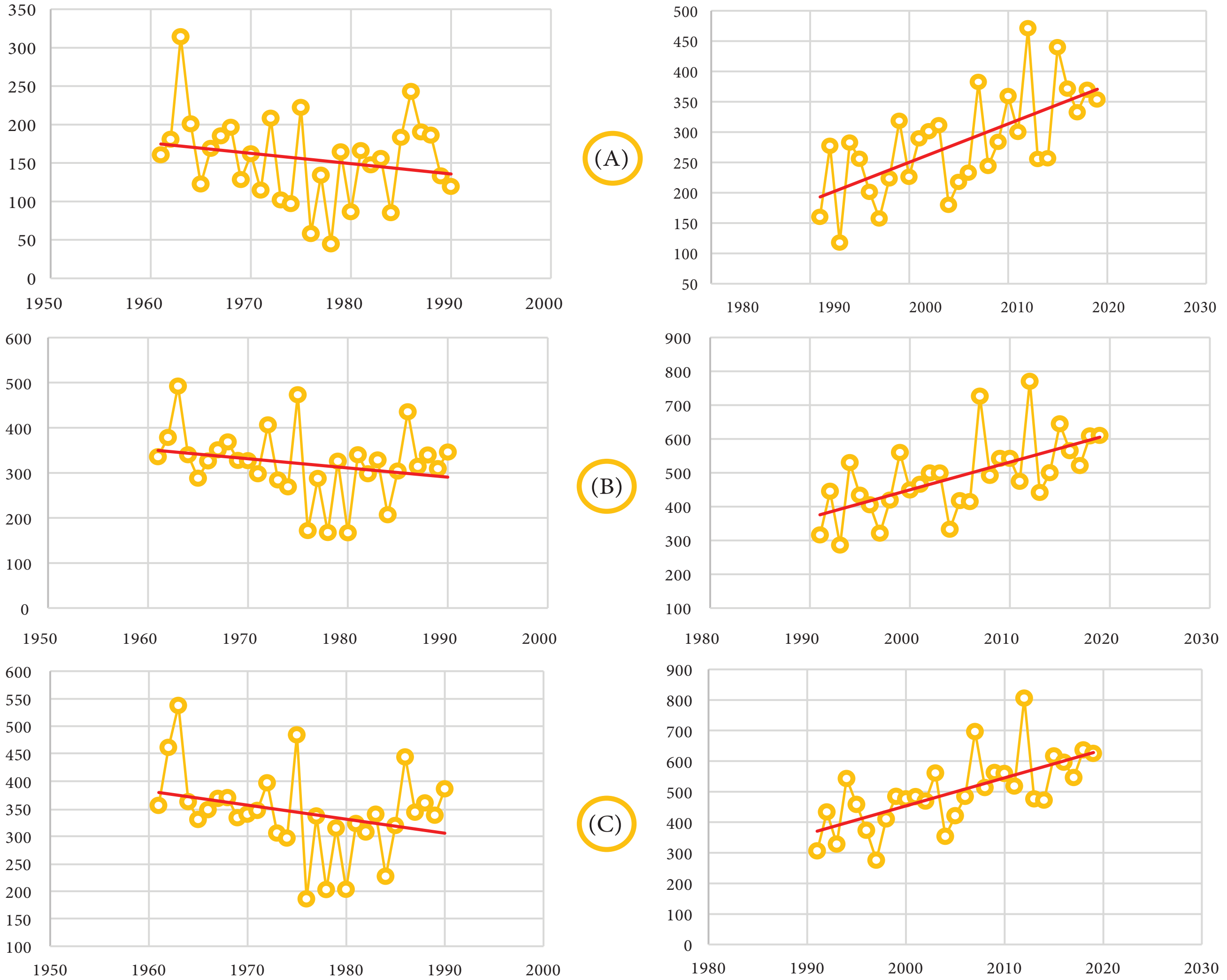
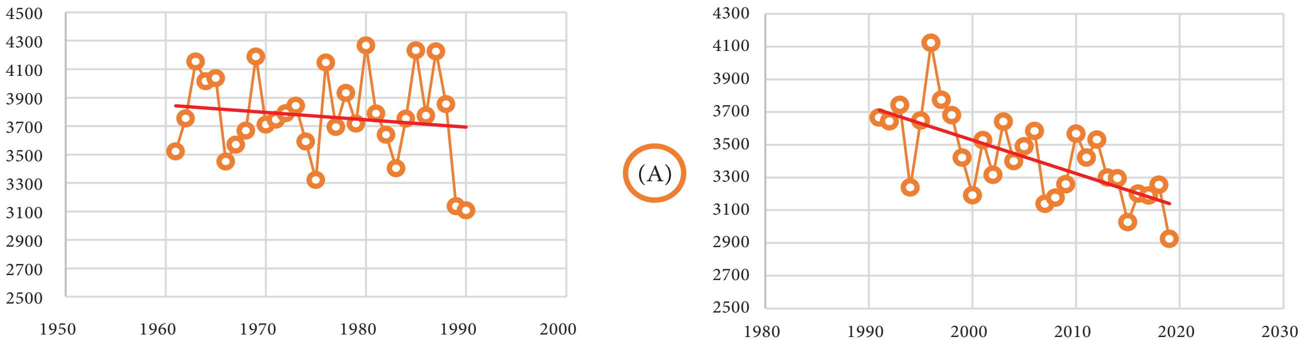


Figure 5-50: Trends in Cooling Degree Days, (CDDcold18) for two time periods - left 1961-1990, and right 1991-2019: (A) Briceni – Northern AEZ, (B) Chisinau – Central AEZ, (C) Cahul – Southern AEZ.



[260] Cooling degree days, using a threshold of 18 °C.
[261] Heating degree days, using a threshold of 18 °C.

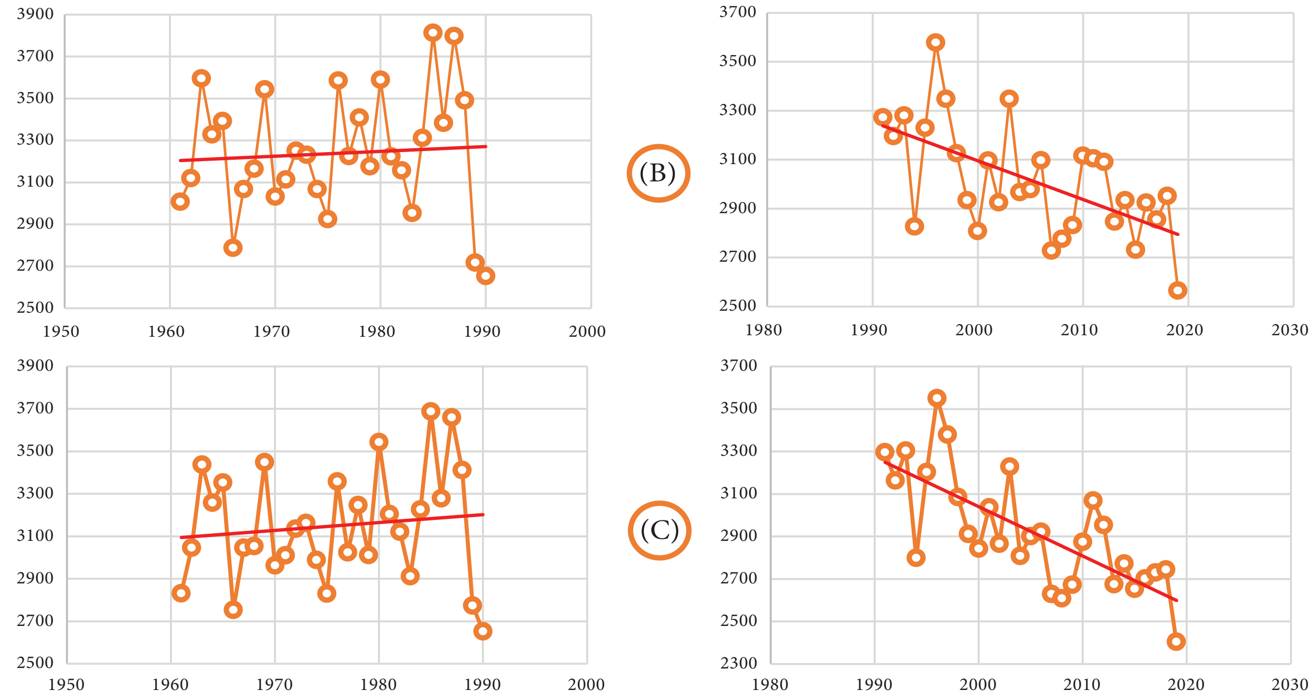


Figure 5-51: Trends in annual Heating Degree Days, (HDDheat18) for two time periods - left 1961-1990, and right 1991-2019: (A) Briceni – Northern AEZ, (B) Chisinau – Central AEZ, (C) Cahul – Southern AEZ.

5.4.2.3. Future climate change projections of Cooling Degree Days, (CDDcold18) and Heating Degree Days, (HDDheat18)

The Figure 5-52, illustrate the temporal evolution over 1961-2100 years of annual Cooling degree days (CDDcold18) throughout the RoM for 6 individual CMIP6 GCMs, the historical time period (black), and future time period SSP1-2.6 (blue), and SSP5-8.5 (red) scenarios with multi-model range envelope (grey, blue, and pink shaded areas) for three Republic of Moldova's AEZs: Northern (left), Central (middle), and Southern (right) mean, maximum and minimum of models spread over 1961- 2100 years. The high increasing trends is observed in CDDcold18, for three RoM's AEZs, with larger increases under SSP5-8.5, and lower under SSP1-2.6 scenarios.

In short term future time period 2021-2040, the projected CMIP6 6 GCMs ensemble mean increases in CDDcold18 could be from 139.6 degree-days in Northern to 184.9 degree-days in Southern AEZs under SSP5-8.5, and/or minimum increase from 130.9 degree-days in Northern to 178.2 degree-days in Southern AEZs, in case of SSP1-2.6 scenarios, comparative to 1995-2014 reference period.

In 2041-2061 medium term time period, the tendency to increase in CDDcold18 will persist, the projected CMIP6 6 GCMs ensemble mean increases in CDDcold18 will be from 272.3 degree-days in Northern up to 370.7 degree-days in Southern AEZs under SSP5-8.5, and/or minimum increase from 158.3 degree-days in Northern to 213.8 degree-days in Southern AEZs, in case of SSP1-2.6 scenarios.

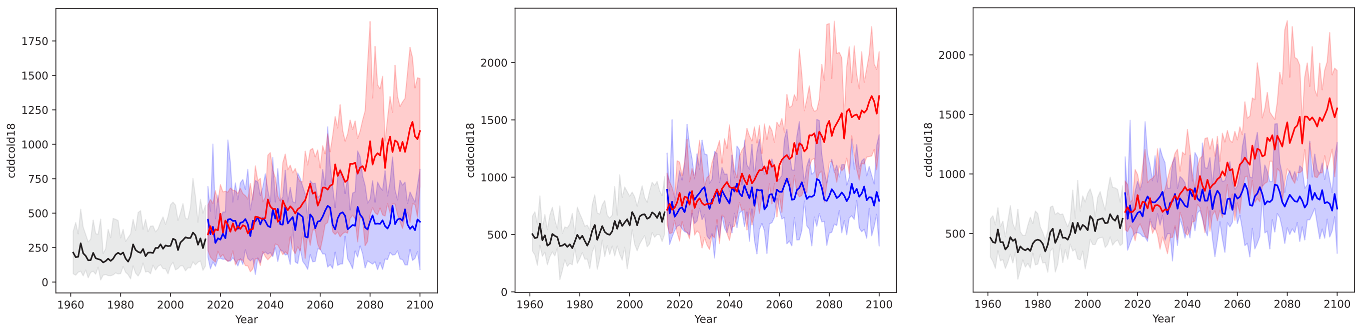


Figure 5-52: Averaged projected time-series (and uncertainty) from 1961 to 2100 for Cooling degree days (CDDcold18): historical time period (black), and future time period SSP1-2.6 (blue), and SSP5-8.5 (red) scenarios with multi-model range envelope (grey, blue, and pink shaded areas) for three RoM's AEZs: Northern (left), Central (middle), and Southern (right).

Relative to the reference period 1995-2014, the projected CMIP6 6 GCMs ensemble mean maximum increases in CDDcold18 by the end of the twenty-first century, in 2081-2100 time period, will be from 706.4 degree-days in Northern up to 908.1 degree-days in Southern AEZs under SSP5-8.5, and/or minimum increase from 148.0 degree-days in Northern to 260.2 degree-days in Southern AEZs, in case of SSP1-2.6 scenarios, see more in Table 5-29, and Figure 5-53.

Table 5-29: Projected CMIP6 6 GCMs Ensemble Change of Cooling Degree Days (CDDcold18): Presented for Four 20-Year Time Periods in the Future (2021–2040, 2041–2060, 2061-2080, and 2081–2100) for SSP1-2.6 and SSP5-8.5, Relative to the 1995–2014 Baseline Period

AEZ	Scenario	Projected change by 2021-2040	Projected change by 2041-2060	Projected change by 2061-2080	Projected change by 2081-2100
Northern	SSP1-2.6	130.9	158.3	167.6	148.0
	SSP5-8.5	139.6	272.3	504.4	706.4
Central	SSP1-2.6	165.9	201.5	223.3	193.6
	SSP5-8.5	172.3	348.5	624.1	859.3
Southern	SSP1-2.6	178.2	213.8	238.3	260.2
	SSP5-8.5	184.9	370.7	595.5	908.1

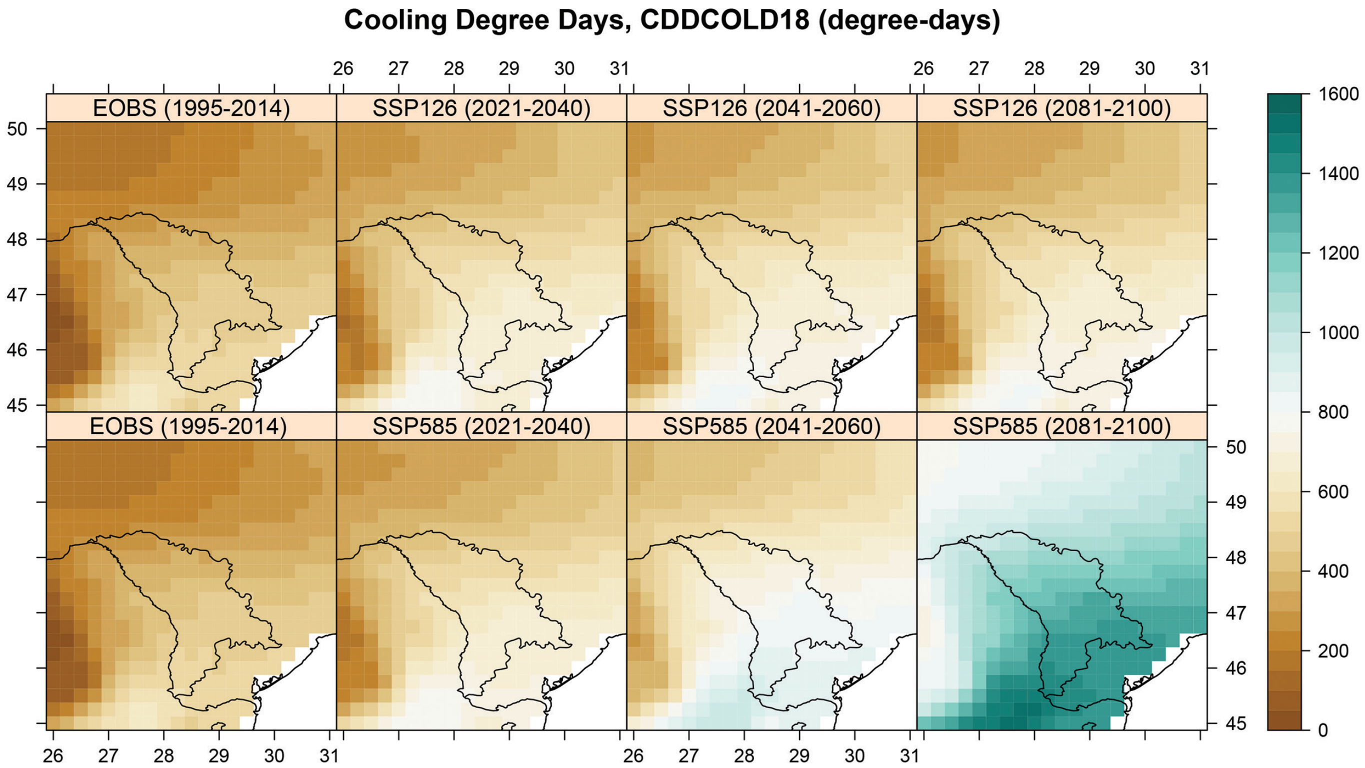


Figure 5-53: CMIP6 6 GCMs ensemble projections of Cooling Degree Days (CDDcold18), under two SSP1-2.6 and SSP5-8.5 scenarios, comparative to 1995-2014 reference period.

The Figure 5-54, illustrate the temporal evolution over 1961-2100 years of annual Heating Degree Days (HDDheat18) throughout the RoM for 6 individual CMIP6 GCMs, the historical time period (black), and future time period SSP1-2.6 (blue), and SSP5-8.5 (red) scenarios with multi-model range envelope (grey, blue, and pink shaded areas) for three RoM's AEZs: Northern (left), Central (middle), and Southern (right) mean, maximum and minimum of models spread over 1961-2100 years. The high decreasing trends is observed in HDDheat18, for three AEZs, with larger decreases under SSP5-8.5, and lower under SSP1-2.6 scenarios.

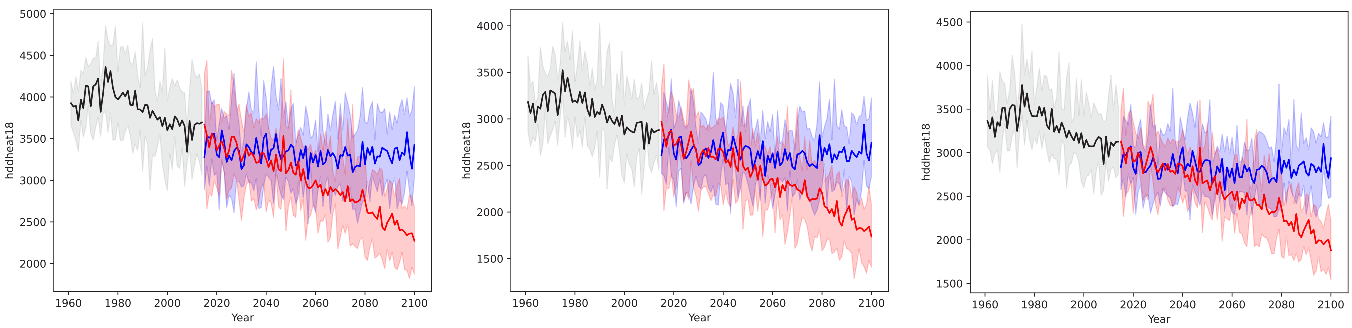


Figure 5-54: Averaged projected time-series (and uncertainty) from 1961 to 2100 for Heating Degree Days (HDDheat18): historical time period (black), and future time period SSP1-2.6 (blue), and SSP5-8.5 (red) scenarios with multi-model range envelope (grey, blue, and pink shaded areas) for three RoM's AEZs: Northern (left), Central (middle), and Southern (right).

In short term future time period 2021-2040, the projected CMIP6 6 GCMs ensemble mean decreases in HDDheat18 could be from -322.5 degree-days in Northern to -233.9 degree-days in Southern AEZs under SSP5-8.5, and/or decrease from -311.2 degree-days in Northern to -240.1

degree-days in Southern AEZs, in case of SSP1-2.6 scenarios, comparative to 1995-2014 reference period.

In 2041-2061 medium term time period, the tendency to decrease in HDDheat18 will persist, the projected CMIP6 6 GCMs ensemble mean decreases in HDDheat18 will be from -553.0 degree-days in Northern to -435.4 degree-days in Southern AEZs under SSP5-8.5, and/or minimum decrease from -353.9 degree-days in Northern to -274.1 degree-days in Southern AEZs, in case of SSP1-2.6 scenarios.

Relative to the reference period 1995-2014, the projected CMIP6 6 GCMs ensemble mean maximum decreases in HDDheat18 by the end of the twenty-first century, in 2081-2100 time period, will be from -1187.1 degree-days in Northern to -975.7 degree-days in Southern AEZs under SSP5-8.5, and/or minimum decrease from -338.8 degree-days in Northern to -321.4 degree-days in Southern AEZs, in case of SSP1-2.6 scenarios, see more in Table 5-30, and Figure 5-55.

Table 5-30: Projected CMIP6 6 GCMs Ensemble Change of Heating Degree Days (HDDheat18): Presented for Four 20-Year Time Periods in the Future (2021–2040, 2041–2060, 2061-2080, and 2081– 2100) for SSP126, and SSP585, Relative to the 1995–2014 Climatological Baseline Period

AEZ	Scenario	Projected change by 2021-2040	Projected change by 2041-2060	Projected change by 2061-2080	Projected change by 2081-2100
Northern	SSP1-2.6	-311.2	-353.9	-408.1	-338.8
	SSP5-8.5	-322.5	-553.0	-831.5	-1187.1
Central	SSP1-2.6	-253.0	-291.0	-344.5	-276.3
	SSP5-8.5	-245.8	-459.9	-697.2	-1025.5
Southern	SSP1-2.6	-240.1	-274.1	-330.0	-321.4
	SSP5-8.5	-233.9	-435.4	-600.3	-975.7

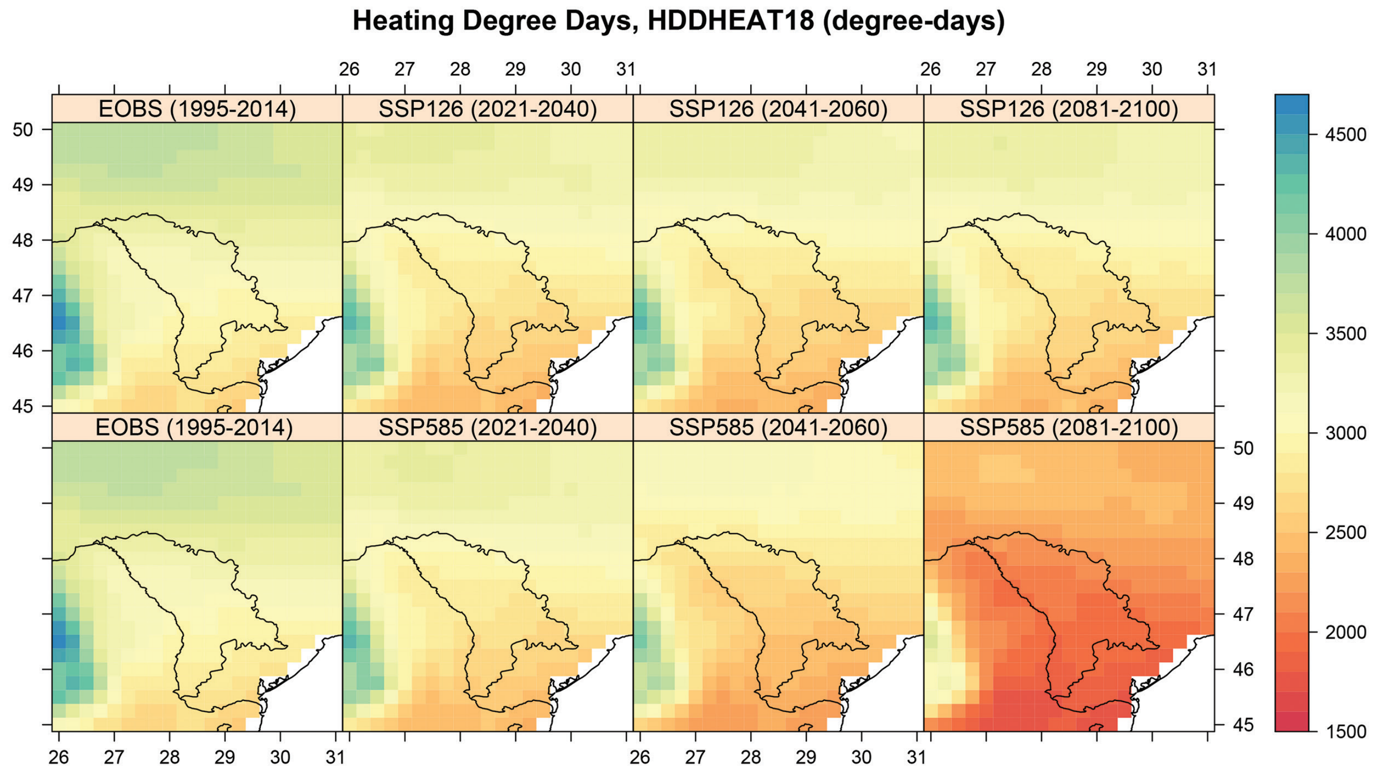


Figure 5-55: CMIP6 6 GCMs Ensemble projections of Heating Degree Days (HDDheat18), under two SSP1-2.6 and SSP5-8.5 scenarios, comparative to 1995-2014 reference period.

5.4.3. Climate Change and Forestry Sector

In RoM, the forest coverage index, during the last two centuries, has varied from 30 per cent to about 6per cent (1918), and in the post-war period it will be partially recovered to 11.4 per cent (Talmaci, et al., 2018), following the post-war period to be partially recovered so far at 11.2 per cent (GD no. 52 as of 29.04.2021)[262]. The lands of the forest fund occupy an area of 449.8 thousand ha, which constitutes about 13.3 per cent of the country's territory. Most of the land of the forest fund is owned by the state (80.7 per cent), the rest is owned by local public authorities (18.7 per cent) and privately owned (0.6 per cent). That indicator is well below the European average (about 29 per cent).

[262] https://www.legis.md/cautare/getResults?doc_id=126208&lang=ro.

At the same time, the medium-term task, set out in a series of national policy and strategy documents, represents 15 per cent of the territory's forests. The distribution of forests is very uneven, as a result of anthropogenic impact (deforestation and land use for agricultural purposes, afforestation of degraded land unfit for agriculture), as well as due to restrictive climatic conditions.

The forestry sector is extremely vulnerable to climate change and exposed to natural disasters. The previous subchapters set out the updated characteristics of the forest fund and their development trend. The updated information is very important for monitoring the development dynamics of the forest fund, removals from the category 4A 'Forest land' within

LULUCF, for the analysis of measures, policies, national plans and the assessment of progress in their implementation, as well as for future use in the development of sectoral adaptation measures to reduce the risks and vulnerabilities associated with climate change, including their status, implementation, results achieved and expected, efficiency measures already taken and updating future measures.

The respective negative results are due to the hydro-meteorological hazards, as well as to the anthropogenic factor. The growth and development of trees is directly influenced by droughts, floods, abnormally high or low temperatures, forest fires, etc. The destabilizing and limiting factors identified and registered periodically with the application of forest management works and outside them are those that affect the forest fund are: felling / ruptures of wind and snow, drying, attacks of defoliating and xylophagous pests, fires, game damage, pollution, landslides, erosion, surface rock, unhealthy stems, swamps, etc.

Climate change scenarios indicate that RoM is prone to become more arid. This can intensify droughts and forest fires, as well as other factors listed above that depend to some extent on them.

For the forests in the north of the country during the massive droughts of 1972-1980, the intensive drying process were highlighted. Pendulum oak, the main species of these forests, in the last 25 years, bears very little fruit, which reduces the natural regeneration of seeds to a minimum, and the very small amount of seeds recorded is not used to the maximum, sometimes even totally compromised. In the Rosoșani and Ocnița forest, the only natural birch oak stands have been preserved, which represent the south-western end of the birch spreading area in Eastern Europe (Postolache, 1995). Although the birch bears abundant fruit, unfortunately its natural regeneration from seeds does not take place, which may lead in the future to the disappearance of the birch from these trees (Boaghie, 2005). According to the data of the forest arrangements of OS Briceni[263] and OS Ocnița[264], an unusual climatic phenomenon by intensity and surface - frost (frost) took place in late November 2000 in the Central and Northern part, especially in the North-Eastern part of the Republic of Moldova. The surface of the affected forests was 51 thousand ha (Postolache et al., 2000). In this context, it was affected by the forest fund of several forestry entities and scientific reservations. The consequences of the frost in the autumn of 2000 were felt by the forest vegetation for a period of about 7-8 years, during which the trees that were less affected largely restored their canopy.

With the application of forest works carried out by the Forestry Research and Management Institute, the 2016 field phase and 2017 office phase within OS Cuhurești, it was possible to establish the issues regarding the condition of stands affected by ruptures and / or windfalls produced in June 2016 and their management measures for the future. Thus, the analysis and processing of plot descriptions on development units using special field programs, allowed the finding that ruptures and / or windfalls were recorded on a total area of 918.4 ha, which is about 17 per cent of the area covered with forests (Prosii, 2018). Also, there were damages brought to the forest fund within several forest entities by the precipitation in the form of sleet from April 22-24, 2017 by spindle rupture, crown bending, etc. Following the phenomena mentioned above, as well as other smaller ones, in the process of forest management works, the necessary measures were established for the recovery of the situation, the improvement of local risk reduction capacities, the implementation of climate change-adjusted approaches in the forestry sector, etc.

5.4.3.1. Data and Methods

The calculation of the vulnerability indicators of the forest fund per country was based on the indicators calculated for the forest fund managed by the "Moldsilva" Agency, and in addition to the state-owned forests and ATU forest fund, include the forests of other state-owned owners, privately owned forests, as well as forests in Transnistria.

In accordance with Law no. 168 of 31.07.2015, the amendment of article 24 of Law no. 64-XII of 31 May 1990 on the Government[265], the Moldsilva Agency is the administrative authority subordinated to the central environmental body of the public administration, empowered to ensure the implementation of state policy in the fields of forestry and hunting, in order to sustainable development of the forestry sector, hunting from the forest fund ensuring the protection and protection of forests and fauna, maintaining and conserving the biodiversity of the Republic of Moldova.

The assessment of the climate change impact on forestry sector was made based on projections of future changes in 27 extreme temperature and precipitation indices received by regionalization of global experiments the most reliable in the RoM 6 CMIP (Eyring et al. 2016).

Six GCMs from the Coupled Model Intercomparison Project Phase 6 – CMIP6 were statistically downscaled for the historical reference period (1995-2014) and two scenarios (SSP): SSP1-2.6 and SSP5-8.5 for four future time periods: 2021- 2040, 2041-2060, 2061-2080, and 2081-2100, see list of selected GCM models in Table 5-31.

For each of the CMIP6 6 global model downscaled simulations we calculated the representative 20-year averages for 27 extreme temperature and precipitation indices for two scenarios SSP1-2.6, and SSP5-8.5, and then have extracted regional averages for the RoM AEZs.

Table 5-31: List of selected CMIP6 models with daily climate data

Model Name	Institute, Country	Variant Label
GFDL-ESM4	Geophysical Fluid Dynamics Laboratory, USA	r1i1p1f1
NESM3	Nanjing University, China	r1i1p1f1
MPI-ESM1-2-LR	Max-Planck Institute, Germany	r1i1p1f1
CNRM-ESM2-1	National Centre for Meteorological Research, France	r1i1p1f2
CNRM-CM6-1	National Centre for Meteorological Research, France	r1i1p1f2
INM-CM5-0	Institute of Numerical Mathematics, Russia	r1i1p1f1

[263] Forest Research and Management Institute (2016), The arrangement of the Briceni forest area. Edinet Forestry Enterprise, Chisinau, 2016. 282 pp. (in Romanian).

[264] Forest Research and Management Institute (2016), The arrangement of the Ocnita forest area. Edinet Forestry Enterprise, Chisinau, 2016. 315 pp. (in Romanian).

[265] <https://www.legis.md/cautare/getResults?doc_id=85150&lang=ro>.

To assess the forestry sector vulnerability to climate change (by indicators), it was used the empirical-statistical approach, linking fluctuations of forestry vulnerability indicators to climate extreme conditions during the most recent time period (2000-2019). Statistical analysis of the possible impact of the climate change on forestry vulnerability indicators by categories (forest area, pest, defoliation and wood production) was carried out using the methodology presented in Taranu, 2014, Taranu, et al., 2018.

Initially, according to the statistical data on national forestry vulnerability indicators of various categories were constructed linear and polynomial trends for forestry vulnerability indicators by categories in the RoM over the observed time period 2000-2019.

Secondly, the Pearson correlations between forestry vulnerability indicators by categories and predictor variables was used for selection the statistically significant variables. After that, multiple regression equations linking forestry vulnerability indicators by categories with 27 extreme temperature and precipitation indices during the most recent time period (2000-2019), with the highest level of statistical significance were calculated (using the statistical application package STATGRAPHICS Centurion and Microsoft Office Excel).

The extreme temperature and precipitation predictor variables was selected in conformity with the step-by-step regression analysis, by taking into account their contribution to forestry vulnerability indicators by categories, and the consecutive analysis of all possible combinations, with the purpose to find the most reliable model. The regression coefficients of the remaining extreme temperature and precipitation predictor variables show, in what direction and how much may be modified the forestry vulnerability indicators in response to future changes in the extreme temperature and precipitation.

Finally, the analysis of the impact of future climate changes, determined by projections of changes in extreme temperature and precipitation indices on the forestry vulnerability indicators by categories without undertaken any adaptation measures was carried out, using the regression equations relationship in the forestry vulnerability indicators by categories with projections of changes in extreme temperature and precipitation indices, were calculated projections of forestry vulnerability indicators changes in the RoM (%/20 years) for the near term (2021–2040), mid-term (2041–2060), and long term (2081–2100), according to an ensemble from CMIP6 6 GCMs for SSP1-2.6, and SSP5-8.5 scenarios, relative to the most recent time period (2000-2019) – reference scenario.

5.4.3.2. Summary of Observed Trends in Forestry Vulnerability Indicators

5.4.3.2.1. Linear trends of variability in forestry vulnerability indicators on the territory of the Republic of Moldova

According to the selection and distribution of the area by species by administrative districts taking into account the forest fund managed by the Agency "Moldsilva" and the administrative-territorial units (ATUs), it is mentioned that 19.7 per cent of the forest fund of the RoM is located in northern districts of the country, 52.9 per cent in central districts, 21.2 per cent in the districts of southern region, and 6.2 per cent in the territorial administrative units on the left bank of the Dniester. Also, the share of forests in administrative districts registers very varied values. Thus, for the Taraclia district located in the south of the country, the share of forests represents 5.3 per cent, being the smallest of all the districts, and for the Straseni district located in the central part of the RoM, the share of forests is 34.8 per cent of the surface.

Without taking into account the administrative units on the left bank of the Dniester where the share of forests is 6.7 per cent of the territory, the proportion of forests by regions is: north - 7.4 per cent, center - 17.9 per cent, and south - 8.8 per cent[266].

It is mentioned that forests are the main element in ensuring the ecological balance in the geographical area. Thus, the issue of conservation and sustainable development of existing forests, as well as the expansion of forest lands by afforestation of new areas unfit for agricultural use, is a matter of national interest and one of the main measures for adaptation to climate change.

About 65 species of trees can be found in the native forest fund, including: pedunculate oak (Quercus robur), sessile oak (Quercus petraea), fluffy oak (Quercus pubescens), bramble oak (Quercus pedunculiflora), red oak (Quercus rubra), European beech (Fagus sylvatica), white poplar (Populus alba), black poplar (Populus nigra), gray poplar (Populus canescens), poplar (Populus tremula), Canadian poplar (Populus x canadensis), white willow (Salix alba), poplar willow (Salix fragilis), willow (Salix caprea), acacia (Robinia pseudoacacia), common ash (Fraxinus excelsior), American ash (Fraxinus americana), fluffy ash (Fraxinus pallisae), mojdrean (Fraxinus ornus), large-leaved lime (Tilia platyphyllos), silver lime (Tilia tomentosa), lime (Tilia cordata), hornbeam (Carpinus betulus), hornbeam (Carpinus orientalis), field maple (Acer platanoides), mountain maple (Acer pseudoplatanus), American maple (Acer negundo), jujube (Acer campestre), Tartar maple (Acer tataricum), cherry (Prunus avium), common walnut (Juglans regia), American walnut (Juglans nigra), field elm (Ulmus minor), mountain elm (Ulmus glabra), velvet (Ulmus laevis), willow (Elaeagnus angustifolia), honey locust (Gleditsia triacanthos), silver birch (Betula pendula), white mulberry (Morus alba), black mulberry (Morus nigra), Turkish cherry (Prunus mahaleb), wild apple (Malus sylvestris), plum (Prunus domestica), prickly pear (Prunus cerasifera), forest hair (Pyrus pyraster), ash tree (Ailanthus altissima), pig chestnut (Aesculus hippocastanum), edible caste (Castanea sativa), scurvy (Sorbus domestica), sorbet (Sorbus tominalis), white alder (Alnus incana), black alder (Alnus glutinosa), hungarian oak (Quercus frainetto), scots pine (Pinus sylvestris), black pine (Pinus nigra), spruce (Picea abies), thuja (Thuja orientalis), white pine (Pinus strobus), larch (Larix decidua), fir (White Abies), green pike (Pseudotsuga menziesii), Pine (Pinus cembra) and other species.

Forest area by species (ha) is the cumulative distribution of area for each tree element of the same species.

The observed trends in forestry vulnerability indicator - forest area by species, ha, (FA) in the Republic of Moldova was calculated by linear regression analysis and their main statistical parameters, including significance of change (p-value), for 2000-2019 reference time period is presented in Table 5-32 and Figure 5-56.

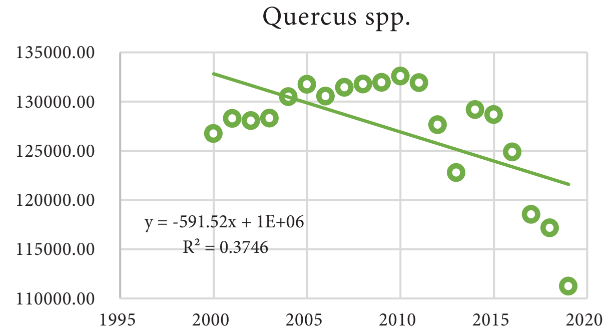
[266] According to "Moldsilva" Agency data.

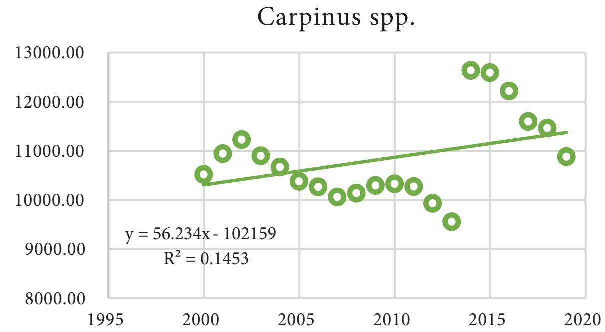
Table 5-32: Linear trends of forestry vulnerability indicator FA (forest area by species, ha/year) and their statistical significance (p-value) for observation time period (2000-2019) in the RoM

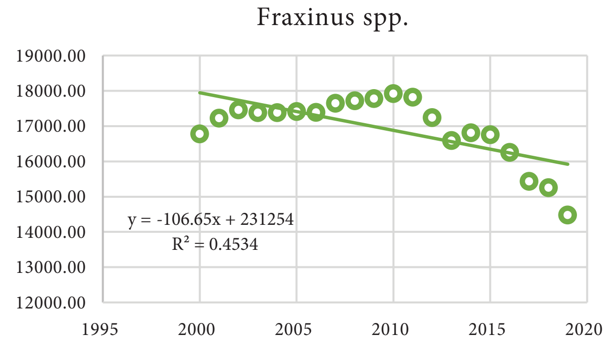
Species	x	Trend	R^2	p-value
Quercus spp.	127203.4	-591.5	37.5	**0.0041**
Carpinus spp.	10842.8	+56.2	14.5	0.0973
Fraxinus spp.	16934.4	-106.7	45.3	**0.0011**
Acer spp.	3459.1	+84.7	76.4	**0.0000**
Ulmus spp.	3065.2	+9.2	5.3	0.3253
Tilia spp.	3214.4	+91.4	68.0	**0.0000**
Salix spp.	2310.5	+38.3	35.8	**0.0053**
Pinus spp.	5502.8	-97.7	80.5	**0.0000**
Populus spp.	5762.0	-27.0	32.9	**0.0081**
Robinia spp.	112447.9	-1854.7	56.7	**0.0001**
Other species	8722.8	+264.6	75.1	**0.0000**
Rariști	27957.4	+37.4		0.8133
Total	327422.57	-2095.6	37.3	**0.0042**

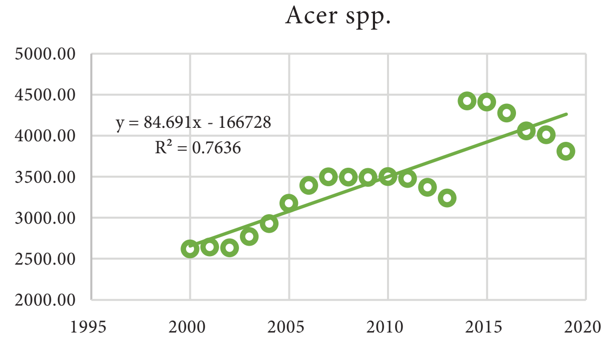
As can be seen from Table 5-32, and Figure 5-56, a high decreasing trend in total forest area, statistically significant, by -2095.6 ha per year was observed, caused by decreasing trend in forest area species: -1854.7 ha per year (Robinia spp.), -591.5 ha per year (Quercus spp.t.), -106.7 ha per year (Fraxinus spp.), -97.7 ha per year (Pinus spp.), and -27.0 ha per year (Populus spp.), during the 2000-2020 reference time period, with high degree of certainty.

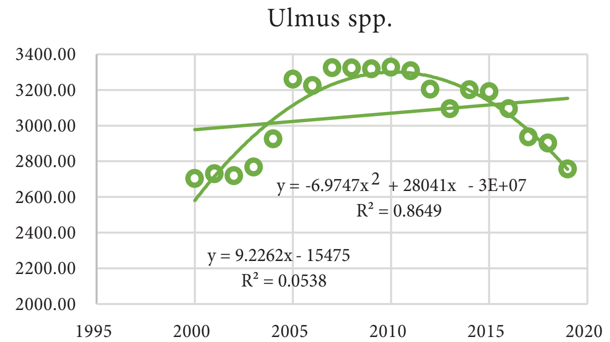
While for some forest species the increasing trends by +264.6 ha per year (Other species), +91.4 ha per year (Tilia spp.), +84.7 ha per year (Acer spp.), +38.3 ha per year (Salix spp.), statistically significant, was observed during the 2000-2019 reference time period, with high degree of certainty.

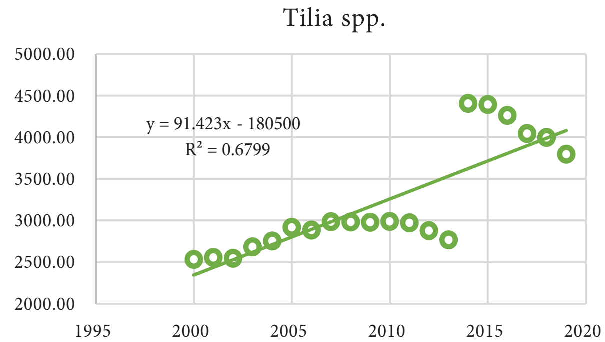


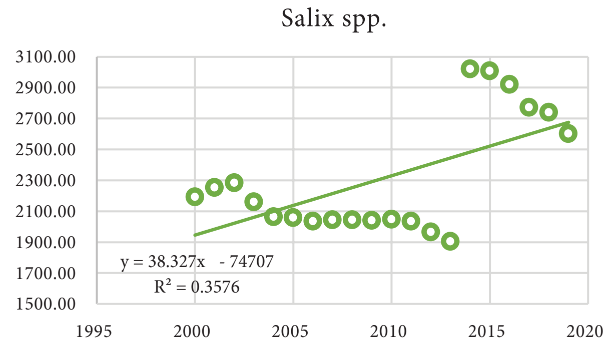


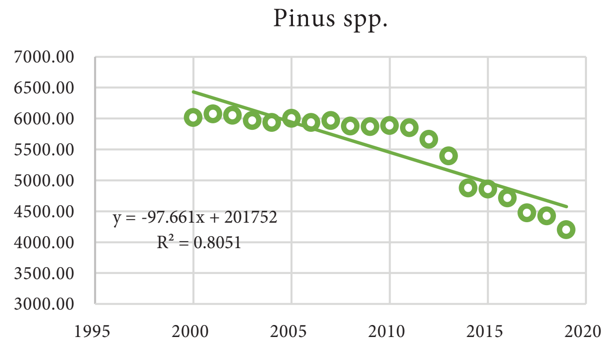












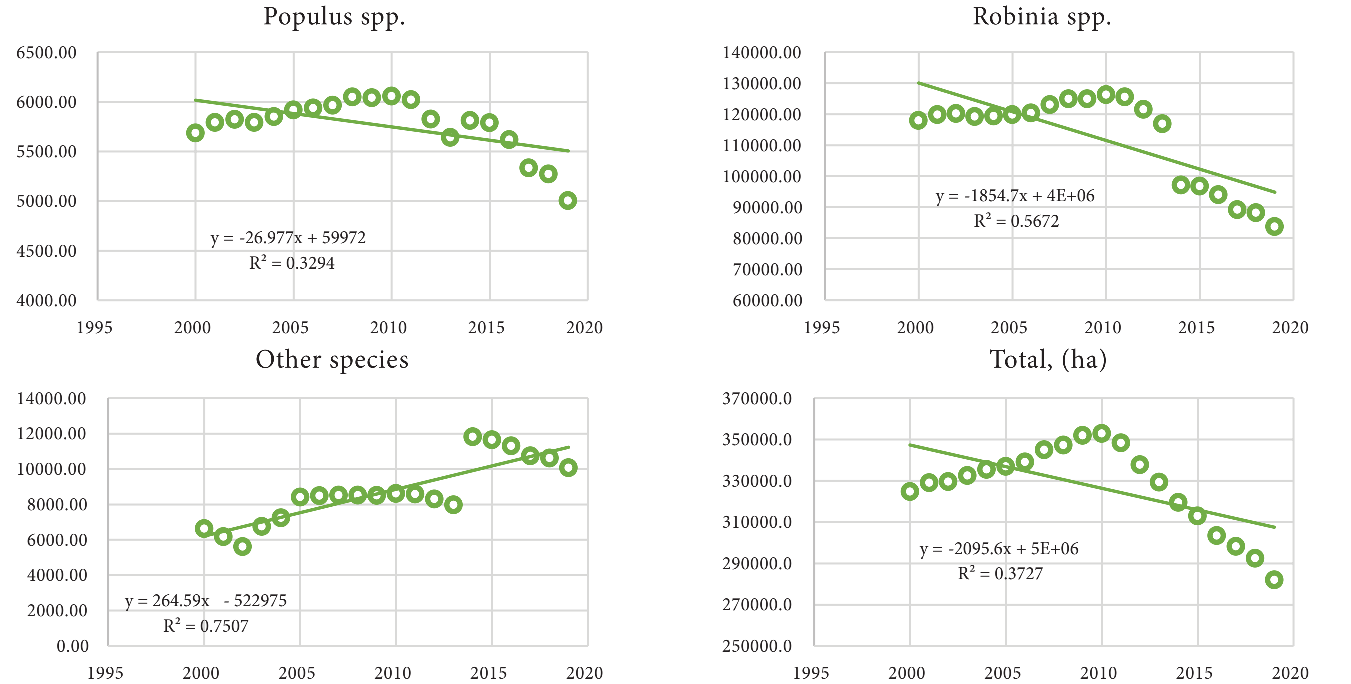


Figure 5-56: FA (forest area by species, ha) variability trends and their coefficients of determination (R^2) for observation period 2000-2019 in the RoM.

Detailed forestry-pathological surveillance (forestry-pathological monitoring) on defoliating pests is carried out in oak, ash and other species stands, where, following previous visual or aero-visual research, defoliation of trees of 20 per cent and more was detected.

The main defoliating pests of forests are: green oak moth (*Tortrix viridana L.*), green oak (*Operophtera brumata L.*), brown oak (*Erannis defoliaria Clerck*), hairy oak caterpillar (*Lymantria dispar L.*), trombone leaf ash (*Stereonychus fraxini Deg.*) and others. Surveillance is carried out in order to detect the mass multiplication of pests, to determine the area of outbreaks of pest species. The works are applied according to an established methodology, and the condition of the trees is characterized by the degree of drying of the crown.

The characteristic signs of the attacked trees are: drying of the branches and whole crown, scars in the bark, the bark affected by birds, pests, galleries dug in the bark and wood. The category of tree condition is assessed through six categories with different degrees of intensity.

In the context of the study of the risk of damage to forest vegetation by defoliating and xylophagous pests, including through changes in climatic factors, were identified, analyzed and refined / systematized data on the area of pest attacks in the forest fund of 24 forest entities for 1998-2020 (data were systematized by forestry enterprises and entirely on forest background).

The observed data have been confirmed the presence of defoliating and xylophagous pests in dependence from the climatic conditions of the year in which they occurred and for the following year of limiting climate disaster (drought, high temperatures, lack of humidity, frost, etc.).

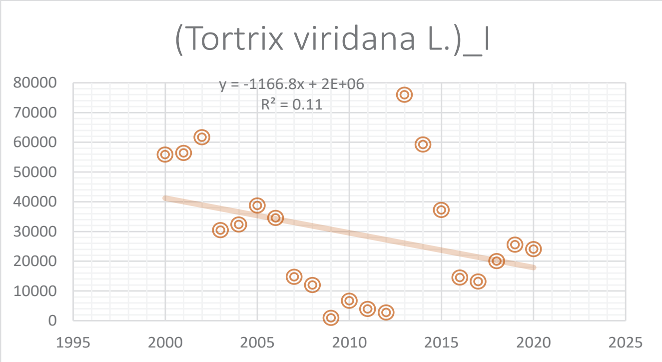
The observed trends in forestry vulnerability indicator - pest by species, ha, (*PS*) in the RoM was calculated by linear regression analysis and their main statistical parameters, including significance of change (*p-value*), for 2000-2019 reference time period is presented in Table 5-33 and Figure 5-57.

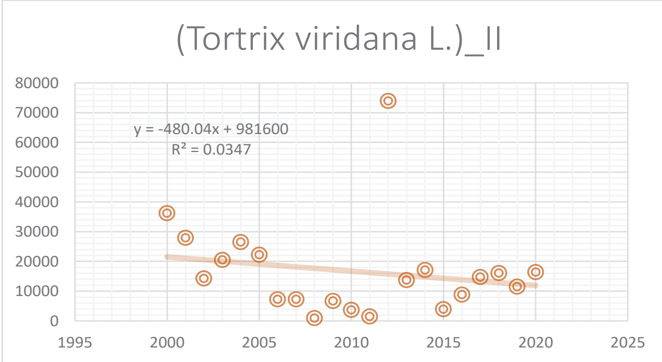
As can be seen in Table 5-33 and Figure 5-57, in some defoliating and xylophagous pests the increasing trend by +521.9 ha per year (*Stereonychus fraxini deg. I*), +267.8 ha per year (*Xylophagous pests, I*), +250.3 ha per year (*Xylophagous pests, II*), +181.6 ha per year (*Stereonychus fraxini deg. II*), and +135.6 ha per year (*Lymantria dispar L. I*), statistically significant, was observed during the 2000-2019 reference time period.

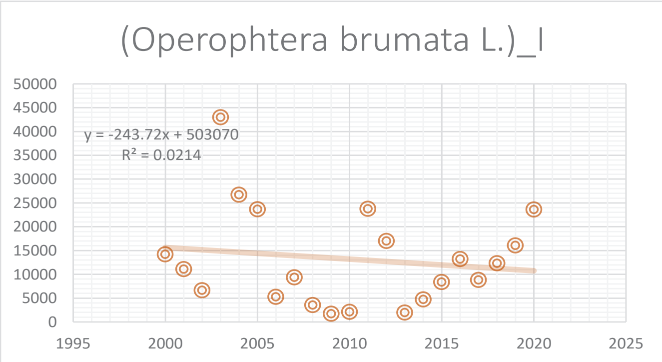
While in case of defoliating pests *Tortrix viridana L. I, Tortrix viridana L. II, Operophtera brumata L. I, Operophtera brumata L. II* was observed decreasing trend, statistically not significant, so it can be noted just a tendency to decrease in the risk of damage to forest vegetation by those pests, in the 2000-2019 time period.

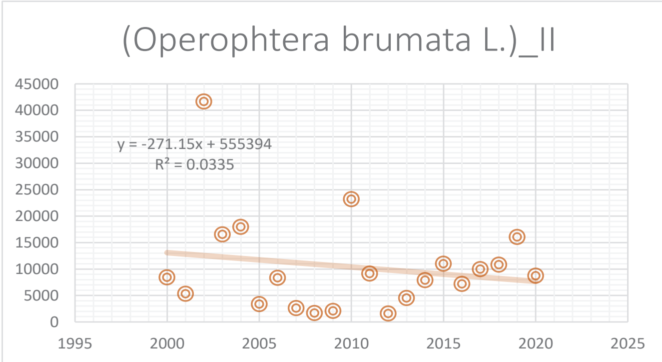
Table 5-33: Linear trends of forestry vulnerability indicator PS (pest by species, ha) and their statistical significance (p-value) for observation time period (2000-2019) in the RoM

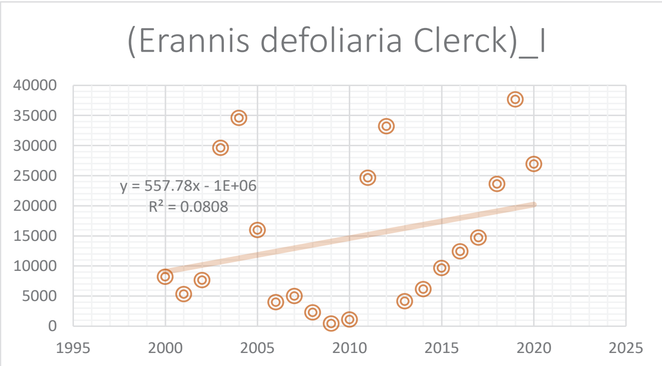
Pest by species, ha	x	Trend	R^2	p-value
Tortrix viridana L. I	29545.0	-1166.8	11.0	0.1418
Tortrix viridana L. II	16713.8	-408.0	3.5	0.4190
Operophtera brumata L. I	13190.8	-243.7	2.1	0.5268
Operophtera brumata L. II	10379.0	-271.2	3.3	0.4274
Erannis defoliaria Clerck. I	14626.9	+557.8	8.0	0.2118
Erannis defoliaria Clerck. II	10930.2	+293.7	4.3	0.3654
Lymantria dispar L. I	926. 9	+135.6	18.1	**0.0543**
Lymantria dispar L. II	761.6	+74.8	9.4	0.1759
Stereonychus fraxini deg. I	4639.7	+521.9	66.8	**0.0000**
Stereonychus fraxini deg. II	2356.7	+181.6	19.5	**0.0451**
Xylophagous pests, I	8774.3	+267.8	51.6	**0.0002**
Xylophagous pests, II	8334.3	+250.3	49.8	**0.0004**

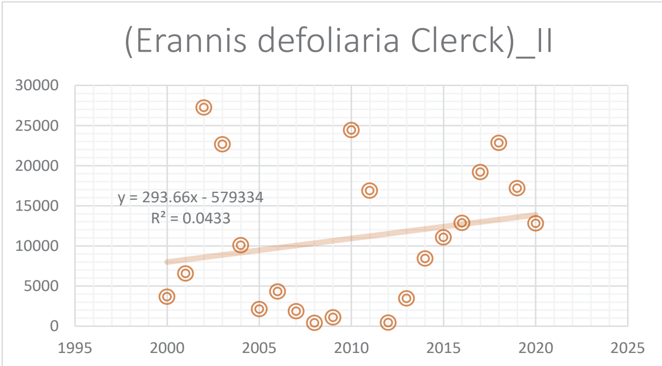

(Tortrix viridana L.)_I
y = -1166.8x + 2E+06
R² = 0.11

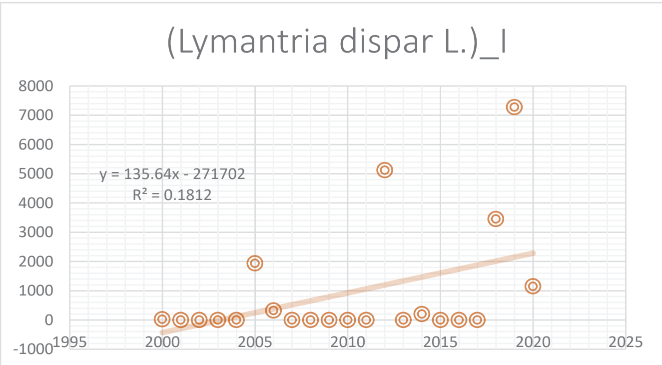

(Tortrix viridana L.)_II
y = -480.04x + 981600
R² = 0.0347

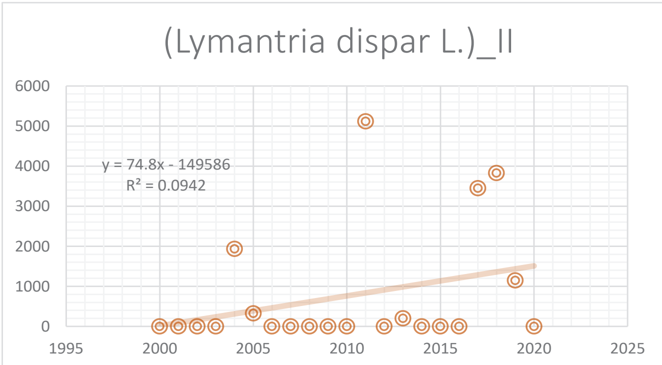

(Operophtera brumata L.)_I
y = -243.72x + 503070
R² = 0.0214

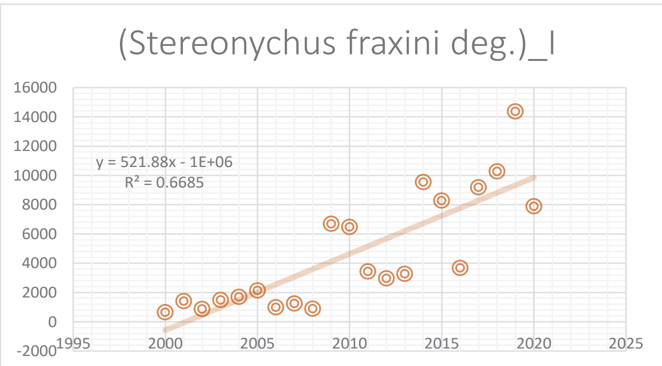

(Operophtera brumata L.)_II
y = -271.15x + 555394
R² = 0.0335

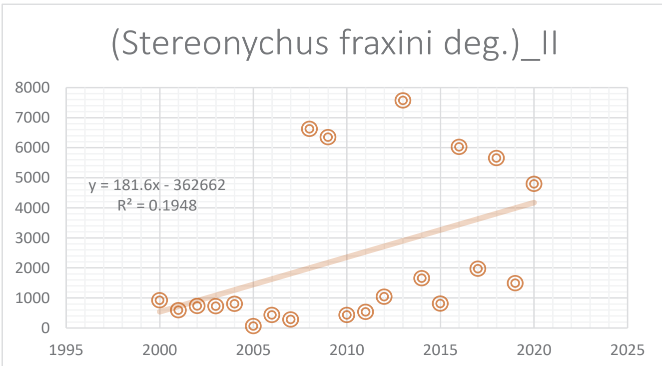

(Erannis defoliaria Clerck)_I
y = 557.78x - 1E+06
R² = 0.0808


(Erannis defoliaria Clerck)_II
y = 293.66x - 579334
R² = 0.0433


(Lymantria dispar L.)_I
y = 135.64x - 271702
R² = 0.1812


(Lymantria dispar L.)_II
y = 74.8x - 149586
R² = 0.0942


(Stereonychus fraxini deg.)_I
y = 521.88x - 1E+06
R² = 0.6685


(Stereonychus fraxini deg.)_II
y = 181.6x - 362662
R² = 0.1948

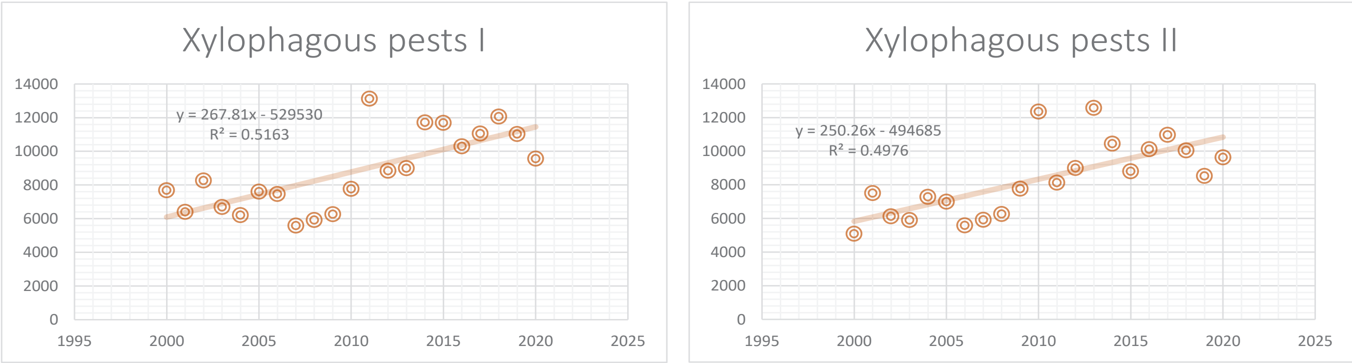


Figure 5-57: PS (pest by species, ha) variability trends and their coefficients of determination (R^2) for observation period 2000-2019 in the RoM.

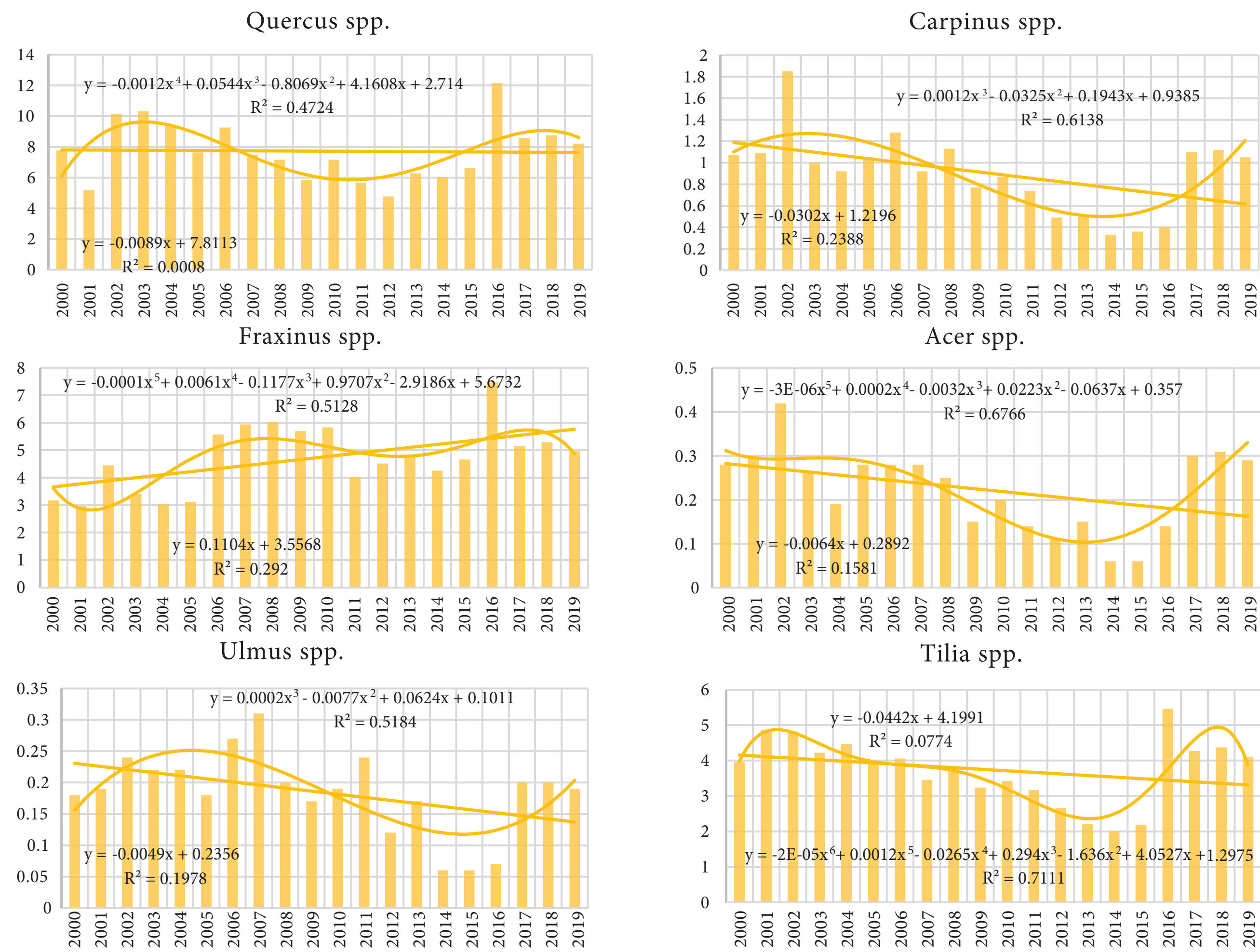
The observed trends in the next forestry vulnerability indicator - wood production by species, thous, m^3 (WP) in the RoM was calculated by linear regression analysis and their main statistical parameters, including significance of change (p-value), for 2000-2019 reference time period is presented in Table 5-34 and Figure 5-58.

As can be seen in Table 5-34 and Figure 5-58, the mostly decreasing trends/or tendency in wood production by species was observed, statistically significant, in case of *Carpinus spp.*, *Ulmus spp.*, and other species, during the 2000-2019 reference time period. And only in case of *Fraxinus spp.*, the increasing trend by 0.110 thous, m^3 per year, statistically significant, was observed.

Table 5-34: Linear trends of forestry vulnerability indicators WP (wood production by species, thous, m^3) and their statistical significance (p-value) for observation time period (2000-2019) in the RoM

Wood production by species	x	Trend	R^2	p-value
Quercus spp.	7.7	-0.009	0.1	0.9079
Carpinus spp.	0.9	-0.030	23.9	**0.0288**
Fraxinus spp.	4.7	0.110	29.2	**0.0139**
Acer spp.	0.2	-0.006	15.8	0.0825
Ulmus spp.	0.2	-0.005	19.8	**0.0494**
Tilia spp.	3.7	-0.044	7.7	0.2349
Salix spp.	0.3	-0.001	0.4	0.7805
Pinus spp.	0.7	0.022	7.1	0.2566
Populus spp.	6.0	0.046	3.7	0.4166
Robinia spp.	14.7	-0.216	12.9	0.1201
Other Species	1.1	-0.060	33.3	**0.0077**
Total	40.7	-0.194	2.4	0.5143

Note: Bold is used to mark statistically significant values.



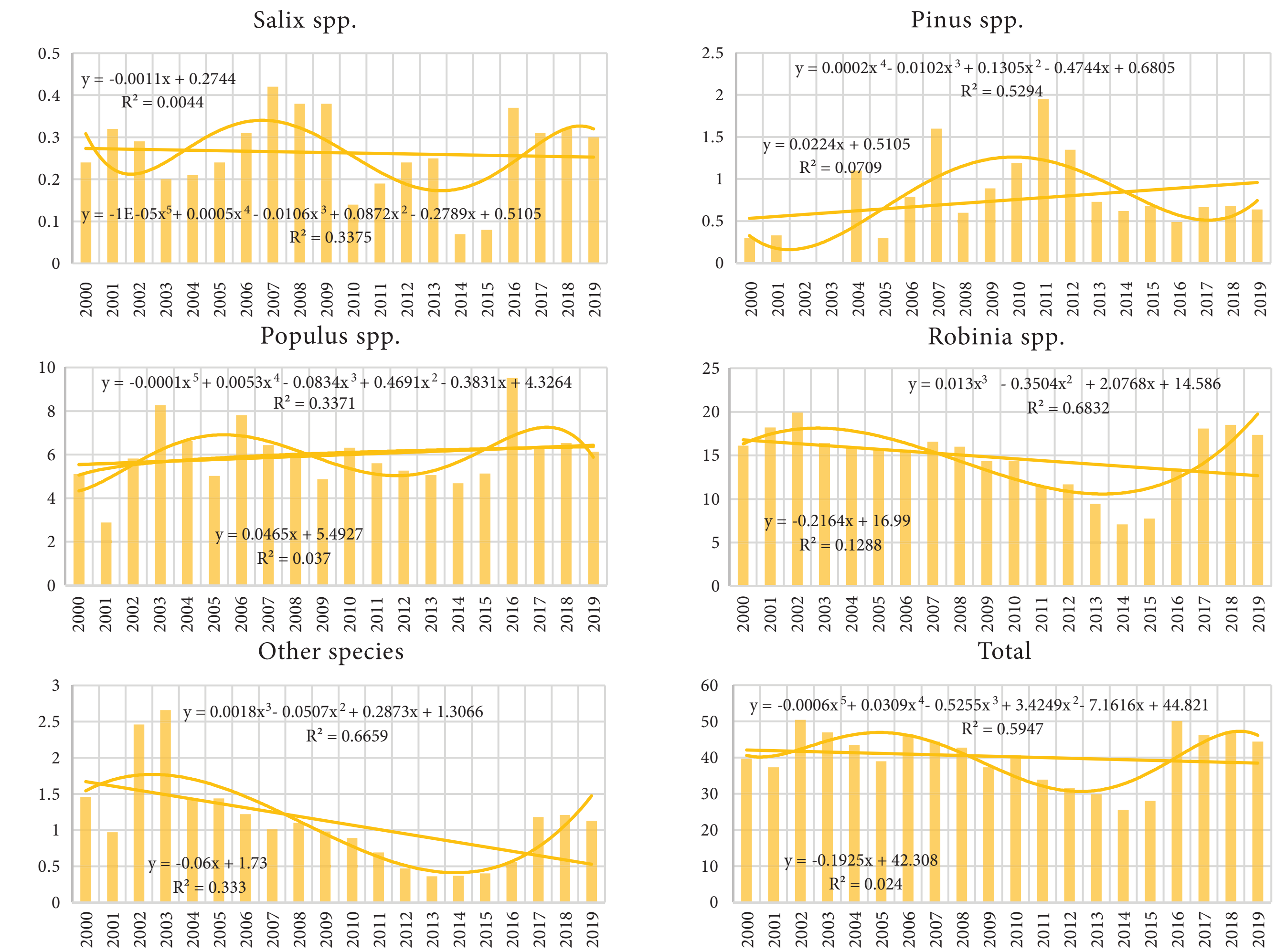


Figure 5-58: WP (wood production by species, thous, m³) variability trends and their coefficients of determination (R^2) for observation period 2000-2019 in the RoM.

5.4.3.2.2. The relationship of forestry vulnerability indicators variability with predictor variables (extreme temperature and precipitation indices)

A multiple linear regression analysis was used with 27 extreme temperature and precipitation indices as independent variables, and forestry vulnerability indicators by categories (*FA*, *PS*, and *WP*) at the country level, as the dependent variable to quantify the separate effects of those factors. The influential climate predictor variables were not identical for each forestry vulnerability indicator category.

The analysis of the data presented in the Table 5-35 shows that the influence of climatic conditions (extreme temperature and precipitation indices) on forestry vulnerability indicator *FA*, forest area by species, was statistically significant for all forest species during the 2000-2019 reference observed period. Coefficient of determination R^2 shows that the combined effect of extreme temperature (TXx, TNn, TXn, TNx, TN10p, Tx10p, TN90p, TX90p, SU, FD, TR, CSDI, ID, GSL, WSDI) and precipitation (R10mm, R20mm, r95ptot, r99p, r99ptot, rx1day, rx3day, rx5day, CWD, SDII) indices have defined from 62.2 per cent (*Ulmus spp.*) up to 90.6 per cent (*Carpinus spp.*) of the variability of average annual forest area by species in this period.

Table 5-35: The relationship of FA (forest area by species) variability with extreme temperature and precipitation indices during the 2000–2019 reference period

Species	Regression equation	P-value	R^2
Quercus spp.	$FA_{Quercus\ spp.}$ = 8.538E4 + 972.3*TXx - 613.2*TN10p + 819.5*Tx10p - 556.1*TX90p + 808.5*TNx + 1346. *CWD + 300.6*r99p - 1829. *r99ptot + 96.4*rx5day - 2398. *SDII	***0.0155***	83.7
Carpinus spp.	$FA_{Carpinus\ spp.}$ = 1.4E4 - 52.5*FD + 331.1*TN10p + 51.4*TN90p - 62.3*CSDI - 16.7*GSL - 90.4*R10mm + 126.4*r20mm - 64.5*r95ptot + 12.8*rx3day + 642.9*SDII	***0.0016***	90.6
Fraxinus spp.	$FA_{Fraxinus\ spp}$ = 1.432E4 + 32.4*r99p - 186.1*r99ptot - 270.3*SDII + 166.5*TXx - 239.2*TN10p + 204.1*Tx10p - 98.7*TX90p + 48.5*CSDI	***0.0128***	76.3
Acer spp.	$FA_{Acer\ spp.}$ = 3502. - 3.9*r95ptot - 1.2*rx1day + 3.2*rx3day + 177.9*SDII - 106.3*TXx + 21.6*SU + 14.6*TX90p - 31.4*ID - 106.6*TXn	***0.0032***	85.8
Ulmus spp.	$FA_{Ulmus\ spp.}$ = 2808. - 26.5*TNn + 7.7*SU + 13.4*TR - 86.9*TN10p - 40.2*TX90p	***0.0108***	62.2
Tilia spp.	$FA_{Tilia\ spp.}$ = 4892. - 68.1*R10mm - 25.6*r95ptot + 535.3*SDII - 177.5*TXx + 121.8*TX90p - 48.1*CSDI - 82.2*TXn - 15.2*WSDI	***0.0022***	83.5
Salix spp.	$FA_{Salix\ spp.}$ = 2511. - 17.3*FD + 132.4*TN10p + 34.6*TN90p - 21.5*CSDI - 5.1*GSL - 39.4*R10mm - 14.8*r95ptot - 11.0*rx1day + 9.4*rx3day + 296.5*SDII	***0.0026***	89.5

Species	Regression equation	P-value	R^2
Pinus spp.	FA $_{Pinus\ spp.}$ = 5002. + 71.7*R10mm + 39.0*r95ptot + 36.9*r99p - 232.0*r99ptot + 8.9*rx3day - 773.2*SDII + 114.7*TXx - 186.0*TNn - 104.7*TX90p + 15.9*WSDI + 200.8*TXn	***0.0092***	89.0
Populus spp.	FA $_{Populus\ spp.}$ = 4853. + 36.1*TXx - 162.1*TN10p + 98.9*Tx10p - 29.0*TX90p + 33.4*CSDI - 18.9*TXn - 34.6*R10mm - 3.8*r95ptot + 8.5*r99p - 64.1*r99ptot + 17.2*rx1day	***0.0239***	85. 6
Robinia spp.	FA $_{Robinia\ spp.}$ = 2.172E5 + 2321. *R10mm + 1018. *r95ptot + 1268. *r99p - 7818. *r99ptot + 263.8*rx1day - 2.432E4*SDII	***0.0135***	66.3
Robinia spp.	FA $_{Robinia\ spp}$ = 6.91E4 + 952.2*R10mm + 359.5*r95ptot + 549.3*r99p - 3071. *r99ptot - 9554. *SDII + 3711. *TXx - 5241. *TN10p + 835.1*ID + 1547. *TXn - 1911. *TX90p + 1012. *CSDI	***0.0334***	84.1
Other species	FA $_{Other\ species}$ = 1.657E4 - 167.3*R10mm - 69.3*r95ptot + 2.1*rx1day + 4.8*rx3day + 1102. *SDII - 539.2*TXx + 339.1*TX90p - 136.8*CSDI - 271.8*TXn - 41.3*WSDI	***0.0417***	78.8
Total	FA $_{Total}$ = 4.631E5 + 3200. *r10mm + 1117. *r95ptot + 1917. *r99p – 1.138E4*r99ptot – 2.957E4*SDII	***0.0418***	82.9

Note: Bold is used to mark statistically significant values: p ≤ 0.001 indicate statistically significant non-zero correlations at the 99.9% confidence level; p ≤ 0.01 indicate statistically significant non-zero correlations at the 99.0%, and p ≤ 0.05 indicate statistically significant non-zero correlations at the 95.0% confidence level. *FA – forest area by species, thousand ha*; Predictor Variables -Extreme Indices: temperature – *TXx, TNn, TXn, TNx, TN10p, Tx10p, TN90p, TX90p, SU, FD, TR, CSDI, ID, GSL, WSDI and precipitation* - R10mm, R20mm, r95ptot, *r99p, r99ptot, rx1day, rx3day, rx5day, CWD, SDII.*

The analysis of the data presented in the Table 5-36 shows that the influence of climatic conditions (extreme temperature and precipitation indices) on forestry vulnerability indicator PS, pest by species, ha, including areas of pests' infestation that have been appeared in the current year, was statistically significant for all pest species during the 2000-2019 reference observed period. Coefficient of determination R^2 shows that the combined effect of extreme temperature (TXx, TNn, TXn, TNx, TN10p, Tx10p, TN90p, TX90p, DTR, SU, CSDI, GSL, WSDI) and precipitation (R10mm, R20mm, r95ptot, r99p, r99ptot, rx1day, rx3day, rx5day, CWD, SDII) indices have defined from 30.6 per cent (*Erannis defoliaria Clerck*) up to 81.8 per cent (*Lymantria dispar L.*) of the variability of average annual forest area by species in this period.

Table 5-36: The relationship of PS (pest by species, ha) variability with extreme temperature and precipitation indices during the 2000–2019 reference period

Pests	Regression equation	P-value	R^2
Tortrix viridana L.	PS $_{Tortrix\ viridana\ L.}$ = 3.702E4 + 1905. *CSDI - 4958. *CWD	***0.0350***	32.59
Operophtera brumata L.	PS $_{Operophtera\ brumata\ L.}$ = -2.866E4 + 1898. *Tx10p + 4004. *CWD - 249.8*R10mm + 1888. *r20mm	***0.0120***	55.47
Erannis defoliaria Clerck	PS $_{Erannis\ defoliaria\ Clerck}$ = -5028. + 1305. *Tx10p + 1358. *r20mm	***0.0450***	30.58
Lymantria dispar L.	PS $_{Lymantria\ dispar\ L.}$ = 5471. + 121.4*r99p - 923.1*r99ptot	***0.0332***	81.78
Stereonychus fraxini deg.	PS $_{Stereonychus\ fraxini\ deg.}$ = 7.849E4 - 626.5*TXx + 121.6*TNn + 136.2*SU - 9485. *DTR - 847.8*TN90p + 1442. *TX90p + 266.3*CSDI - 201.2*WSDI + 53.51*GSL	***0.0133***	80.41
Xylophagous pests	PC $_{Xylophagous\ pests}$ = -4408. + 26.8*PRCPTOT - 363.9*CWD - 172.0*R10mm - 141.1*r99p + 743.1*r99ptot - 113.3*rx-1day + 65.7*rx5day + 582.7*SDII	***0.0267***	72.31

Note: Bold is used to mark statistically significant values: p ≤ 0.001 indicate statistically significant non-zero correlations at the 99.9% confidence level; p ≤ 0.01 indicate statistically significant non-zero correlations at the 99.0%. and p ≤ 0.05 indicate statistically significant non-zero correlations at the 95.0% confidence level. *PC - pest by species*, thousand ha; Predictor Variables -Extreme Indices: temperature – *TXx, TNn, TXn, TNx, TN10p, Tx10p, TN90p, TX90p, DTR, SU, CSDI, GSL, WSDI and precipitation - R10mm, R20mm, r95ptot, r99p, r99ptot, rx1day, rx3day, rx5day, CWD, SDII.*

Table 5-37: The relationship of WP (wood production by species) variability with extreme temperature and precipitation indices during the vegetation period (2000 - 2019)

Species	Regression equation	P-value	R^2
Quercus spp.	WP $_{Quercus\ spp}$ = 5.3- 0.06*FD + 0.5*TN10p + 0.25* TN90p - 0.23*TX90p - 0.2*CSDI + 0.6*r20mm - 0.03*r95p + 0.1*r99ptot + 0.7*SDII	0.3922	51.73
Carpinus spp.	WP $_{Carpinus\ spp}$ = 0.77 - 0.01*FD - 0.02*TX90p + 0.02* ID + 0.06* TXn + 0.004* GSL - 0.006*CDD + 0.10*CWD + 0.04*r20mm + 0.01* r95ptot - 0.01* rx5day	***0.0079***	86.22
Fraxinus spp.	WP $_{Fraxinus\ spp}$ = 1.04 - 0.2*TXx + 0.04*SU - 0.3*TN10p - 0.2*TXn + 0.02*GSL +0.003*rx1day + 0.2*SDII	***0.0270***	67.28
Acer spp.	WP $_{Acer\ spp}$ = -0.31 - 0.01*TR + 0.02*TN10p + 0.02*TNx + 0.01*TXn + 0.002*GSL - 0.001*PRCPTOT + 0.01*R10mm + 0.01* r20mm + 0.006* r99ptot - 0.002*rx5day	***0.0077***	86.32
Ulmus spp.	WP $_{Ulmus\ spp}$ = -0.56 + 0.002*CDD + 0.006*R10mm + 0.001*r95ptot - 0.001*rx5day - 0.04*SDII + 0.003*FD - 0.006*TR + 0.01*TNx + 0.001*WSDI + 0.002*GSL	***0.0101***	85.34
Tilia spp.	WP $_{Tilia\ spp}$ = -0.39 - 0.05*CSDI + 0.02*GSL + 0.09*TNn + 0.32*TN10p	***0.0322***	48.45
Salix spp.	WP $_{Salix\ spp}$ = -0.56+ 0.003*FD - 0.002*TR - 0.02*Tx10p + 0.008*CSDI + 0.003*GSL	***0.0181***	58.9
Pinus spp.	WP $_{Pinus\ spp}$ = -6.75 + 0.34*DTR + 0.04*FD - 0.31*TN10p - 0.05*TXn + 0.007*GSL	***0.0066***	65.04
Populus spp.	WP $_{Populus\ spp.}$ = 39.91 - 0.47*R10mm + 1.38*SDII - 0.43*TNn - 4.79*DTR + 0.35*TN90p -0.42*TNx	0.0858	52.74
Robinia spp	WP $_{Robinia\ spp.}$ = 8.87 + 0.23*TNn - 0.04*TR + 0.14*ID - 0.05*TNx + 0.03*GSL + 1.65*r20mm - 0.11*r95p + 0.24*r95ptot + 0.1*r99p - 0.08*rx5day	***0.0176***	83.12
Total	WP $_{Total}$ = 25.54 - 1.03*TXx + 1.15*TN10p + 0.18*GSL	***0.0477***	38.18

Note: Bold is used to mark statistically significant values: p ≤ 0.001 indicate statistically significant non-zero correlations at the 99.9% confidence level; p ≤ 0.01 indicate statistically significant non-zero correlations at the 99.0%, and p ≤ 0.05 indicate statistically significant non-zero correlations at the 95.0% confidence level. *WP - wood production by species*, thous, m³; Predictor Variables -Extreme Indices: temperature – *TXx, TNn, TXn, TNx, TN10p, Tx10p, TN90p, TX90p, SU, FD, TR, CSDI, ID, GSL, WSDI and precipitation* - R10mm, R20mm, r95ptot, *r99p, r99ptot, rx1day, rx3day, rx5day, CWD, SDII.*

5.4.3.3. Future climate change projections of forestry vulnerability indicators

Using the regression equations relationship in the forestry vulnerability indicators by categories with projections of future changes in extreme temperature and precipitation indices, were calculated projections of forestry vulnerability indicators by categories changes in the RoM (%/20 years) for the near term (2021–2040), mid-term (2041–2060), and long term (2081–2100), according to an ensemble from CMIP6 6 GCMs for SSP1-2.6, and SSP5-8.5 scenarios, relative to the 2000-2019 reference time period.

In short term future time period 2021-2040, the projected CMIP6 6 GCMs ensemble mean increases in total forest area by species, due to future changes in extreme temperature and precipitation, could be by +10% and for some individual forest species from +3-4% (*Quercus spp.*, and *Ulmus spp.*), up to +22-23% (*Robinia spp.*), while for other forest species is expected the decrease from -12-15% (*Carpinus spp., Salix spp., Acer spp.*, and *other species*) to +17-19% (*Tilia spp.*), with minimum decrease by -1-2% (*Fraxinus spp.*), and -7% (*Populus spp.*), according to both SSPs scenarios, comparative to 2000-2019 reference time period.

In 2041-2061 medium term time period, the tendency to increase in total forest area by species, due to future changes in extreme temperature and precipitation, will persist for the same forest species in lower extent, the projected CMIP6 6 GCMs ensemble mean increases will be by +8-9 per cent in total forest area by species, and for some individual forest species from +1-2 per cent (*Quercus spp.*), +3-5 per cent (*Ulmus spp.*) up to +22-19 per cent (*Robinia spp.*), and for other forest species is expected the tendency to decrease from -9-13 per cent (*Carpinus spp., Populus spp., Acer spp., Salix spp., Populus spp.*, and *other species*) to -11-16 per cent (*Tilia spp.*), with minimum decrease by -3-5 per cent (*Fraxinus spp.*), according to both SSPs scenarios.

Relative to the reference time period 2000-2019, by the end of the twenty-first century, in 2081-2100 time period, the projected CMIP6 6 GCMs ensemble mean increases in total forest area by species, due to future changes in extreme temperature and precipitation, under SSP1-2.6 scenario could be by +9 per cent in total forest area by species, and for some individual forest species from +2-5 per cent (*Quercus spp.*, and *Ulmus spp.)* up to +20 per cent (*Robinia spp.*), while for other forest species is expected the decrease from -8-13 per cent (*Populus spp., Carpinus* spp., Salix spp., *Acer spp.*, and *other species*) to -17 per cent (*Tilia spp.),* with minimum decrease by -3 per cent (*Fraxinus spp.*) or/and in case of SSP5-8.5 scenario, the expected increase in total forest area by species will be by +5 per cent, and for some individual forest species from +1-4 per cent (*Ulmus spp., Acer spp.),* +7 per cent *(Carpinus* spp.), +13 per cent (*Robinia spp.*), up to +42 per cent (*Salix spp.*), while for other forest species is expected a decrease from -4 per cent (*Quercus spp.*), -8 per cent (*Pinus spp.),* -14 per cent (*Fraxinus spp.)* up to -19 per cent (*Populus spp.),* comparative to 2000-2019 reference time period, see more in Table 5-38.

Table 5-38: Projections of Future Changes in FA (forest area by species, ha) in the Republic of Moldova, (%/20 years) relative to 2000-2019 Reference Period, according to the CMIP6 Ensemble of 6 GCMs for SSP1-2.6 and SSP5-8.5 Scenarios

Time Period	SSP	Quercus spp.	Carpinus spp.	Fraxinus spp.	Acer spp.	Ulmus spp.	Tilia spp.	Salix spp.	Pinus spp.	Populus spp.	Robinia spp.	Other species	Total
2021-2040	SSP1-2.6	3	-12	-2	-15	3	-17	-12	13	-7	22	-13	10
	SSP5-8.5	3	-13	-1	-15	4	-19	-13	14	-7	23	-15	10
2041-2060	SSP1-2.6	2	-11	-3	-12	3	-16	-9	12	-9	22	-13	10
	SSP5-8.5	1	-9	-5	-9	5	-11	-1	6	-10	19	-9	8
2061-2080	SSP1-2.6	2	-12	-4	-12	4	-14	-9	10	-9	20	-10	9
	SSP5-8.5	-2	-2	-10	-1	7	-4	21	-2	-14	9	-4	4
2081-2100	SSP1-2.6	2	-13	-3	-12	5	-17	-13	10	-8	20	-13	9
	SSP5-8.5	-4	7	-14	4	1	0	42	-8	-19	13	-1	5

In short term future time period 2021-2040, according to both SSPs scenarios the projected increases in pest area infestation by species, ha, due to future changes in extreme temperature and precipitation, could be for some individual pest species from +44-47 per cent (*Lymantria dispar L.*) up to +312-317 per cent (*Stereonychus fraxini deg.*), while for other pest species is expected the decrease from -8-9 per cent (*Xylophagous pests*), -11 per cent (*Operophtera brumata L.*), -65 per cent (*Erannis defoliaria Clerck*) up to +76-77 per cent (*Tortrix viridana L.*), comparative to 2000-2019 reference time period.

In 2041-2061 medium term time period, the tendency to increase in pest area infestation by species will persist for the same pest species in lower extent, the projected CMIP6 6 GCMs ensemble mean increases, due to future changes in extreme temperature and precipitation, will be for some individual pest species from +30-31 per cent (*Lymantria dispar L.*) up to +292-306 per cent (*Stereonychus fraxini deg.*), according to both SSPs scenarios. While for other pest species is expected the tendency to decrease in pest area infestation from -8 per cent (SSP1-2.6) or/and -11 per cent (SSP5-8.5) (*Xylophagous pests)*, -49 per cent (SSP5-8.5) (*Operophtera brumata L.),* -63 per cent (SSP1-2.6) or/and -86 per cent (SSP5-8.5) (*Erannis defoliaria Clerck)* up to -72 per cent (SSP5-8.5) or/and -81 per cent (SSP1-2.6) (*Tortrix viridana L.*)

Relative to the reference time period 2000-2019, by the end of the twenty-first century, in 2081-2100 time period, the projected CMIP6 6 GCMs ensemble mean increases in pest area infestation by species, due to future changes in extreme temperature and precipitation, could be for some individual pest species from +28 per cent (SSP1-2.6) (*Lymantria dispar L.*) to +325 per cent (SSP1-2.6) or/and +207 per cent (SSP5-8.5) (*Stereonychus fraxini deg.*), while for other pest species is expected a decrease in pest area infestation from -5 per cent (SSP1-2.6) or/and -10 per cent (SSP5-8.5) (*Xylophagous pests),* -18 per cent (SSP1-2.6) or/and -73 per cent (SSP5-8.5) (*Operophtera brumata L.),*

-72 per cent (SSP1-2.6) or/and -87 per cent (SSP5-8.5) (*Tortrix viridana L.)* up to -70 per cent (SSP1-2.6) or/and -103 per cent (SSP5-8.5) (*Erannis defoliaria Clerck),* comparative to 2000-2019 reference time period, see more in Table 5-39.

Table 5-39: Projections of Future Changes in pest by species (SP), ha, (%/20 years) Relative to 2000-2019 Reference Period, according to the CMIP6 Ensemble of 6 GCMs for SSP1-2.6, and SSP5-8.5 Scenarios

Time Period	SSP	Tortrix viridana L.	Operophtera brumata L.	Erannis defoliaria Clerck	Lymantria dispar L.	Stereonychus fraxini deg.	Xylophagous pests
2021-2040	SSP1-2.6	-76	-11	-65	44	312	-9
	SSP5-8.5	-77	0	-65	47	317	-8
2041-2060	SSP1-2.6	-81	2	-63	30	306	-8
	SSP5-8.5	-72	-49	-86	31	292	-11
2061-2080	SSP1-2.6	-71	-29	-77	33	297	-11
	SSP5-8.5	-77	-62	-92	-19	229	-6
2081-2100	SSP1-2.6	-72	-18	-70	28	325	-5
	SSP5-8.5	-87	-73	-103	-2	207	-10

In short term future time period 2021-2040, the projected CMIP6 6 GCMs ensemble mean decrease in total wood production by species, thousand m^3 according to both SSPs scenarios could be by -6-7 per cent and for some individual forest species from -18 per cent (*Fraxinus spp.*), -19 per cent (SSP1-2.6) or/and -21 per cent (SSP5-8.5) (*Pinus spp. T*), -25 per cent (SSP1-2.6) or/and 27 per cent (SSP5-8.5) (*Robinia spp.)* up to -28 per cent (SSP1-2.6) or/and -31 per cent (SSP5-8.5) (*Quercus spp.*), while for other forest species is expected the increases in wood production, due to future changes in extreme temperature and precipitation, could be from +8 per cent (SSP1-2.6) or/and +10 per cent (SSP5-8.5) (*Carpinus spp.*, and *Salix spp.*), +20 per cent (SSP1-2.6) or/and 18 per cent (SSP5-8.5) (*Tilia spp.*), +56 per cent (SSP1-2.6) or/and +51 per cent (SSP5-8.5) (*Acer spp.*) up to +128 per cent (SSP1-2.6) or/and +130 per cent (SSP5-8.5) (*Populus spp.),* comparative to 2000-2019 reference period.

In 2041-2061 medium term time period, the tendency to decrease in total wood production by species, thousand m^3, due to future changes in extreme temperature and precipitation, will persist for the same forest species, the projected CMIP6 6 GCMs ensemble mean decreases will for total wood production -6 per cent (SSP1-2.6) or/and -9 per cent (SSP5-8.5), and for some individual forest species from -18 per cent (SSP1-2.6) or/and -9 per cent (SSP5-8.5) (*Fraxinus spp.*), -5 per cent (SSP1-2.6) or/and -26 per cent SSP5-8.5 (*Ulmus spp.*), -27 per cent (SSP1-2.6) or/and -10 per cent (SSP5-8.5) (*Pinus spp. T*), -26 per cent (SSP1-2.6) or/and -31 per cent (SSP5-8.5) (*Robinia spp.)* and -28 per cent (SSP1-2.6) or/and -24 per cent (SSP5-8.5) (*Quercus spp.*), while for other forest species is expected the increases in wood production, due to future changes in extreme temperature and precipitation, could be from +8 per cent (SSP1-2.6) (*Carpinus spp.*), +9 per cent (SSP1-2.6) or/and +10 per cent (SSP5-8.5) (*Salix spp.*), +21 per cent (SSP1-2.6) or/and +19 per cent (SSP5-8.5) (*Tilia spp.*), +58 per cent (SSP1-2.6) or/and +45 per cent (SSP5-8.5) (*Acer spp.)* up to +124 per cent (SSP1-2.6) or/and +148 per cent (SSP5-8.5) (*Populus spp.*).

Relative to the reference time period 2000-2019, by the end of the twenty-first century, in 2081-2100 time period, the projected CMIP6 6 GCMs ensemble mean decrease in total wood production by species, thousand m^3, due to future changes in extreme temperature and precipitation, under SSP1-2.6 scenario, could be by -7 per cent in total wood production, and for some individual forest species from -8-9 per cent (*Ulmus spp., and Pinus spp. T*), -16 per cent (*Fraxinus spp.*), -20 per cent (*Robinia spp.*) up to -30 per cent (*Quercus spp.),* while for other forest species is expected the increase in wood production from +5 per cent (*Carpinus* spp.), +10 per cent (Salix spp.), +18 per cent (*Tilia spp.*), +49 per cent (*Acer spp.*), and 127 per cent (*Populus spp.*).

In case of SSP5-8.5 scenario, the expected decrease in total wood production by species could be by -6 per cent in total wood production, and for some individual forest species from -2 per cent (*Carpinus spp.*), -36 per cent (*Robinia spp.*), -86 per cent (*Ulmus spp.*) up to -107 per cent (*Pinus spp. T*), while for other forest species is expected an increase in wood production from +6 per cent (*Fraxinus spp.*), +11 per cent (*Quercus spp.*), +43 per cent (*Acer spp.*), +40 per cent (*Tilia spp.*) up to 224 per cent (*Populus spp.*), comparative to 2000-2019 reference period, see more in Table 5-40.

Table 5-40: Projections of Future Changes in Wood Production by species, (%/20 years) Relative to 2000-2019 Reference Period, according to the CMIP6 Ensemble of 6 GCMs for SSP1-2.6, and SSP5-8.5 Scenarios

Time Period	SSP	Quercus spp.	Carpinus spp.	Fraxinus spp.	Acer spp.	Ulmus spp.	Tilia spp.	Salix spp.	Pinus spp. T	Populus spp.	Robinia spp.	Total
2021-2040	SSP1-2.6	-28	8	-18	56	1	20	8	-19	128	-25	-6
	SSP5-8.5	-31	10	-18	51	1	18	9	-21	130	-27	-7
2041-2060	SSP1-2.6	-28	8	-18	58	-5	21	9	-27	124	-26	-6
	SSP5-8.5	-24	-2	-9	45	-26	19	10	-10	148	-31	-9
2061-2080	SSP1-2.6	-30	3	-15	50	-11	18	13	-7	130	-27	-7
	SSP5-8.5	-4	-7	2	38	-62	26	4	-39	200	-31	-9
2081-2100	SSP1-2.6	-30	5	-16	49	-8	18	10	-9	127	-29	-7
	SSP5-8.5	11	-2	6	43	-86	40	2	-107	224	-36	-6

5.4.4. Climate Change and Human Health

5.4.4.1. Data and Methods.

5.4.4.1.1. Heatwave (HW) Definitions and Calculation

The heatwave (HW) calculations used in ClimPACT2 are based on Perkins & Alexander (2013), with some slight modifications to the Excess Heat Factor (EHF).

A heatwave is defined as 3 or more days where either the EHF is positive. All HW definitions in ClimPACT2 are calculated over the extended summer period (with the exceptions of the Excess Heat Factor (EHF) and Excess Cold Factor (ECF) as defined by Nairn and Fawcett (2013), (see below short description of methodology). In the northern hemisphere the extended summer season includes May to September, Table 5-41.

For each of the above three HW definitions there are **five HW Aspects** that are calculated for each year or summer.

1. **HW Number (HWN):** The number of HW events (>= 3 HW days) that begin in the period of interest in addition to those that start prior to but continue into the period of interest.
2. **HW Frequency (HWF):** The number of days that contribute to HWs defined by HWN (these are termed 'HW days'). For HW's that begin prior to the period of interest, only the HW days within the period of interest are counted. For HW's that extend beyond the period of interest, a maximum of 14 days beyond the period of interest is counted.
3. **HW Duration (HWD):** Length in days of the longest heatwave defined by HWN.
4. **HW Magnitude (HWM):** The mean of the mean HW days of each HW defined by HWN.
5. **HW AMplitude (HWA):** The peak daily value in the hottest HW (defined as the HW with the highest HWM).

Table 5-41: Heatwave Index Definitions and Description

Short name	Long name	Definition	Description	Units
HWN (EHF)	Heatwave number (HWN) as defined by the Excess Heat Factor (EHF)	The number of individual heatwaves that occur each summer (May – Sep in northern hemisphere). A heatwave is defined as 3 or more days where either the EHF is positive	Number of individual heat-waves	events
HWF (EHF)	Heatwave frequency (HWF) as defined by the Excess Heat Factor (EHF)	The number of days that contribute to heatwaves as identified by HWN[267].	Total number of days that con-tribute to individual heatwaves	days
HWD (EHF)	Heatwave duration (HWD) as defined by the Excess Heat Factor (EHF)	The length of the longest heatwave identified by HWN[268].	Length of the longest heatwave	days
HWM (EHF)	Heatwave magnitude (HWM) as de-fined by the Excess Heat Factor (EHF)	The mean temperature of all heatwaves identified by HWN.	Average temperature across all individual heatwaves	$°C^2$
HWA (EHF)	Heatwave amplitude (HWA) as defined by the Excess Heat Factor (EHF)	The peak daily value in the hottest heatwave (defined as the heatwave with highest HWM).	Hottest day of the hottest heatwave	$°C^2$

[267] See Perkins and Alexander (2013) for more details.
[268] Perkins and Alexander (2013) for more details.

5.4.4.1.2. Excess Heat Factor Definitions and Calculation

The excess heat factor (EHF)[269] is a combination of two excess heat indices (EHI) representing the *acclimatization* to heat and the climatological *significance*:

$$\mathbf{EHI(accl.) = [(TM_i + TM_{i-1} + TM_{i-2})/3] - [(TM_{i-3} + ... + TM_{i-32})/30]}$$

$$\mathbf{EHI(sig.) = [(TM_i + TM_{i-1} + TM_{i-2})/3] - TM90_i,} \quad (5.25)$$

Where TM_i represents the average daily temperature for day i and $TM90_i$ is the 90th percentile of TM over all calendar day i within the user-specified base period, using a 15 day running window.

TM is calculated via:

$$\mathbf{TM = (TX + TN)/2.,} \quad (5.26)$$

The EHF is defined from the above two definitions:

$$\mathbf{EHF = EHI(sig.)\ x\ max(1,EHI(accl.)),} \quad (5.27)$$

5.4.4.1.3. Trends in Heatwave Metrics

Another approach to investigate continuous heatwave and cold wave changes over time is through annual monotonic trends. To do this, we used the Mann-Kendall test (Hirsch et al., 1982) to detect statistically significant trends and the Sen-slope estimator (Sen, 1968; Perkins & Alexander, 2013) to estimate the trend slopes. They are both well- known non-parametric approaches to handle time-series of climatological data, whose distribution are often highly skewed. We applied the trend tests for both the entire historical record (i.e., 1961–2019) and future projections including the reference period 1995–2014 (i.e., 1961–2100).

[269] ClimPACT2 User Guide, 2016, https://github.com/ARCCSS-extremes/climpact2/.

5.4.4.1.4. Study Area and Data

This study encompasses three the RoM AEZs (Northern, Central and Southern) for historical records and future projections (see more in Taranu, 2014; Taranu, et all., 2018). We used the observed daily maximum and minimum temperature data of 14 meteorological stations for 1961-2019 time period, kindly provided by the State Hydrometeorological Service.

For modelling of future projections, gridded downscaled daily minimum and maximum temperature data were used over the RoM AEZs. Six GCMs from the Coupled Model Intercomparison Project Phase 6 – CMIP6 (Eyring et al. 2016) were statistically downscaled for the historical reference period (1995-2014) and two scenarios (SSPs): SSP1-2.6 and SSP5-8.5 for four future time periods: 2021- 2040, 2041-2060, 2061-2080, and 2081-2100, see list of selected GCM models in Table 5-42.

Data analysis, statistics and figures were done using Python (van Rossum, 1995), ClimPACT2 tool, and R scripting (R Core Team, 2020).

Table 5-42: List of selected CMIP6 models with daily climate data

Model Name	Institute, Country	Variant Label
GFDL-ESM4	Geophysical Fluid Dynamics Laboratory, USA	r1i1p1f1
NESM3	Nanjing University, China	r1i1p1f1
MPI-ESM1-2-LR	Max-Planck Institute, Germany	r1i1p1f1
CNRM-ESM2-1	National Centre for Meteorological Research, France	r1i1p1f2
CNRM-CM6-1	National Centre for Meteorological Research, France	r1i1p1f2
INM-CM5-0	Institute of Numerical Mathematics, Russia	r1i1p1f1

For each of the CMIP6 6 global model downscaled simulations we calculated the representative 20-year averages for heatwave indices for two scenarios SSP 1-2.6, and SSP 5-8.5, and then have been extracted regional averages for the RoM AEZs of EHF for HWM, HWA, HWN, HWF, HWD.

5.4.4.2. Current State and Historical Changes in EHF Heatwave Indices in the Republic of Moldova

Analysis of historical records confirms that the long-term state of EHF heatwave characteristics has consistently increased in the RoM's AEZs. The decade 2010–2019, representing the more recent past, was far higher than previous decades for the EHF heatwave metrics based on spatial averages (Table 5-43). This is strong evidence of recent intensification of the Republic of Moldova's AEZs EHF heatwaves.

The EHF heatwave characteristics have been continuously increased over the past about 60 years. Results from our linear trend analysis in EHF heatwave indices reveal a consistent statistically significant intensification of EHF heatwave characteristics over the past about 60 years across most of RoM AEZs, including the Northern AEZs. Overall, the spatial pattern of increasing trends is consistent for all EHF heatwave metrics used, no decreasing trends have been detected for historical time period 1961-2019. All regions with increasing trends were statistically significant ($p \leq 0.05$) for at least four metrics (EHF.HWA, EHF.HWN, EHF.HWF, and EHF.HWD), following the Mann-Kendall test, (Table 5-44).

From the adaptation and mitigation perspective, it is important to quantify trends across regions. For this reason, we have quantified regional averages of trends (Table 5-44) in EHF heatwave metrics across the RoM AEZs and meteorological stations. All AEZs and meteorological stations studied have exhibited upward trends for the EHF heatwave metrics assessed. Heatwave characteristics have increased faster for Falesti (Northern AEZ), Cornesti, and Chisinau (Central AEZ) and Leova (Southern AEZ) during the historical 1961-2019 time period. For instance, the EHF heatwave peak temperature increased from +1.6°C^2 per decade (Tiraspol) up to +3.1°C^2 - +3.7°C^2 per decade across Chisinau, Cornesti, and Falesti, which means heatwave peak temperature became from +3.1°C to +4.7°C hotter in these locations over about 60-year period assessed.

Table 5-43: Decadal average EHF heatwave characteristics within the historical time period 1961–2019

Time period	EHF heatwave indices							
	HWA, °C²		*HWN, events*		*HWF, days*		*HWD, days*	
	x	σ	x	σ	x	σ	x	σ
				Northern AEZ				
1961-1970	17.2	11.7	2.3	1.1	10.3	6.4	5.3	2.2
1971-1980	11.0	4.2	2.3	1.4	9.4	6.6	4.7	1.7
1981-1990	15.2	7.7	2.3	1.0	11.8	5.0	6.9	2.6
1991-2000	22.6	12.0	3.8	2.3	19.0	11.9	7.3	2.3
2001-2010	23.8	12.9	3.8	1.8	23.0	12.1	9.9	4.5
2010-2019	26.7	14.1	6.5	1.7	42.4	13.6	13.1	3.7
				Central AEZ				
1961-1970	17.1	14.3	2.3	1.6	9.6	6.1	4.7	1.1
1971-1980	13.4	8.1	2.1	1.6	10.4	8.2	4.6	2.0
1981-1990	15.9	4.3	2.1	0.8	11.1	5.1	6.9	2.1
1991-2000	21.4	7.7	3.8	2.2	21.7	14.7	8.4	3.6
2001-2010	27.0	13.6	4.6	2.5	27.4	15.2	9.6	4.1
2010-2019	29.9	15.2	5.5	1.8	39.0	16.1	12.2	4.6
				Southern AEZ				
1961-1970	16.3	14.6	2.7	1.4	11.1	6.9	5.6	2.5
1971-1980	10.8	5.6	2.2	1.3	9.4	7.2	4.6	1.8
1981-1990	13.9	6.2	2.0	0.7	9.8	5.4	5.9	2.1
1991-2000	20.5	10.6	3.3	2.2	16.7	11.1	6.8	2.6
2001-2010	26.4	12.4	4.3	2.2	26.0	14.3	8.9	4.4
2010-2019	24.5	16.9	5.6	1.5	38.0	18.6	12.6	5.0

The EHF heatwaves are also lasting longer in the Republic of Moldova AEZs, with cumulative trend increases in EHF.HWD from 1.0 – 1.3 days per decade in Soroca, Balti, Camenca, Bravicea, Baltata, Leova, Leova, Cahul up to 1.4 – 1.8 days per decade over Briceni, Falesti, Cornesti, Tiraspol, Chisinau, and Dubasari, with maximum increase by 1.8 days per decade in Dubasari. The trends in EHF heatwave characteristics for the Falesti, Cornesti and Chisinau are greater than other territories. This is due to its higher extent positioned over a heatwave hotspot.

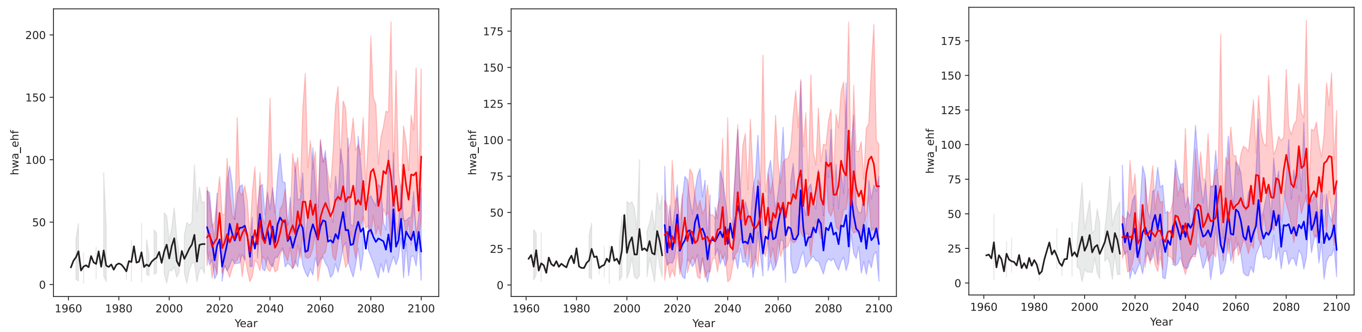
Table 5-44: Trends in EHF heatwave indices across the RoM for period 1961-2019, (59 years)[270]

Station	Linear trends in heatwave indices									
	EHF.HWM, (°C²)		EHF.HWA, (°C²)		EHF.HWN (events)		EHF.HWF, (days)		EHF.HWD (days)	
	Slope	*p-value*	Slope	*p-value*	Slope	*p-value*	Slope	*p-value*	Slope	*p-value*
Briceni	0.013	0.604	0.247	**0.007**	0.085	**0.000**	0.603	**0.000**	0.143	**0.000**
Balti	0.032	0.252	0.215	**0.012**	0.074	**0.000**	0.556	**0.000**	0.130	**0.000**
Bravicea	0.028	0.443	0.277	**0.003**	0.077	**0.000**	0.526	**0.000**	0.117	**0.000**
Falesti	0.028	0.304	0.373	**0.001**	0.091	**0.000**	0.659	**0.000**	0.145	**0.000**
Soroca	0.013	0.538	0.212	**0.016**	0.066	**0.000**	0.497	**0.000**	0.110	**0.000**
Cornesti	0.027	0.235	0.363	**0.000**	0.090	**0.000**	0.690	**0.000**	0.138	**0.000**
Dubasari	0.015	0.492	0.278	**0.001**	0.075	**0.000**	0.662	**0.000**	0.176	**0.000**
Camenca	0.019	0.392	0.240	**0.015**	0.063	**0.000**	0.474	**0.000**	0.105	**0.001**
Tiraspol	0.019	0.364	0.162	**0.030**	0.064	**0.000**	0.541	**0.000**	0.143	**0.000**
Baltata	0.008	0.788	0.107	0.212	0.047	**0.001**	0.401	**0.000**	0.120	**0.000**
Chisinau	0.027	0.296	0.317	**0.001**	0.082	**0.000**	0.637	**0.000**	0.142	**0.000**
Leova	0.005	0.877	0.286	**0.005**	0.069	**0.000**	0.523	**0.000**	0.133	**0.000**
Comrat	0.007	0.788	0.221	**0.014**	0.066	**0.000**	0.554	**0.000**	0.130	**0.000**
Cahul	0.029	0.293	0.248	**0.014**	0.074	**0.000**	0.576	**0.000**	0.127	**0.000**

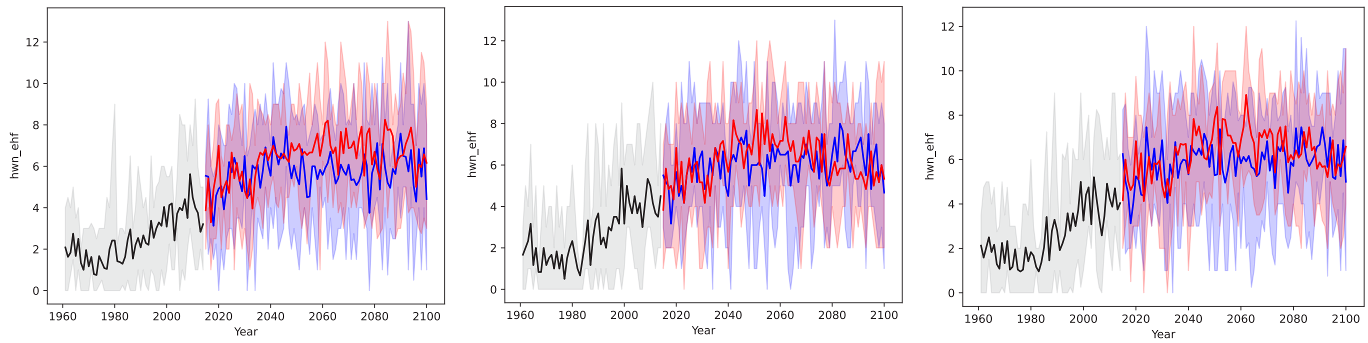
[270] The EHF estimates the accumulated heat excess over three consecutive days by combining two heat factors –significance (EHIsig) and acclimatization (EHIaccl)

5.4.4.3. Projected changes and trends in EHF heatwave indices across the Republic of Moldova

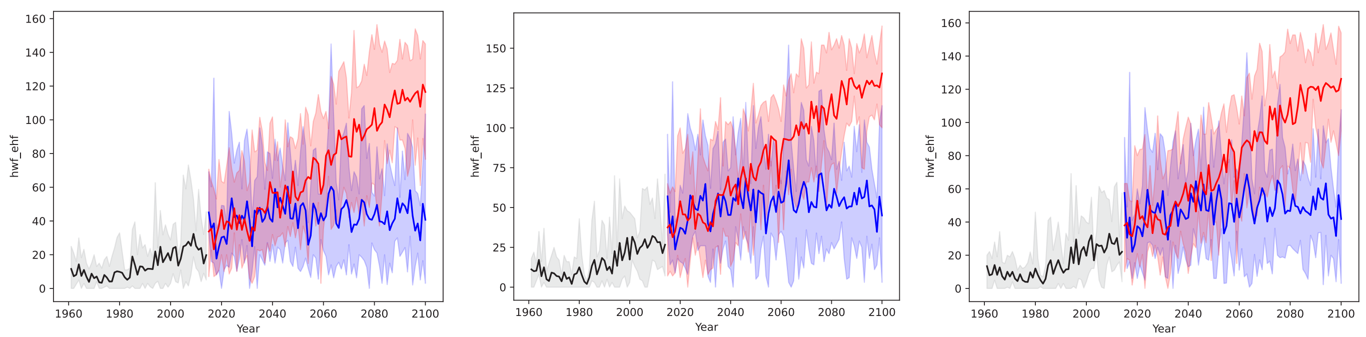
The Figure 5-59, illustrate the temporal evolution over 1961-2100 years of annual EHF heatwave characteristics (EHF. HWA, (˚C^2), EHF.HWN, (events), EHF.HWD, (days), and EHF.HWF, (days) throughout the Republic of Moldova for 6 individual CMIP6 GCMs, the historical time period (black), and future time period SSP1-2.6 (blue), and SSP5-8.5 (red) scenarios with multi-model range envelope (grey, blue, and pink shaded areas) for three RoM's AEZs: Northern (left), Central (middle), and Southern (right) mean, maximum and minimum of models spread over 1961- 2100 years. The high increasing trends is observed in EHF heatwave characteristics, for three RoM's AEZs, with larger increases under SSP5-8.5, and lower under SSP1-2.6 scenarios.



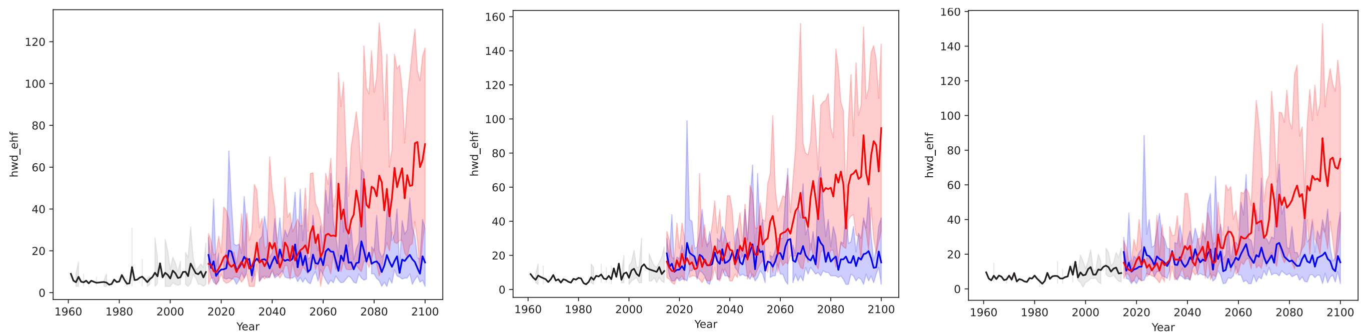
A) Heatwave peak temperature (EHF.HWA)



B) Heatwave number (EHF.HWN)



C) Heatwave frequency (EHF.HWF)



D) Heatwave duration (EHF.HWD)

Figure 5-59: Averaged projected time-series (and uncertainty) from 1961 to 2100 for EHF heatwave indices: historical time period (black), and future time period SSP1-2.6 (blue), and SSP5-8.5 (red) scenarios with multi-model range envelope (grey, blue, and pink shaded areas) for three RoM's AEZs: Northern (left), Central (middle), and Southern (right).

In short term future time period 2021-2040, the projected CMIP6 6 GCMs ensemble mean increases in Heatwave amplitude (HWA) as defined by the Excess Heat Factor (EHF) -EHF. HWA, $(^{\circ}C^2)$[271], could be from +11.9$^{\circ}C^2$ in Northern to +8.4$^{\circ}C^2$ in Southern AEZs under SSP5-8.5, and/or minimum increase from +10.8$^{\circ}C^2$ in Northern to +7.3$^{\circ}C^2$ in Southern AEZs, in case of SSP1-2.6 scenarios, comparative to 1995-2014 reference period.

In 2041-2061 medium term time period, the tendency to increase in EHF.HWA will persist, the projected CMIP6 6 GCMs ensemble mean increases in EHF.HWA will be from +22.3$^{\circ}C^2$ in Northern to +19.4$^{\circ}C^2$ in Southern AEZs under SSP5-8.5, and/or minimum increase from +14.6$^{\circ}C^2$ in Northern to +12.3$^{\circ}C^2$ in Southern AEZs, in case of SSP1-2.6 scenarios.

Relative to the reference period 1995-2014, the projected CMIP6 6 GCMs ensemble mean maximum increases in EHF. HWA by the end of the twenty-first century, in 2081-2100 time period, will be from +53.7$^{\circ}C^2$ in Northern to +47.6$^{\circ}C^2$ in Southern AEZs under SSP5-8.5, and/or minimum increase from +10$^{\circ}C^2$ in Northern to +14.7$^{\circ}C^2$ in Southern AEZs, in case of SSP1-2.6 scenarios, see more in Table 5-45, and Figure 5-60A.

[271] The peak daily value in the hottest heatwave (defined as the heatwave with highest HWM).

Table 5-45: Projected CMIP6 6 GCMs Ensemble Change of EHF heatwave characteristics: Presented for Four 20-Year Time Periods in the Future (2021–2040, 2041–2060, 2061-2080, and 2081–2100) for SSP1-2.6, and SSP5-8.5, Relative to the 1995–2014 Baseline Period

Period	Scenario	EHF.HWM, $(^{\circ}C^2)$	EHF.HWA, $(^{\circ}C^2)$	EHF.HWN, (events)	EHF.HWD, (days)	EHF.HWF, (days)
Northern AEZ						
2021-2040	SSP1-2.6	+0.4	+10.8	+1.9	+5.2	+19.7
	SSP5-8.5	+0.9	+11.9	+1.9	+6.0	+20.3
2041-2060	SSP1-2.6	+1.2	+14.6	+2.3	+6.4	+23.7
	SSP5-8.5	+2.1	+22.3	+3.1	+11.5	+38.7
2061-2080	SSP1-2.6	+1.3	+15.0	+2.0	+7.5	+23.9
	SSP5-8.5	+4.3	+41.8	+3.4	+28.5	+67.1
2081-2100	SSP1-2.6	+0.8	+10.0	+2.3	+5.1	+21.6
	SSP5-8.5	+5.8	+53.7	+3.0	+45.3	+88.3
Central AEZ						
2021-2040	SSP1-2.6	+0.3	+8.8	+1.7	+5.8	+20.2
	SSP5-8.5	+0.9	+10.9	+1.7	+5.8	+20.0
2041-2060	SSP1-2.6	+1.3	+14.6	+2.2	+6.7	+25.9
	SSP5-8.5	+2.0	+22.5	+3.0	+12.6	+43.0
2061-2080	SSP1-2.6	+1.1	+13.4	+2.0	+9.3	+28.0
	SSP5-8.5	+4.4	+40.7	+3.0	+30.4	+71.9
2081-2100	SSP1-2.6	+1.0	+12.2	+2.4	+5.8	+24.6
	SSP5-8.5	+6.4	+50.8	+2.3	+52.9	+92.9
Southern AEZ						
2021-2040	SSP1-2.6	+0.2	+7.3	+1.6	+7.0	+23.4
	SSP5-8.5	+0.7	+8.4	+1.7	+7.5	+23.2
2041-2060	SSP1-2.6	+0.8	+12.3	+2.3	+8.2	+29.0
	SSP5-8.5	+1.5	+19.4	+3.1	+16.3	+49.2
2061-2080	SSP1-2.6	+0.7	+12.8	+2.1	+10.7	+31.9
	SSP5-8.5	+4.0	+33.4	+2.3	+34.4	+70.2
2081-2100	SSP1-2.6	+1.0	+14.7	+2.7	+9.9	+35.4
	SSP5-8.5	+6.4	+47.6	+1.7	+58.5	+98.6

In short term future time period 2021-2040, the projected CMIP6 6 GCMs ensemble mean increases in Heatwave number (HWN), as defined by the Excess Heat Factor (EHF) - EHF.HWN, (events)[272], could be from +1.9 events in Northern to +1.6-1.7 events in Southern AEZs according to both SSPs scenarios, comparative to 1995-2014 reference period.

In 2041-2061 medium term time period, the tendency to increase in EHF.HWN will persist, the projected CMIP6 6 GCMs ensemble mean increases in EHF.HWN for three RoM's AEZs will be uniform the maximum increase by +3.1 events under SSP5-8.5, and/or minimum increase by +2.2-2.3 events, in case of SSP1-2.6 scenarios.

Relative to the reference period 1995-2014, the projected CMIP6 6 GCMs ensemble mean increases in EHF.HWN by the end of the twenty-first century, in 2081-2100 time period, will be from +3.0 events in Northern to +1.7 events in Southern AEZs under SSP5-8.5, and/or in case of SSP1-2.6 scenarios the spatial distribution of increase will be quite different from +2.3 events in Northern up to +2.7 events in Southern AEZs, see more in Table 5-45, and Figure 5-60B.

In short term future time period 2021-2040, the projected CMIP6 6 GCMs ensemble mean increases in Heatwave frequency (HWF) as defined by the Excess Heat Factor (EHF) - EHF.HWF, (days)[273], could be from +20.3 days in Northern up to +23.4 days in Southern AEZs under SSP5-8.5, and/or from +19.7 days in Northern up to +23.4 days in Southern AEZs, in case of SSP1-2.6 scenarios, comparative to 1995- 2014 reference period.

In 2041-2061 medium term time period, the tendency to increase in EHF.HWF will persist, the projected CMIP6 6 GCMs ensemble mean increases in EHF.HWF will be from +38.7days in Northern up to +49.2 days in Southern AEZs under SSP5-8.5, and/or minimum increase from +23.7 days in Northern up to +29.0 days in Southern AEZs, in case of SSP1-2.6 scenarios.

Relative to the reference period 1995-2014, the projected CMIP6 6 GCMs ensemble mean maximum increases in EHF.HWF by

[272] The number of individual heatwaves that occur each summer (May – Sep in northern hemisphere). A heatwave is defined as 3 or more days where either the EHF is positive.

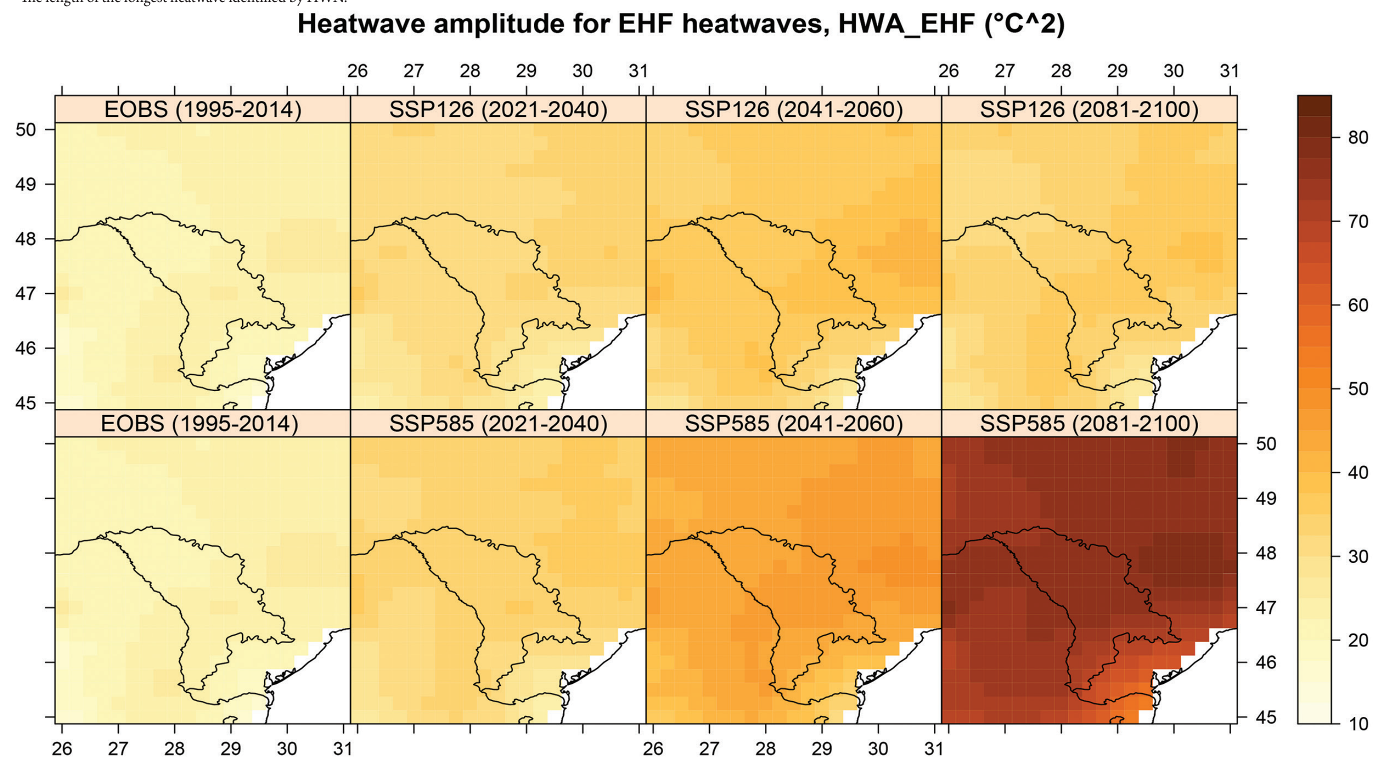
[273] The number of days that contribute to heatwaves as identified by HWN.

the end of the twenty-first century, in 2081-2100 time period, will be from +88.3 days in Northern up to +98.6 days in Southern AEZs under SSP5-8.5, and/or minimum increase from +21.6 days in Northern up to +35.4 days in Southern AEZs, in case of SSP1-2.6 scenarios, see more in Table 5-45, and Figure 5-60C.

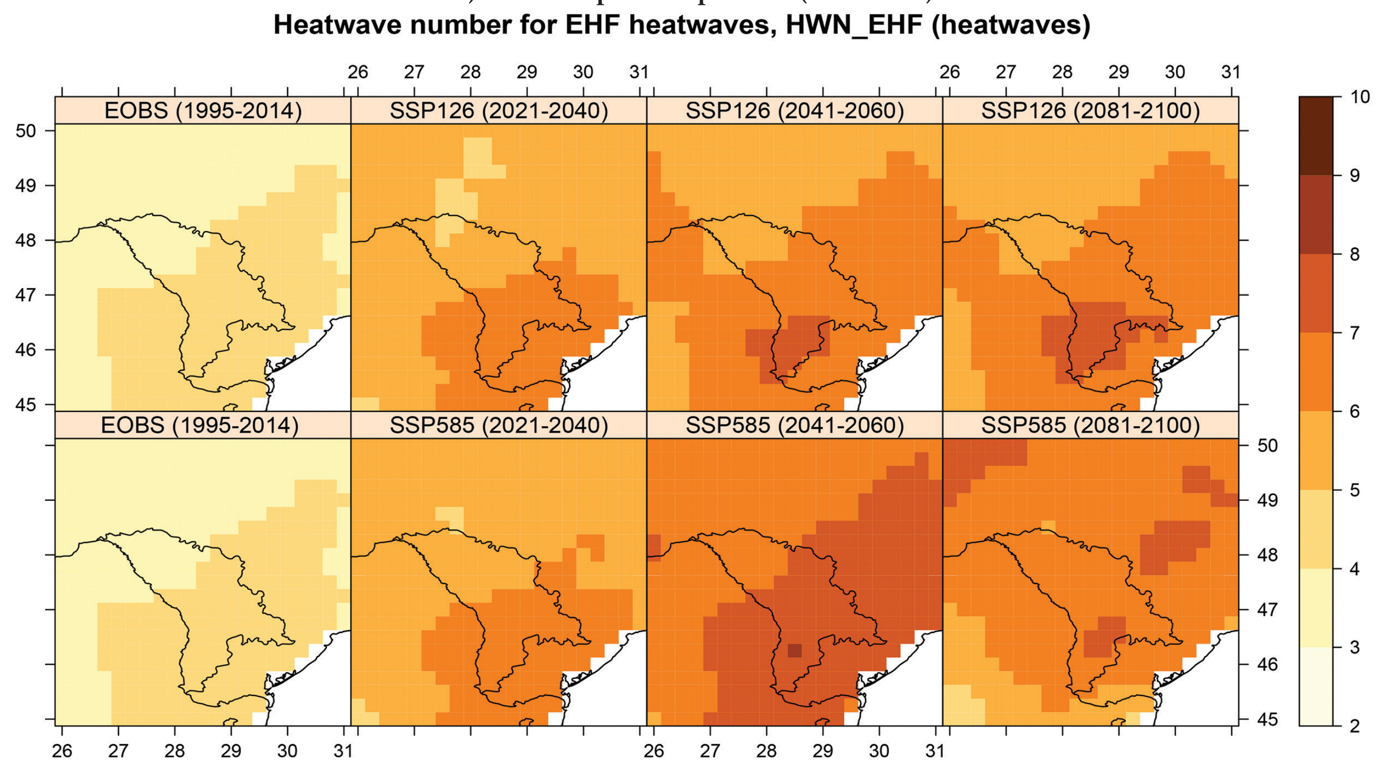
In short term future time period 2021-2040, the projected CMIP6 6 GCMs ensemble mean increases in Heatwave duration (HWD), as defined by the Excess Heat Factor (EHF) - EHF.HWD, (days)[274], could be from +6 days in Northern up to +7.5 days in Southern AEZs under SSP5-8.5, and/or minimum increase from +5.2 days in Northern up to +7.0 days in Southern AEZs, in case of SSP1-2.6 scenarios, comparative to 1995- 2014 reference period.

In 2041-2061 medium term time period, the tendency to increase in EHF.HWD will persist, the projected CMIP6 6 GCMs ensemble mean increases in EHF.HWD will be from +11.5 days in Northern up to +16.3 days in Southern AEZs under SSP5-8.5, and/or minimum increase from +6.4 days in Northern up to +8.2 days in Southern AEZs, in case of SSP1-2.6 scenarios.

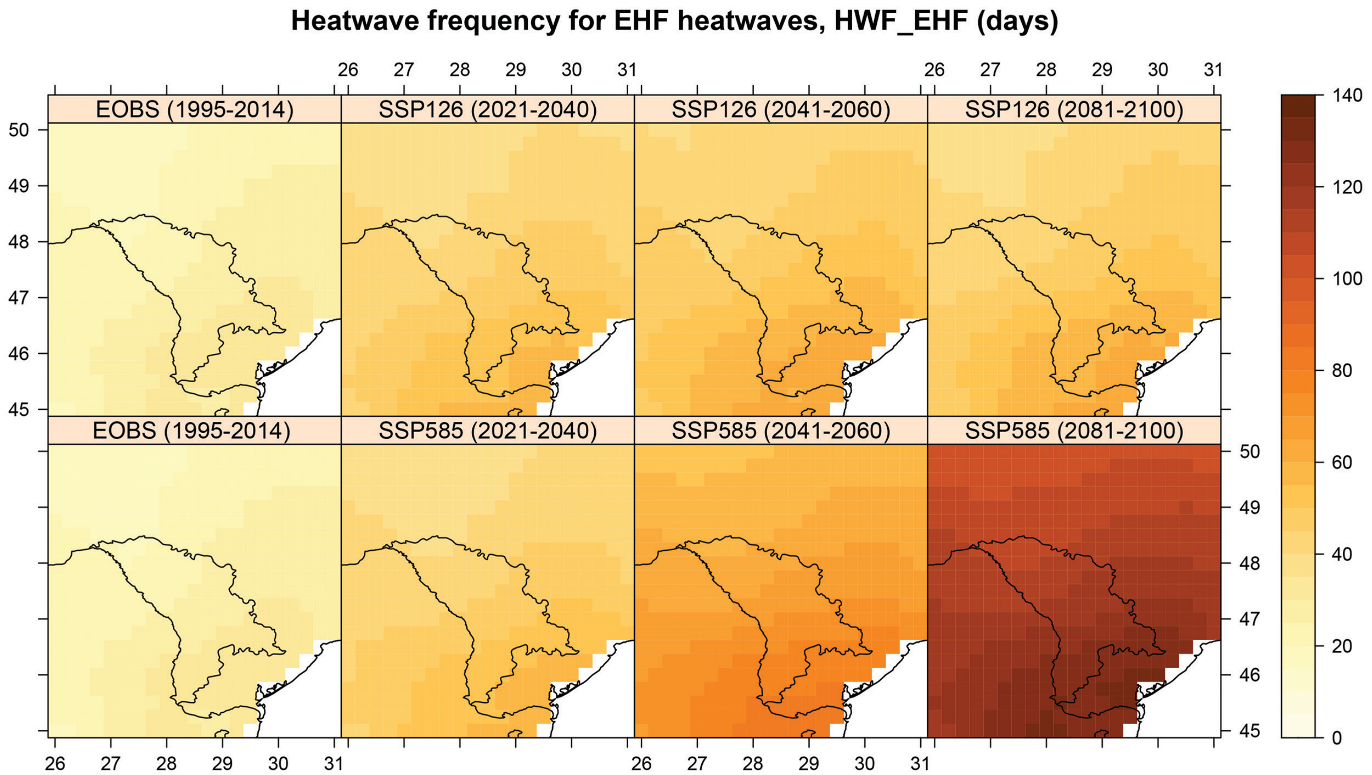
[274] The length of the longest heatwave identified by HWN.



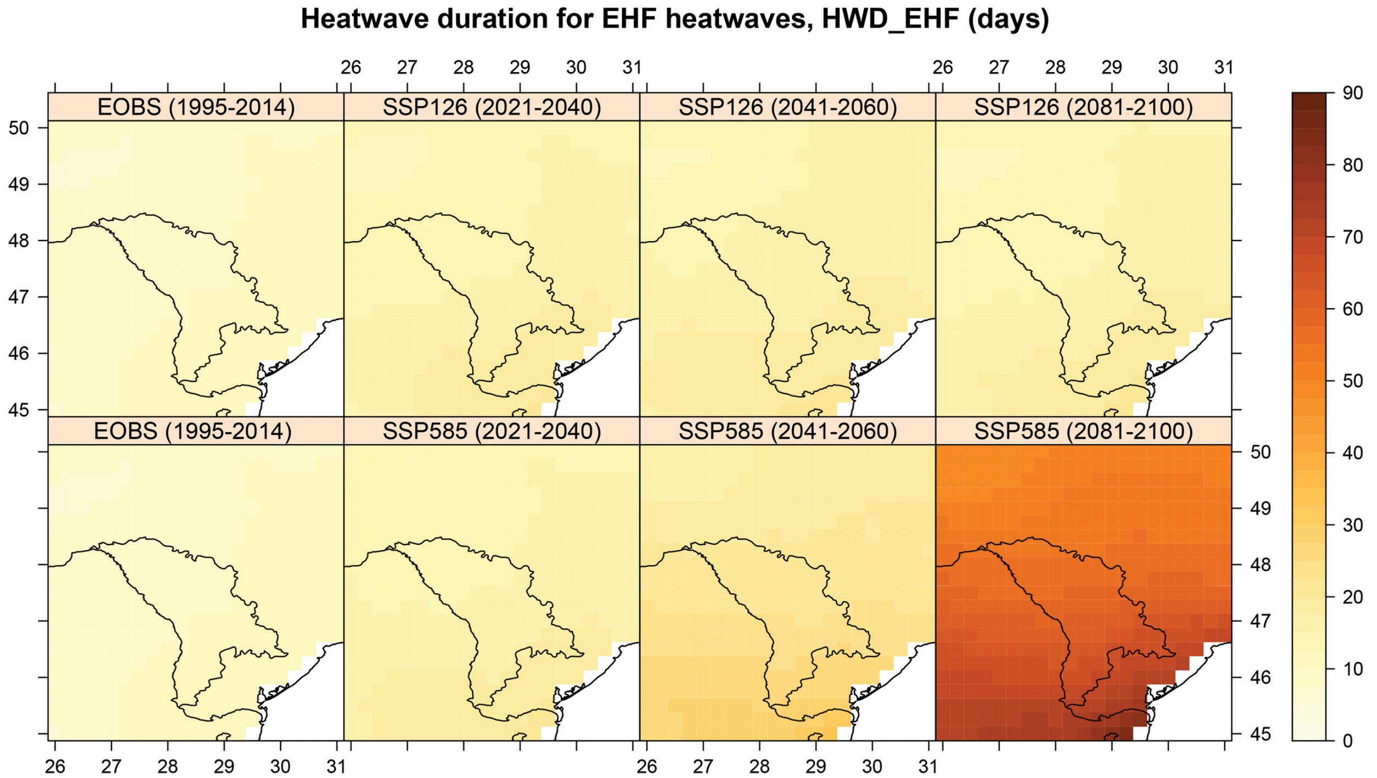
A) Heatwave peak temperature (EHF.HWA)



B) Heatwave number (EHF.HWN)



C) Heatwave frequency (EHF.HWF)



D) Heatwave duration (EHF.HWD)

Figure 5-60: CMIP6 6 GCMs Ensemble projections of EHF heatwaves, under two SSP1-2.6 and SSP5-8.5 scenarios, comparative to 1995-2014 reference period.

5.5. Climate Change Adaptation

5.5.1. Climate Change Adaptation Strategic Vision and Goal, and Supporting Institutional Arrangements and Policy Framework

5.5.1.1. Institutional Arrangements, Governance and Legal Framework

In the RoM, Climate Change Adaptation (CCA) planning and implementation is a shared responsibility and requires involvement by line Ministries of the Government, their subordinated agencies, LPA, private sector, civil society. However, the nature of involvement varies across these stakeholders.

The Ministry of Environment (MoE) of the RoM is the state authority vested with the power to develop and promote policies and strategies addressing climate change, environmental protection, rational use of natural resources and biodiversity conservation; to identify priorities, develop and promote national programs and action plans which address such priorities, coordinate relevant actions and monitor their implementation in the best way; to promote the state policy and determine the priority directions of climate change and environmental research and development; to ensure international collaboration in climate change and environmental protection; to collect, systematize and manage own information database to support own activities, to ensure maintenance and optimization of the sector information system, other environment and climate-related responsibilities.

On behalf of the Government of the RoM, the MoE is responsible for implementation of international climate change and environment related treaties to which the RoM is a Party (including the UNFCCC, signed by the RoM on June 12, 1992, ratified by the Parliament on March 16, 1995, as well as the Kyoto Protocol, ratified by the RoM on February 13, 2003, the official date of accession being April 22, 2003).

The National Climate Change Commission (NCCC) is operationalized through a dedicated Government Decision, aimed at leading the Climate Change Coordination Mechanism (CCCM)[275] in cross-sectorial coordination of all climate-related components: adaptation, GHG emissions and mitigation. The purpose of the multi-stakeholder CCCM is to foster the dialogue, coordination, collaboration and coherence among sectors, to act as leverage, and to report on climate change planning and actions by all stakeholders. The established multi-stakeholder partnership is foreseen to contribute to a common understanding in climate planning, improved rationality and effectiveness of policymaking, to facilitate the implementation of climate action, to have a contribution to the sustainability of governance. Cross-sectorial coordination will enhance also the transparency in the implementation of prioritized adaptation measures.

The NCCC is a permanent formalized body with the highest representation of key stakeholders: sectorial ministries, NGOs, academia, research, private sector, taking into consideration gender dimension through including representatives of women's associations and considering gender equality in all supervision activities of NCCC. Such organizational structure of NCCC comprises actors of horizontal, inter-sectorial planning and of vertical integration, with the representation of lower sectorial/ national level, thus ensuring a multi-level framework with interactions between government and civil society representatives. The NCCC will have a Secretariat as a technical executive body.

At the sector level, the NCCC is supported by the sectorial administration in charge of the development of sector-specific climate change enabling environment and reporting on climate action, establishing working groups or nominate focal points. Technical Committees on specific thematic areas will be established ad-hoc when the need in advanced thematic expertise is required, in particular during the consideration of donor project proposals. Such need will be met by recruitment of mitigation or adaptation experts. The Commission will coordinate also previously initiated actions, which have not been completed under the Kyoto Protocol. Through the proposed structure of the CCCM, the Republic of Moldova overcomes the issue of limited integration and connectivity between levels, which is an impediment to the effective decision-making process in adaptation and mitigation. A dedicated Government Decision (under approval) will enact the cross-cutting coordination mechanism.

The Climate Change Adaptation Strategy of the RoM and its implementation Action Plan (CCAS, 2014)[276], provides for an integrated vision of the Republic of Moldova's development opportunities and the ability to respond in a resilient way to the impact of climate change. The objectives of the CCAS are oriented towards increasing the country's capacity to adapt and respond to actual or potential climate change effects and it is underpinned by an in-depth study of future climate risks and their impacts on vulnerable sectors. The CCAS and its implementation Action Plan[277] serve as an umbrella strategy that creates an enabling environment for Central and Local Public Authorities to integrate CCA and risk management into existing and future strategies through a range of sectorial and local actions. The sectorial approach in climate change adaptation in the Republic of Moldova is prevailing at the current stage of the country's development, while cross-sectorial and sub-national approaches are becoming increasingly important. Some sectors are already implementing adaptation actions, while others need more support in adaptation planning and implementation.

The new CCAS and the associated Action Plan that will cover the timeframe 2022-2030 are now under elaboration in the second cycle of the NAP process, implemented by UNDP.

5.5.1.2. Climate Change Adaptation Vision and Goal

The RoM's climate change adaptation vision incorporates the concept of integrating climate adaptation into medium- and long-term development planning to foster adaptation action, enhancing climate risks into investment decision making and business planning, increasing the resilience of country's

[275] GD No. 444 of 01. 07. 2020 regarding the establishment of the coordination mechanism in field of climate change, Official Gazette No. 188-192 art. 635 of 24.07.2020.

[276] GD No. 1009 of 10.12.2014 regarding the Moldova's 2020 Climate Change Adaptation Strategy and its implementation Action Plan, Official Gazette No. 372-384 of 19.12.2014.

[277] The implementation Action Plan for Moldova's 2020 Climate Change Adaptation Strategy is considered as the 1st National Action Plan (NAP-1).

economic sectors, land use and ecosystems, and accelerating the transition towards country's resilient sustainable development.

A further advance in medium- and long-term adaptation planning in a coherent and strategic manner is seen through an iterative social and gender-sensitive National Adaptation Planning (NAP) process. This commitment is reinforced via the approval of a dedicated Government Decision No. 444 (2020)[278], which also institutionalize the coordination and oversight of both adaptation planning and implementation through a cross-sectorial multi-stakeholder coordination mechanism chaired by the NCCC. As such, the NAP process is seen as a practical approach to vertical (subnational- national) and horizontal (multi-sectorial) decision-making integration, which also facilitates the integration of top-down assessments of climatic risks with bottom-up planning of adaptation needs, options and priorities.

Through the NAP process components, the Republic of Moldova establishes an evidence-based framework that makes adaptation planning an inclusive, gender-responsive and flexible process, while also supporting priority adaptation actions in the most climate-vulnerable sectors and areas.

The sectorial approach in climate change adaptation planning of the RoM derives from the CCAS that sets out the priority sectors of adaptation and promotes actions to reduce climate impact through strengthened institutional capacities at national, sectorial and local levels, improved knowledge management, convergent policy on climate change adaptation and disaster risks reduction. Therefore, the NAP process promotes gradual mainstreaming of adaptation into planning, budgeting and decision-making of Agriculture, Health, Water, Forestry, Energy and Transport sectors. Although the technical and financial requirements to build climate change resilience across economic sectors are still being assessed, it is already clear, that it will certainly require significant effort and mobilization of innovative solutions, financial resources, institutional capacity and political will for effective action.

The RoM's climate change adaptation approach incorporates also the aspects of most vulnerable socio-economic and natural systems, population groups, urban and rural communities, in which critical issues are found and which require a coherent and wide response to climate risks and vulnerabilities through transformative adaptation interventions. The NCCC is to provide effective leadership needed for transformative changes with consideration of the critical role of sub-national authorities and local organizations in these changes.

In support of climate action, the Government of the RoM strives to create an effective enabling environment for attracting climate investments in adaptation priority areas. Technologically innovative solutions, new business models are expected to be deployed by international donors, investors and the country's private sector in resilient infrastructure and nature-based solutions.

To facilitate this process, the list of investment priorities was produced based on the review of national and sectorial development plans and policies, along with an extensive consultation process ensured by a wide representation of stakeholders across sectors and levels of governance, in particular, private sector, civil society and academia representatives that accounted for different types of knowledge in the area of climate change adaptation. The current list of adaptation investment areas is the outcome of Country Programming for the engagement with GCF carried out in a country-driven participative modality, ensuring transparency of each step of the appraisal process. The list of adaptation investment priorities will be updated as needed, at least once per year, within a stakeholder participatory process, using relevant prioritization approaches.

Based on the above-stated vision, the RoM's medium- and long-term adaptation goal is to reach a sustainable social and economic development resilient to the impact of climate change by establishing a strong enabling environment for a coherent and effective adaptive action with mitigation benefits, integrating climate risk into investment decision making and business planning, while remaining socially inclusive and sensitive to gender impacts of climate change.

As such, the whole of the RoM's adaptation framework makes a contribution to the country's sustainable development priorities embodied in the NDS "Moldova 2030" and to the overarching adaptation goal of the Paris Agreement to enhance adaptive capacity and resilience, to reduce vulnerability, with a view to contributing to sustainable development, and ensuring an adequate adaptation response in the context of the goal of holding average global warming well below 2 °C and pursuing efforts to keep it below 1.5 °C.

5.5.2. National and Sectorial Climate Change Adaptation Priorities

The RoM has an evolving climate change adaptation policy framework, with many complementarities and links to the cross-cutting sustainable development policy framework. Therefore, the adaptation priorities stated in the current updated NDC derive from both the national climate change policies and related development national and sub-national policies and plans. Some policies of the RoM have their official validation until 2020, while a few policies cover the timespan until 2030, therefore, the draft policy documents, laws and regulations that passed various stages of public consultation and Government approval have been taken into account when identifying cross-sectorial and sectorial adaptation priorities.

The NDS "Moldova 2030", being the main reference document for the sectoral strategies and the subsequent policy interventions, aims to assume a greater responsibility to stop the degradation of the environment and the uncontrolled consumption of natural resources, taking into account the needs of future generations, as well as commitments undertaken under 2030 Agenda. The NDS "Moldova 2030" declares the principles of the green economy, which will ensure economic resilience and adaptation to the impact of global climate change and will contribute to enhancing its competitiveness at the regional and international levels, and, in the long term, will avoid the huge economic costs due to environmental degradation and climate impact. In

[278] GD No. 444 of 01. 07. 2020 regarding the establishment of the coordination mechanism in field of climate change, Official Gazette No. 188-192 art. 635 of 24.07.2020.

the Strategy, people's interests are placed at the center of the development process, which could be accounted for in a sustainable way only by empowering people to participate, to contribute and to benefit from economic, cultural, social and political development based on a common attitude in which all human rights and freedoms are observed.

Climate actions are fundamental to the achievement of all 17 Sustainable Development Goals. The draft NDS "Moldova 2030" sets out clear priorities for combating climate change by creating an efficient energy policy, along with a forward-looking climate change policy leading to a fair transition to a climate-neutral and competitive economy that will create opportunities for new jobs and sustainable growth at the same time. The National Coordination Council for Sustainable Development was created to set up a participatory and transparent process in the adoption and implementation of the Sustainable Development Goals.

The Association Agreement between the European Union and the RoM[279] is an important treaty that commits Moldova to economic, judicial and financial reforms to converge its policies and legislation to those of the European Union. The chapter on climate change focuses on actions in six areas: (i) mitigation; (ii) adaptation; (iii) carbon emission trading; (iv) research, development, implementation and other related issues; (v) integrating climate aspects into sectorial policies and (vi) awareness-raising, education and training. The Association Agreement is accompanied by an implementation Program of Action for European Integration: Freedom, Democracy, Welfare[280], which addresses adaptation to climate change and sets the framework for the congruence of Moldovan policies with European ones.

Promoting the "green" economy program in the RoM for the years 2018-2020 and the Action Plan[281] for its implementation ensures the development of the necessary capacities of all those involved in the planned activities in order to achieve the following specific targets by 2020: 17% of gross final energy consumption from renewable sources and improvement of energy efficiency by 8.2%; promoting organic farming by implementing green economy principles and expanding the area of agricultural land used for organic farming by about 20%; reducing air pollution by 30% by developing sustainable transport, etc.

The Biological Diversity Strategy for the years 2015-2020[282] addresses the causes of biodiversity loss through incorporation of requirements such as halting the biodiversity loss process starting with the government and ending with the entire society.

The Environmental Strategy for 2014-2023 and the Action Plan for its implementation[283] ensures the consistence of the long-term strategic planning with the EU rules and has a context for the development and approval of climate change adaptation strategies. Building up of an efficient system of environmental management contributing to increased quality of environmental factors and to observing the right of the population to a clean, healthy and sustainable natural environment is the main objective of the Environmental Strategy.

The National Strategy on Ensuring Equality between women and men (2017-2021) in the RoM and the Action Plan for its implementation[284] aims at greater reduction of gender gaps due to the social, economic and environmental vulnerabilities exacerbated by climate change. The strategy includes the area of intervention 2.6. "Climate change", stating as Specific Objective 1.10: Adjustment of sectorial adaptation strategies to climate change by including gender equality[285]. The gender policy is supported by the Law No. 5-XVI of 09.02.2006 on ensuring equal opportunities between women and men, which stipulates that in the Republic of Moldova, women and men enjoy equal rights and freedoms and are guaranteed equal opportunities for their exercise.

The National Greening Program for SMEs[286] (approved by Government Decision no. 592/2019) is implemented with the purpose to promote, support and develop the capacity of SMEs to adopt practices of greening the processes of production and provision of services. It involves a complex of activities with an integrated approach of awareness on introducing the greening practices in the processes of production and provision of services.

The Government Decision No. 590 of 21.06.2018 on approval of the Concept of the reform of the national system of management, prevention and reduction of the consequences of floods addresses the problem of flood prevention, transition from the defensive forms of action to those of risk management. The Concept promotes a flood risk management system by establishing components for the management, prevention and reduction of the consequences of the flood risks.

5.5.2.1. Cross-sectorial Climate Change Adaptation Priorities

Being a complex process, adaptation to climate change requires cross-sectorial perspectives and the involvement of a multi-level governance system with strong capacities for both planning and implementing adaptation. In the undertaken sectorial and institutional level capacity assessments of Moldova, it was concluded that the need exists to strengthen country's capacities to plan and implement cross-sectorial adaptation.

The Table 5-46 provides information on the categories of cross-sectoral adaptation priorities, along with the main actions and activities to be implemented in support to prioritized options that aim at country's preparedness for and the absorption of climate impacts, building resilience at national and sub-national levels.

[279] Association Agreement between the Republic of Moldova and the European Union and the European Atomic Energy Community and their Member States <http://www.parlament.md/LinkClick.aspx?fileticket=gXkO-TU94I6Q%3D&tabid=203&language=ro-RO>
[280] Program of Action for European Integration: Freedom, Democracy, Welfare 2011-2014, GD no. 289 of 07.05.2012, <https://gov.md/sites/default/files/document/attachments/program_guvern-ro.pdf>
[281] Government Decision No. 160 of 21.02.2018 on Approval of Program for Promoting Green Economy in the Republic of Moldova for 2018-2020: pub: 02.03.2018 in Official Monitor Nr.68-76. art No: 208. <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=374523>
[282] The Biological Diversity Strategy for the years 2015-2020 of the Republic of Moldova and the Action Plan for its implementation, GD No.274 of 18.05.2015, <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=358781>
[283] Government Decision No. 301 of 24.04.2014 on Approval of the Environmental Strategy for the years 2014-2023 and the Action Plan for its implementation. The Official Gazette No. 104-109. <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=352740>
[284] The National Strategy on Ensuring Equality between women and men (2017-2021) in the Republic of Moldova and the Action Plan for its implementation, GD No. 259 of 28.04.2017, <http://lex.justice.md/viewdoc.php?action=view&view=doc&id=370442&lang=1>
[285] <http://lex.justice.md/viewdoc.php?action=view&view=doc&id=370442&lang=1>
[286] GD No. 592 of 27.11.2019 regarding the approval of the Greening Program for small and medium-sized enterprises, Official Gazette No. 360-366 art. 907.

Table 5-46: Cross-Sectorial Climate Change Adaptation Priorities

<table>
<tr><th>Category of adaptation priorities</th><th>Adaptation priorities</th><th>Main activities and actions in support of adaptation priorities</th></tr>
<tr><td rowspan="6">Policy enforcement, knowledge and capacity building</td><td>Strengthen climate change adaptation legal and policy framework at different levels of governance</td><td>- Undertake policy and policy practices analysis in relation to climate change adaptation with the aim to identify the level of consideration to address climate-related issues and provide recommendations for further mainstreaming of CCA into the national and sub-national policy framework.
- Incorporate CCA into broader development context and provide a comprehensive, integrated climate policy approach toward a resilient sustainable development.
- Develop a strong alignment of CCA and national development goals and objectives, particularly in the priority sectors: agriculture, forestry, health, water, energy and transportation, taking into consideration social and gender aspects.
- Incorporate nature-based solutions into adaptation planning and policy development, with a focus on biodiversity conservation, ecosystem services management, and disaster risk reduction.
- Increase the enforcement of policies requiring considerations of the climate-resilient engineering solutions, construction codes, technical protocols and standards in developing new infrastructure.</td></tr>
<tr><td>Enhance institutional capacities to effectively plan and implement CCA</td><td>- Address system-level gaps and impediments to effectively plan for and implement CCA through a participatory capacity assessment at the individual, institutional and enabling environment levels in all priority sectors to identify newly exposed weaknesses at the ministerial and sector levels.
- Ensure sustained availability of capacity and technical skills to address the challenge of climate-related analysis and interventions as a key aspect of ensuring that the NAP becomes a successful iterative process and enable the continued and progressive long-term adaptation planning.
- Adopt internal, institutional level performance and incentive systems that encourage staff to promote ambitions, transformative climate actions and provide tools to enable staff to contribute to climate-resilient and adaptation action.</td></tr>
<tr><td>Strengthen institutions to provide effective leadership and coordination of adaptation planning and action at national and sub-national level</td><td>- Enhance political commitment and leadership at the highest level in promoting CCA planning and action in Moldova.
- Promote active involvement of high-level political leaders in outreach activities to increase the ability to gather multiple stakeholders and ensure broad public involvement. In advocating the CCA high-level leaders are to be supported by skilled and dedicated experts from the area.
- Promote effective leadership for transformational change, be it through strong centralized decision-making or through the distribution of power to make more localized decisions.
- Reinforce the long-term, coordinated approach to capacity development that addresses both institutional capacity needs and individual skills development.
- Operationalize an effective CCA cross-sectorial Coordination Mechanism with coherent approaches in planning energy, forestry, human health, water, food security and gender equality and with the contribution to improved long-term, sustained adaptation action.</td></tr>
<tr><td>Ensure inclusive and effective stakeholder engagement and participation in the adaptation planning and implementation</td><td>- Facilitate dialogue among stakeholders at different levels to ensure that adaptation planning processes at national and sub-national levels are informed and mutually supportive.
- Develop and implement a comprehensive, gender-sensitive and inclusive communication and outreach strategy to sensitize policy makers and all stakeholders, including the general public and the private sector, on the importance of CCA, and to ensure that advocacy of climate adaptation becomes a national priority.
- Ensure the full and inclusive participation in adaptation policy development, planning and action of all climate-relevant actors, such as national, sectorial, sub-national levels stakeholders, private sector, smallholders, women, vulnerable groups and local communities, whose involvement is key to achieving national resilience and adaptation objectives.
- Ensure coordination and collaboration among national and sub-national actors in their adaptation priorities and actions, in particular, to enable sub-national authorities and local organizations to access the information, resources (including finance) and capacity they need to implement adaptation.
- Engage government stakeholders in generating solutions and accelerating action to address systemic gaps in the implementation of climate adaptation action.
- Engage private sector in climate change resilience building in all sectors of Moldova and in urban and rural communities.</td></tr>
<tr><td>Close prioritized knowledge gaps in CCA at national and subnational levels based on a consistent and updated knowledge foundation</td><td>- Close identified CCA priority knowledge gaps at individual and institutional levels during the undertaken assessments through the involvement of adaptation experts and knowledge-providing institutions.
- Promote climate-related knowledge management within government and climate lead agencies, along with the need to strengthen information management to enable continuous learning and improvement and to ensure leverage of existing knowledge into CCA action.
- Implementation of required capacity-building activities for specific institutions of governance systems at the state (national), regional (sub-national) and local levels to apply adaptation planning to enhance in-house knowledge.
- Development and implementation of a comprehensive Knowledge Management Strategy (KMS) that expands the climate communication and knowledge management in support of the NAP process.
- Establish and operationalize an adaptation knowledge platform/portal as a gateway for sharing, exchanging and acquiring knowledge about various adaptation areas, including the impacts, risks, vulnerabilities and adaptation actions needed to build resilience across the country. The platform is to be operationalized in a user-friendly manner, incorporating relevant knowledge, facilitating stakeholder engagement, providing needed information and support for general and targeted users.
- Establish the Community of practice for the agriculture sector accompanied by an effective program to build the capacities of its constituencies at different levels.</td></tr>
<tr><td>CCA data gathering and analysis processes in place, access to climate information improved through the development and application of analytical tools</td><td>- Ensure a good understanding of impacts from climate-related hazards at sector level, with efforts to be focused on translating the results of the assessments into actionable information for the decision-makers of national and sub-national level, businesses, and communities which have the responsibility to respond to shifting probabilities and impacts of climate-related hazards.
- Technical planners of line Ministries, local level consultants, policy analysts, researchers to handle principal approaches and methods, evaluation tools that identify observed and potential impacts of climate change, climate risks and vulnerabilities at national and sub-national levels, identify the adaptive capacities of socio-economic and natural systems in order to evaluate and rank vulnerabilities to hazards, evaluate diverse assets, other type of evaluations.
- Produce gender-responsive, sector- and sub-sector level guidelines or manuals for standardized data collection, and implement technical standards for climate risks and vulnerabilities assessments and their interpretation to help integrate CCA considerations into development planning processes at the sectorial level.
- Provide on-site training programs focused on climate impacts and vulnerability assessment methodologies and approaches, as well as socio-economic assessment and valuation methodologies.
- Apply high-quality analytical tools for forecasting/modelling future climate impacts and response in key priority areas.</td></tr>
</table>

Category of adaptation priorities	Adaptation priorities	Main activities and actions in support of adaptation priorities
	Extend CCA integration into sub-national development	- Identify and implement opportunities to mainstream CCA measures into relevant local policies, and identify and prioritize medium and long-term adaptation options to be incorporated into local level development planning. - Reduce climate risks in Moldova's priority sectors (agriculture, water, forestry, health, energy, transport) through local capacity strengthening, improved knowledge management, convergent policy on climate change adaptation and disaster risks reduction. - Periodically update district level vulnerability index and its mapping based on relevant climate, economic, social, environment, occupational indicators, other proxies.
Improved climate information	Timely delivered and widely accessible high-quality climate risk information	- Carrying out the monitoring of the hydrometeorological conditions and of the quality of the environment for information and protection of population and economy sectors against dangerous hydrometeorological phenomena. - Produce regular meteorological, agrometeorological, hydrological forecasts. - Produce warnings on hydrometeorological hazards and environmental pollution. - Implement modernized climate information and Early Warning Systems (EWS). Systematically include vulnerability, accommodate multiple timescales and account for evolving risk and rising uncertainty in the warnings. - Promote investments in climate information and EWSs. Apply warning criteria and thresholds, linked to potential impact and damage by severe weather. - Assess the quality-of-service delivery, especially for EWS at the SHSM, based on the *WMO Strategy for Service Delivery* and address gaps. - Expand use of Climate Information Services in five targeted sectors of the economy: agriculture, water, health, forest, transport and energy. - Intensify efforts to increase food and water security, particularly for smallholder farmers. - Provide to hydrometeorological information on the quality of environmental factors to population, central and local public administration, economic agents, national defense authorities. - Participation of SHSM in the EUMETNET programmes. - Continuous operation of severe weather warning platform www.meteoalarm.eu by the SHSM for the Republic of Moldova - Provision of quality-controlled data sets according to the WMO standards. - Implementation of the WMO strategy for service delivery. - Operationalization of a real-time data quality control system. - Enhancement of the SHSM nowcasting and forecasting capacities. Strengthen ability to forecast intensities, geographical spacing and timing for critical meteorological parameters.
Integrated disaster risk management	Improve the decision-making in the face of uncertainty	- Specialized institutions and agencies with national level status to deliver adaptation prerequisites, such as fundamental climatic and other data, analysis and assessments on climate change impacts, vulnerability and early warning systems for informed decision making. - Identify adaptation choices that are robust across a range of future outcomes based on the country's climate change scenario and identify the transformational actions in the areas/sectors needed. - Put in place regulations to address potential danger of waste treatment facilities from burning during the droughts with high temperatures, as well as from floods, and the need for water supply for their operation in the case of occurrence of climate risks.
	Improve Disaster Risk Reduction management	- Establish a legal and institutional framework for managing weather disasters in risk situations, with a focus on the emergency response. - Apply the methodology of weather disasters impact assessment on the lives of Moldovan citizens and the economic sectors. - Apply the methodology and standards on loss and damage assessment in all affected by climate disasters sectors, population, and geographic areas. - Adoption of integrated disaster risk management. - Development of high-quality hazard maps. - Scaling up capacity to prepare and respond to disaster through increased access to mechanisms that enable early action, alongside climate risk insurance and other social safety nets. - Provision of insurance coverage against damaging events to agricultural producers.
Community-level climate change adaptation	Promote resilient development of urban communities	- Address the capacity gaps and weaknesses in coverage of urban issues within the NAP process. Communicate urban adaptation component as part of the NAP. - Comprehensively assess city/town development needs and climate vulnerabilities through climate lens involving climate specialists and local level decision and policymakers. Where possible, apply an integrated climate vulnerability and gender assessment approach to identify community-level vulnerabilities. - Identify city/town level adaptation options and appraise them using relevant criteria. - Municipalities to integrate climate risk data and adaptation strategies into development plans. Chisinau and Balti municipalities to develop, approve and implement integrated urban planning, apply investment and operation to reduce climate risks. - Cities to update topographic maps, along with weather and climate information, satellite, and remote sensing data; models that reveal risks of climate impacts to local areas, and assessments of the vulnerabilities and gender-specific needs for different population groups, such as elderly population living in poverty. - Put efforts to providing weather, climate, hydrological, and related environmental services and information in an integrated way for disaster risk reduction in urban areas, tailored to each city, municipality. - Strengthen city level disaster preparedness and response system to be part of designs and operations. - Promote climate-friendly solutions at municipality level and infrastructure resilience projects through innovative technologies that will contribute to reducing vulnerability to climate change and improving the quality of life. - Promote urban projects/actions with international donors and identify synergies with international agreements. - Strengthen municipality land management systems and invest strategically in resilient infrastructure for greater returns. - Identify monitoring indicators, including gender-disaggregated ones, to monitor the implementation of adaptation actions at the community/city level.
	Promote community-based adaptation action in rural areas	- Promote awareness-raising, capacity building and support to development and implementation of climate investment plans at the local level. - Conduct an in-depth gender-disaggregated cross-sectorial analysis of the impact of climate change on vulnerable groups, with a specific focus on rural women. The results to be widely disseminated to stakeholders, and made available on the communication platform and media channels. - Improve direct access of rural communities of the Republic of Moldova to climate finance to strengthen their resilience and improve livelihood through grant-oriented projects. - Promote climate investments in rural villages that will improve their resilience and ensure sustainable livelihoods. - Promote climate-resilient livelihood through community-based natural resources management. - Identify best practices and technologies of local communities and apply them at the community level.

Category of adaptation priorities	Adaptation priorities	Main activities and actions in support of adaptation priorities
	Strengthen the role of vulnerable groups and local actors in planning processes that affect their own lives	- Promote participatory planning with local populations/communities through the involvement of LPAs, local NGOs, vulnerable groups, developing shared goals, coordinated action, and build on local knowledge. - Increase community level adequate capacity and improve the accessibility to the resources to help make and implement decisions that affect them. - Promote community-driven gender-responsive adaptation action.
Technology transfer and uptake	Strengthen regulatory frameworks and policies to drive investment in climate-resilient technologies and activities	- Adjust country regulatory framework to create stronger incentives for private investment in technologies that will increase climate resilience. - Climate leading agencies shall provide the private sector with information and tools they need to integrate climate investment into the decision-making process through business-friendly impact assessment tools to identify viable investment opportunities. - Promote collaboration between the financial system and actors of the supply chain as a mean to foster private investors' engagement in climate resilience. Commercial banks, insurance companies and agricultural sector supply chain actors shall play a role to engage business to scale-up investments.
	Improve capacity building for technology development and transfer	- Building of institutional capacities to support the transfer of climate and environmentally sound technologies (ESTs), further encouragement of the innovation process, and building targeted technical and scientific skills to utilize technical-scientific potential for the development of context-specific, climate-resilient technologies. - Capacity building needs for technology transfer will be identified for each stage of the Technology Need Assessment (TNA) process to ensure a smooth and successful assessment. Relevant stakeholders will be involved in a consultation process to consider adaptation priority sectors and technologies, identify barriers to technology transfer, measures to address these barriers and explore other needs. - Strengthen knowledge of national stakeholders on various aspects and benefits of adaptation technologies and foster knowledge-sharing and collaboration of stakeholders in technology transfer. - Strengthen technology network, centers of excellence, organizations promoting technology transfer.
	Harness science, technology, and innovation with a focus on resilient transformation for sustainable development	- Promote climate technology innovation systems, targeted climate technology research, development and demonstration support for prioritized adaptation technology measures. - Identify and promote opportunities for targeting innovative solutions, new market segments, developing or adopting new business models, model shifts and/or processes. Support social innovation and entrepreneurs who seek to create climate-resilient social value. - Promote adaptation-related innovative solutions with mitigation benefits, in particular, those applying circular economic business models. - Based on the results of TNA develop a portfolio of projects and programmes which can facilitate access to and the transfer of, climate and environmentally sound technologies (ESTs) and know-how in key sectors of the economy. Identified project ideas should include comprehensive information on location, financial data, risk analyses, financiers involved, and on implementation plans, other relevant data. - Consider the experience of other countries in implementing climate and ESTs and discuss them during the consultation with stakeholders. Taking into account lessons learned from the TNA process and developed portfolio of climate and ESTs, develop a technology roadmap with clear targets, milestones and implementation timeframe.
	CCA technology needs identified in all key sectors	- Carry out a Technology Need Assessment in adaptation in five key sectors (transport, energy, water, forestry and health) to identify the evolving needs for new equipment, techniques, practical knowledge and skills necessary to reduce country's vulnerability to the adverse impacts of climate change, while taking into account the Republic of Moldova's SDGs and development priorities stated in "*Moldova 2030*" National Development Strategy. - Undertake barrier analysis for technology transfer in the main sectors of the economy, referring to economic and market barriers, along with human capacity, information and awareness, institutional, policy-related and regulatory barriers. Provide solutions and de-risking measures for market barriers to climate resilience technology deployment. - Based on identified technological needs, develop a prioritized Technology Roadmap for each sector. - Develop a Technology Action Plan (TAP) for each of the top three prioritized technologies in each of the five sectors of the economy. - Integrate the sectorial Technology Roadmaps into a cohesive CCA Technology Framework with clear medium and long-term objectives and targets to support sector level transformational change. - Develop TAPs into project ideas or GCF (other relevant donors) Concept Notes to support the development of transformative project proposals.
	Uptake of adaptation technologies improved	- Support enhanced technology development and transfer, facilitating the access to and scaling up of environmentally sound and climate-resilient technologies. - Identify means of implementing the TNA results through both domestic budget and external funding. - Promote the deployment of advanced technologies through the identification and prioritization of climate investments and projects. Conducting feasibility assessments of prioritized climate technologies for adaptation with mitigation co-benefits and incorporate them into national processes of climate action implementation. - Strengthening market preparation and business planning for the deployment and scale-up of climate technology solutions prioritized during the TNA. - Engage the private sector to actively contribute to the implementation of climate and ESTs of the country's projects portfolio. - Develop CCA project pipelines in a programmatic manner for promoting both public and private investment in climate resilience. - Improve social acceptance of new adaptation measures and actions, in particular, new technologies and production methods. - Develop technology-related indicators, including transformation indicators, as part of the M&E system to assess specific technology contribution toward reducing the vulnerability and achieving national/sub-national resilience to climate change.
	Support climate technology financing	- Promote access to the funding that will facilitate and realize the actual transfer of technology according to the priority needs through integration of climate technology financing needs into national and sectoral development strategies, plans and investment priorities. - Promote investments in supply chains and local manufacturing to ensure the availability of locally needed technologies. - Encourage development partners, bilateral and multilateral donors to invest in technology-oriented climate projects and programmes.

Category of adaptation priorities	Adaptation priorities	Main activities and actions in support of adaptation priorities
Financing climate change adaptation	Promote capacity building for improved integration of CCA into national and sub-national planning	- Implement capacity-building activities and awareness for budget planning officers and programme managers (other financial planners) on national climate priorities and the contribution of national, sectoral policies and projects to these. - Promote the integration of climate considerations into project designs from early stages through the use of the screening methods and climate budget tagging (CBT) guidelines. - Provide decision-makers with relevant methodology and instruments for measuring non-action costs in CCA, including the financial, economic, and human costs of not managing the risks. Applying non-action cost methodology to promoting investments in climate action.
	Mainstream climate change adaptation in the financial sector of Moldova	- Strengthening the functioning of the financial sector to better disclose climate risks, manage risks and expand into a new risk-pooling market in the country. - Using the information on climate hazards, exposure and vulnerability ensure that investment decisions are climate-resilient. Promote investments appraisal standards against climate risks. - Consider climate risks to improve their pricing to help both the public and private sectors acquire a better technical and financial understanding of risks, establish priorities, shape climate-informed investments, and develop instruments to improve risk-pooling and contingency finance. - Allocate public resources to increase the economic resilience of key sectors of Moldova: agriculture, transport, energy, health, water, forestry and related infrastructure.
	Ensure overall coordination of financial resources for adaptation investments that come both from domestic budget and external sources	- CPAs, in particular, Ministry of Finance, with responsibilities of financial decision-making and oversight of the financial system provide leadership in tracking climate revenues and expenditures. - Generate robust data and the evidence upon which policy recommendations and future spending decisions will be made. - Understand the resource levels required for CCA, as well as the gaps, to finance the (national and sub-national) response to climate change. - Monitor and track climate finance flows using the CBT procedures and applying climate change indicators to annual budget proposal and executed budget. - Ensure the quality of the climate change expenditure data as a key part of the budget review process. - Assess the cost-effectiveness and impact of existing and potential climate-related expenditures. - Reallocate, as necessary, existing resources to achieve climate-compatible national development. - Increase transparency over resource allocation and management.
	Enable access to finance action on identified adaptation priorities	- Promote country-wide dissemination of information on available funding opportunities at the national and international levels on climate resilience and adaptation in various climate-related areas. - CPAs, international donors to direct the financial flows for their availability to local level actors (LPAs, NGOs, SMEs, women associations) to identify, prioritize, implement, and monitor climate adaptation measures. - Incorporate CCA priorities into funding schemes provided by the National Ecological Fund, the National Fund for Regional Development, the Energy Efficiency Fund, the National Fund for the Development of Agriculture and Rural Environment.
	Promote sustainable and effective scale-up and deployment of CCA finance.	- Create incentives to scale up private sector engagement in adaptation investments. - Engage the banking sector in scaling up private sector climate finance through in-country financial institutions. - Promote innovative structured financing solutions for CCA, including insurance-based financing products, scale-up the use of insurance as a tool for risk-sharing. - Support transformative and replicable investments at scale, in particular through donor funding (GCF, GEF, AF, other).
Private sector engagement in building climate change resilience	Support and promote private sector capacity building for climate action	- Leading agencies in climate change to support climate-related information sharing, research and development, and skill-building through demonstrations and training about adaptation options for the private sector, in particular, SMEs. Capacity building on the use of climate-related information and tools to incorporate risks in planning, budgeting, and implementation of measures to be delivered for engaging SMEs in adaptation. - Support the development and delivery of business-relevant climate information and risk analysis. Improve the delivery of information about the risks and uncertainties that are relevant (by geography and sector) to the planning and decision-making processes of SMEs, taking gender into consideration. - Promote regulatory and fiscal incentives that can stimulate risk reduction among private sector actors. Government to consider incentives and compliance measures to motivate SMEs to undertake investment in climate resilience and business development. - Increase availability and knowledge of cost-effective adaptation options. Communicate this information and knowledge to local businesses. - Provide support to the private sector to develop technical skills and expertise for adopting new business processes, developing new products and services, implementing new technologies for increased climate resilience. - Support the private sector to be more active in safeguarding agriculture supply chain against climate impacts, transport, energy and city infrastructure, rural communities. - Implement pilot and demo projects that demonstrate business value and stimulate market demand, development of market linkages across the value chain, and scale-up through larger investments.
	Ensure mainstreaming of climate adaptation and resilience into investment decision making and business planning and operation	- State/public sector with the assistance of international donors to initiate and put in place policies that provide insurance products that transfer risk to another entity and make private financial interventions possible. - De-risk investments in climate resilience and adaptation through diversification of financial instruments, including public loans, grants, seed capital, investments, other. Identify the best financial instruments that suit the Republic of Moldova's market and can stimulate the risk-reward profile for local enterprises. - Promote SMEs collaboration with other businesses or public entities to form partnerships and cooperatives at sector or region levels, pool resources and funding to self-insure against economic and weather-related shocks. - Promote climate investment into resilient infrastructure that will lead to systematically resilient development and growth. - Promote new business models that respond to resilience needs and incorporate nature-based solutions. - Develop and promote support schemes to stimulate investment in energy efficiency technologies and promote the increased use of renewable energy.

Category of adaptation priorities	Adaptation priorities	Main activities and actions in support of adaptation priorities
Gender	Capacity building, knowledge sharing and communication	- Mainstream gender considerations into national and sub-national climate change policy framework (policies, regulations, plans and programs). - Enhance the expertise of relevant stakeholders, in particular, state institutions on systematic integration of gender considerations in all climate-relevant areas. - Promote gender-balanced participation and leadership of CCA coordination and oversight bodies. - Promote gender-responsive implementation of climate action. - Develop and implement focused trainings, other types of education on CCA targeting women, youth, other vulnerable groups. - Promote gender-related knowledge sharing activities among stakeholders.
	Gender-responsive climate action and access to finance	- Enhance the expertise of the technical team on gender integration into respective areas of work. - Undertake gender analysis with regard to technology-related interventions. - Integrate gender-responsive budgeting into national and sub-national climate financing. - Promote the development and transfer of technology taking into account gender considerations.
	Gender-responsive CCA M&E	- Incorporate gender considerations into CCA M&E system of the Republic of Moldova. - Apply the tracking and reporting on gender-related mandates referring to CCA. - Submission of gender-disaggregated data referring to adaptation-related reporting. - Provide information on the differentiated impact of implemented adaptation action on women and men, in particular at the community level.

5.5.2.2. Mid-Term Adaptation Priorities of the Second Cycle of the Republic of Moldova's National Adaptation Planning Process

The above-mentioned CCA priorities tend to be flexible and anticipatory actions to absorb climate impacts or enable quick recovery. From the implementation viewpoint, some actions respond to the immediate and near-term country adaptation needs, therefore, they are formulated as the next iteration of the National Adaptation Planning Process of Moldova (2020-2024). At the same time, NAP-2 and Ag. SAP outcomes and sub-outcomes will also contribute to further advance in adaptation planning through addressing mid- and long-term inter-sectorial and sector-specific adaptation issues.

The second iteration of the NAP cycle in the RoM will be implemented within two parallel implementation tracks:

1) The first track - National Adaptation Plan (NAP-2) with the objective to reduce climate change-related risks throughout the country by strengthening institutional and technical capacities that support integrated CCA planning and programming of forestry, health, water, energy, and transport sectors. It expands and deepens the national approach developed under the first cycle of NAP and strengthens synergies both vertically, at different levels of the governance, and horizontally, between the sectors affected by climate change to reduce duplication of efforts, pool resources for their effective use, and ensure a coherent and comprehensive approach to the integration of CCA responses into the development planning at national and sub-national levels.
2) The second track - Agriculture Sectorial Adaptation Plan (Ag. SAP) with the objective to mainstream climate change adaptation into planning processes of the agriculture sector, while improving food security population and ensuring a gender-sensitive approach and the participation of all vulnerable groups.

The 2nd cycle of National Adaptation Planning process is conceptualized as GCF Readiness Project and it builds on the NDC commitments and on the outcomes on the 1st cycle of NAP Process (2013-2017). The activities will address the main barriers to the integration of CCA considerations into national, sectorial and local government planning and budgeting processes, as identified during stakeholders' consultations within the NAP-1 and preparation of the NAP-2.

The anticipated key benefits from the implementation of the 2nd iteration of NAP include the articulation of a coherent approach to comprehensive risk management and adaptation planning; improved integration between planned and autonomous adaptation; targeted orientation of technical and financial resources to the most vulnerable areas and communities; bridging the gaps between vulnerability and risk assessments, planning and implementation; and concurrence for internal and donor-supported development resourcing, monitoring and assistance.

The first track of NAP-2 consists of 31 activities grouped under sub-outcomes and three outcomes as follows:

Outcome 1: National steering mechanism for long-term CCA planning strengthened

- Legal and institutional framework and mandate for the CCACM strengthened sub-outcome will support the strengthening of the cross-sectorial coordinated approach in line with the institutional and technical capacity needs development for an iterative adaptation planning process.
- Key gaps in CCA capacities identified and addressed sub-outcome will support a participatory capacity assessment at the individual, institutional and enabling environment levels with regard to CCA planning and implementation to be undertaken in all participating sectors, including - for consistency - agriculture, along with the self-assessment survey on current and needed capacities to support medium and long-term adaptation planning to create an enabling environment for adaptation actions.
- Climate change information and knowledge base ex-

panded sub-outcome will strengthen the knowledge base for CCA and will focus on improving the accessibility and availability of climate-related information through a climate change information and knowledge management portal.

Outcome 2: Long-term CCA capacity to plan and implement adaptation actions supported

- CCA capacity development supported to ensure sustainability and local ownership of CCA competencies sub-outcome will focus on the implementation of trainings on climate vulnerability assessment methodologies and socio-economic valuation tools. It will also focus on identifying and implementing opportunities to mainstream gender-sensitive CCA tools, methodologies, and training into relevant ministerial and local policies and practices continuing the capacity building efforts to ensure continuous improvement in national CCA activities.
- Uptake of adaptation technologies improved expands the capacity building activities with the development of a CCA Technology Framework that articulates the medium- and long-term objectives needed to acquire technological know-how to address CCA needs, and achieve transformational technology transfer at sub-national and sector levels.

Outcome 3: NAP implementation strategy developed

- CCA integration into sub-national development expanded sub-outcome has the emphasis on the development of a strong link between CCA and national development goals, particularly in the priority sectors of agriculture, forestry, health, energy and transportation, and on developing CCA capacity in LPAs.
- Systems and capacity to monitor adaptation progress through the SAPs and the NAP process improved sub-outcome will expand the ongoing capacity building and M&E activities developed under the NAP-1 and improve the M&E related data collection and distribution to ensure the achievement of a gender-sensitive CCA M&E system.
- Climate budget tagging applied to improve the accuracy of M&E and budget systems sub-outcome concentrates on the improved integration of climate risks into the budget planning process will ensure that the financial needs for CCA are more accurately assessed. In the medium and long-term, improved methodological rigor in sectorial and local plans will support an improved evidence-base for climate-sensitive budgeting, creating synergies for future NAP cycles and national development plans through sector-specific Adaptation Investment Plan/s.
- Financing strategy for NAP developed sub-outcome will focus on the identification of the investment needs and the improvement of financing options available to support the implementation of short-, medium-and long-term priority CCA measures, and on the promotion of sustainable adaptation outcomes.

The second track referring to Agriculture Sectoral Adaption Plan (Ag. SAP) comprises 17 activities grouped under the outcomes and sub-outcomes:

Outcome 1: Agriculture sector gender-responsive adaptation planning, governance and coordination established will set the basis for stronger governance to provide strategic guidance and increase the adaptive capacities in the Agriculture Sector in Moldova through:

- Institutional arrangements for the Ag. SAP in place sub-outcome will be addressed through a gender-sensitive agriculture-specific impact analysis of interactions between changes in temperature and precipitation averages with hazards such as rainfall, flood, frost, drought, hail, heatwaves, seasonal shifts, and changes in pest and disease patterns, analyzing also current and future scenarios of the agriculture production.
- Key capacity gaps and vulnerabilities related to CCA in the agriculture sector identified and addressed through conducting a gap assessment with regards to the capacities across the sector (at different levels) to tackle climate change impacts agriculture sector.

Outcome 2: Climate vulnerability and adaptation investment rationale strengthened in the agriculture sector will provide updated information and data on vulnerabilities and climate impacts that will be then managed systematically through:

- Information on climate change impacts and associated vulnerabilities analyzed, strengthened and shared at sub-national and/ or sector levels sub-outcome will focus on establishing a gender-balanced and participatory Ag. SAP core working group, including private sector representatives, which will allow better coordination and alignment of actions with the NAP-2 and other CCA initiatives in Moldova.
- Adaptation solutions for addressing barriers to climate adaptation technology transfer identified and actions prioritized at national and/or sectoral levels sub-outcome will develop a training programme targeting both local and central level institutions and non-government partners to help them understand the impacts of climate change as well as vulnerability methodologies and socioeconomic assessment and valuation methodologies.
- Methods and frameworks refined for the national context for analyzing impacts and vulnerabilities, and prioritizing adaptation solutions at sub-national, national and/or sectoral levels sub-outcome will develop a CCA Technology Framework, including identification of sector-specific needs, a prioritization of technologies for the Moldovan agriculture sector and the respective Action Plan for the three top prioritized technologies. Finally, this activity will aim at delivering one Concept Note for an investment to be submitted for consideration by the GCF, in accordance with RoM's Country

Programme for the engagement with GCF.

Outcome 3: Climate Change Adaptation knowledge management, information sharing and gender-sensitive communication established for the agriculture sector:

- Systems developed for gathering, organizing and updating relevant data and information on adaptation sub-outcome will focus on development and facilitation of a Community of Practices, where the MAFI will, on one hand, share relevant information and will, on the other hand, facilitate exchanges between different stakeholders in different regions and institutions at national and sub-national levels.
- Relevance, progress and outputs of adaptation planning communicated to stakeholders based on a developed adaptation strategy sub-outcome will focus on the development and implementation of a gender-sensitive communication and outreach strategy for CCA planning in the Agriculture Sector, which will include several outreach and awareness-raising events, which will secure for the MAFI increased capacities to communicate in a more systematic way the relevant information on CCA to the public.

Outcome 4: Aligning and mainstreaming adaptation into agriculture sectoral planning will aim to integrate CCA measures and best practices at different levels (central, municipal and community level), using the information and data and the institutional arrangements in place.

- Gender-responsive CCA is better integrated into sub-national development plans for the agriculture sector will support the development and implementation of a gender-sensitive communication and outreach strategy for CCA planning in the Agriculture Sector.,
- The outcome will also include work at the local level, supporting priority districts and rural communities to: (a) apply Climate Budget Tagging (CBT) procedure at sector and sub-sector level; allowing to (b) develop a community-based adaptation Action Plan in Agriculture, providing local stakeholders with relevant planning tools to increase resilience.

Outcome 5: Adaptation finance strategy developed will capitalize on the work conducted to develop a CCA Strategy and Action Plan and the work at the sub-national level (Outcome 4) to update the CCA investment plan for the sector with concrete indications of the financial needs and potential sources, including the private sector.

- Gender-sensitive financing plan for prioritized adaptation actions (including blending and timing of different sources of public, private, domestic and international finance) sub-outcome will also explore the required enabling environment for private sector participation in CCA in agriculture, as an element of importance to facilitate the achievement of ambitious adaptation commitments included in the NDC. This component will also identify concrete opportunities for private sector participation, specifically exploring options for the development of a Public-Private Partnership supporting adaptation measures in the agriculture sector.

5.5.2.3. Sector-Specific Climate Change Adaptation Priorities

To address serious economic and social impacts of current and future climate change, RoM has to promote efficient adaptation measures at the sector level in key economy sectors: agriculture, forestry, water, health, energy, and transport. While the needs for addressing climate change are still assessed within various activities, it is obvious that implementation efforts will certainly be of significant proportions and will require the mobilization of innovative solutions, financial resources, institutional capacity and political will for effective action.

In identifying adaptation priorities at national and sector level, relevant sectoral climate change and development policies have been considered, as adaptation is closely interlinked with the country's development policy and regulatory framework.

One of the strategic goals pursued by the NDS "Moldova 2030"[287] that directly influences the quality of life of people is to increase people's access to safe sources of water, energy, sewage systems, road infrastructure and information technology infrastructure. The achievement of this overarching goal is dependent, to a great extent, on the measures to be implemented in key sectors of economy that have to contribute to sectoral and overall country climate resilience and adaptation to climate change. These activities will contribute to achieve the following SDGs: 1.5, 9.1, 9.4, 11.2, 13.1, 13.2, 13.3, 15.2, 15.3, 15.5 and 15.9).

Energy Sector. Improving energy efficiency, increasing the use of renewable energy sources and promoting sustainable development of the energy areas are among the priority objectives of the Energy Strategy of the RoM until 2030, (approved by GD no. 102 of 05.02.2013)[288] with two chronological stages of implementation: 2013-2020 and 2021-2030.

A significant impact on the modernization and promotion of the national economy's sustainable development will have the priority measures provided by the Law on Energy Efficiency No. 139/2018, which encourages the exploitation of the energy efficiency potential in the industrial sector at the national level

The Law on Promoting the Use of Energy from Renewable Sources No. 10 of 26.02.2016 and the draft National Action Plan in the field of Energy Efficiency for the years 2019-2021[289] (2019), is the legal base for promoting the use of energy from renewable sources, diversification of primary energy resources, and ensuring the safety, occupational safety and health in the process of producing energy from renewable sources.

[287] Draft Decision of the Government i „On approval of law draft for Approval of the National Development Strategy "Moldova 2030" <https://particip.gov.md/proiectview.php?l=ro&idd=5805>

[288] Decision of the Government No.102 of 05.02.2013 on Energy Strategy of the Republic of Moldova until 2030 published on 08.02.2013 in the Official Gazette l No. 27-30. art No: 146. <http://lex.justice.md/md/346670/>

[289] National Action Plan in Energy Efficiency for 2019-2021. The draft document was approved at the session of State Secretaries of September 26, 2019. <https://cancelaria.gov.md/ro/apc/sedinta-secretarilor-generali-din-26-septembrie-2019-ora-1400>

Improving the energy performance of buildings is a priority of public policies in the RoM, and the Government Decision No. 1103 of 14.11.2018 for the approval of the Regulation regarding the periodic inspection of the air conditioning systems in buildings[290] This government decision was developed in support to the implemented Law no. 128 of July 11, 2014 on the energy performance of buildings.

Transport Sector. The new (2019) Railway Transport Code[291] sets out concrete rules regarding the state's contribution for the development of the railway infrastructure that will allow the creation of an investment climate in the branch and the development of competitiveness on the international market for freight services.

Agriculture Sector. The Land Code[292] focuses on the principles of soil fertility conservation and enhancement, carried out through works to prevent and combat soil degradation and pollution processes, caused by natural phenomena or by economic and social activities. The draft Land Code comprises a chapter dedicated to soil protection and land management, which regulates obligatory soil protection and improvement measures, land planning measures, agro-ameliorative measures, hydro-ameliorative measures, soil conservation, soil quality monitoring and others.

The Law on subsidized insurance in agriculture, 2020[293] proposes a new subsidy concept adapted to the realities and requirements of the current market, regarding the subsidized insurance of production risks in agriculture. The new law proposes to increase the state's share in insurance, as well as to expand the list of objects and risks subject to subsidized insurance, thus preventing significant economic loss caused by the negative impact of climate change.

Government Decision no. 691 of 11.07.2018[294] on approval of the Regulation on the conditions and procedures for organizing and carrying out the activities for land improvements, protection, conservation and increase of soil fertility, was produced to support implementation of the Program for conservation and enhancing soil fertility for the years 2017-2020 (GD No. 554/2017)[295].

The National Integrated Plant Protection Program for the years 2018-2027 and the Action Plan for its implementation (GD No. 123 of 02.02.2018)[296] provides for actions for development of sustainable agriculture and thus, to provide consumers with quality and safe vegetable products, as well as to ensure a healthy living environment.

The National Strategy for Agricultural and Rural Development 2014-2020 (GD No. 409/2014)[297] states the priorities for agriculture and rural development: increasing the competitiveness of the agri-food sector by modernizing and integrating it into the market, ensuring the sustainable management of natural resources and improving livelihoods in rural areas. The Strategy is complemented by the Government Decision (of 9 June 2019) on the approval of the Regulation on the granting of subsidies for improving livelihoods and work conditions in rural area[298] and provides for the improvement and development of rural public economic infrastructure, renovation and development of rural communities, diversification of rural economy through non-agricultural activities.

Forestry Sector. The Action Plan for the years 2018-2023 on the implementation of the Sustainable Development Strategy of the Forestry Sector[299] refers to the specific objectives and actions addressing the adaptation of the forestry sector to climate change, which includes scientifically justified adaptation measures with clear mitigation co-benefits and sustainable development approaches, adequate maintenance and monitoring of forest condition, with intensification of afforestation/reforestation process through climate-resistant spp. The new version of the Forest Code aligned with European and international standards addresses the urgent problems of forestry sector of Moldova: promoting new practices for sustainable forest management to stop the reduction of woodland, stopping degradation of forest biodiversity by promoting nature-based types of forest with suitable biological diversity; decreasing fragmentation of land, stopping the unauthorized constructions and lease of woodland by ensuring the integrity of the forest fund; combating the illegal exploitation of forests and related trade by implementing the methods of monitoring of timber use and forest certification.

Water Sector. The state's policy in the field of water resources is incorporated in the Environmental Strategy for 2014-2023 (GD 301/2014)[300] which is mainly aimed at preventing the degradation of the quality of water resources in the context of the climate change, the protection and restoration of the wetland environment, providing to the population a sufficient supply of good quality water based on a sustainable, balanced and equitable use of water. The provisions of the Strategy for water supply and sanitation for 2014-2028 (GD No. 199/2014) and the National Program for the implementation of the Protocol on Water and Health for 2016–2025 (GD

[290] DG RM No. 1103 of 14.11.2018 on approval of regulation on periodic inspection of conditioning systems in buildings. Published: 21.12.2018 in Official Monitor No. 499-503. art No: 1312. It was enacted on: 21.12.2018. <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=378528>

[291] Draft Railway Code. The draft document was approved at the session of State Secretaries of October 31, 2019. <https://cancelaria.gov.md/ro/apc/sedinta-secretarilor-generali-din-31-octombrie-2019-ora-1400>

[292] Land code No. 828/1991. Published: 04-09-2001 in the Official Gazette No. 107 art. 817, Amended by LP96 of 11.06.20, MO161-164/03.07.20 art.311; in force since 03.08.2020, <https://www.legis.md/cautare/getResults?doc_id=122075&lang=ro>

[293] Law No 183 as of 11.09.2020 on subsidized insurance in agriculture Published: 16.10.2020 in Official Gazette Nr. 267-271 art. 572.

[294] GD No. 691/2018 on approval of the Regulation on conditions and procedures for carrying out land improvement activities, soil protection, conservation and increasing soil fertility. Published: 10-08-2018 in the Official Gazette No. 295-308 art. 833. Abrogated by GD 985 of 22.12.20, MO22-32/29.01.21 art.33; enacted 29.01.21, <https://www.legis.md/cautare/getResults?doc_ id=125431&lang=ro>

[295] GD No. 554 of 14.07.2017 on approval of the Program for conservation and enhancing soil fertility for the years 2017-2020. Published: 21.07.2017 in Official Gazette No. 253-264. art No: 650. <https://www.legis.md/cautare/getResults?doc_id=113349&lang=ro>

[296] GD No. 123 of 02.02.2018 National Programme for integrated plan protection for 2018-2027 and the Action Plan for its implementation. Published: 09.02.2018 in the Official Gazette No. 40-47. art No: 142. <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=374176>

[297] GD No. 409 of 04.06.2014 on approval of the National Strategy for development of agriculture and rural areas for 2014-2020. Published: 10.06.2014 in Official Monitor No. 152. art No: 451 <http://lex.justice.md/md/353310/>

[298] Decision of the Government on approval of Regulation on provision of subsidies for improving livelihoods and work conditions in rural areas. The draft regulation was approved at the session of the State Secretaries of July 04 2019. <https://cancelaria.gov.md/ro/apc/sedinta-secretarilor-generali-de-stat-din-4-iulie-2019-ora-1400>

[299] Draft GD on approval of the Action Plan for 2018-2023 on implementing the Sustainable Development Strategy for the Forestry Sector of the Republic of Moldova. <https://cancelaria.gov.md/sites/default/files/document/attachments/proiectul_81.pdf>

[300] GD No. 301 of 24.04.2014 on approving Environmental Strategy for 2014-2023 and Action Plan for its implementation Published: 06.05.2014 in Official Monitor No. 104-109, art Nr: 328.

No. 1063 / 2016)[301] aims at improving livelihoods of the population and the access to safe drinking water and improved sanitation. The proposed plan will ensure the development of water and wastewater systems and will play an important role in achieving the 2030 Sustainable Development Goals. The Law no. 182/2019 on the quality of drinking water complements the actions of National Plan on Water and Health and transposes EU Council Directive 98/83 of 3 November 1998 on the quality of water intended for human consumption.

The concept of the automated information system "State Cadaster of Waters" developed in accordance with the provisions of the Water Law No. 272/2011[302] represents the vision on the creation and functioning of the information space of the areas related to the protection, management and records of surface and underground water resources, hydrotechnical constructions and protected areas. The concept incorporates the main principles of data collection and monitoring, their reporting, the basic requirements regarding the functional content of the information. This document is to be adopted in order to operationalize its components.

Measures aimed at achieving climate and environmental objectives set for all water bodies and ecosystems are provided in the Management Plans for the Dniester River Basin Area (GD No. 814/2017) and for the Danube-Prut and Black Sea watershed (GD No. 955/2018)[303].

Law No. 249 of November 15, 2018, aims at protecting surface and groundwater and conservation of habitats and species that are directly dependent on water and it provides for the creation of the Register of protected areas at the level of the river basin areas.

Health Sector. The issue of adapting the health sector and population to climate change is addressed in the National Public Health Strategy for 2014-2020 (GD No 1032/2013)[304], which provides for the need for adopting a sectoral plan for adaptation and increased resilience including that of medical institutions, the need for providing guidance and training to healthcare staff in issues of climate change impacts on population, The draft Government Decision on the approval of the Sectoral Strategy for Adapting the Health System to Climate Change for 2018-2022[305] states sectoral priorities for the reducing the vulnerability and risks to health by implementing measures to adapt the healthcare sector to climate change.

Spatial Planning. Through the draft Government Decision on approving the Regulation on the framework content, the methodological principles for developing and updating, and approving the National Territory Planning Plan (NTPP) the development of the basic set of documents on balanced and sustainable strategic planning of the territory at the country level and on spatial planning will be ensured, in accordance with the objectives of social, economic, cultural and ecological priorities of the country[306].

Along with the analysis of policy and regulatory documents, the current NDC incorporates sectorial adaptation priorities identified and discussed during the development of sector-specific adaptation planning documents of NAP-1, specifically, Sectorial Adaptation Plans (SAPs) for health and forestry sectors and other two partial SAPs for the transport and energy sectors. The SAPs were developed with the aim to facilitate the integration of CCA into relevant new and existing policies, strategies, programmes and activities through sectorial development planning processes. In the prioritization process, consideration was given to the current and future impacts of the climate change at sector and sub-sector levels, to the vulnerabilities of social groups, women, children, and the elderly people.

Mainstreaming Adaptation into Sectorial Planning for key climate adaptation sectors by adopting a SAP approach is a mid-term priority and it is to come into full operation within the second cycle of NAP. The above-mentioned dedicated GD on Climate Change Coordination Mechanism, NAPs and SAPs will mandate the formalization and operationalization of NAPs and SAPs.

Based on the priorities identified under the SAPs, along with the outcomes of other implemented activities revealing sectoral needs, like those of the NC4 of the RoM to UNFCCC (2018), consultation process of NAP-2, a set of mid- and long-term adaptation priorities have been identified to be implemented on a sector basis and summarized in the Table 5-47.

[301] Action Plan for 2018-2025 on regionalization of water supply and sewage system. <http://www.particip.gov.md/proiectview.php?l=ro&idd=4693>

[302] GD on approval of the Concept of the automated Information System „State Cadaster of Water". The draft document was approved by the Cabinet during session of October 23, 2019. <https://gov.md/ro/content/cu-privire-la-aprobarea-conceptului-sistemului-informational-automatizat-cadastrul-de-stat>

[303] GD No. 955 of 03.10.2018 on approval of the Plan for managing the Watershed area Danube - Prut Rivers and the Black Sea. Published: 07.12.2018 in Official Monitor No. 448-460. art No: 1259, it was enacted: 07.12.2018. <https://www.legis.md/cautare/getResults?doc_id=109895&lang=ro>

[304] GD No. 1032 of 20.12.2013 on approval of the National Public Health Strategy for 2014-2020. Published: 27.12.2013 in Official Monitor No. 304-310. art No: 1139.

[305] Draft GD on approval of the Sectorial Strategy for Adapting the Healthcare Sector to climate change for 2018-2022. <https://particip.gov.md/proiectview.php?l=ro&idd=4943>

[306] Draft GD on approval of Regulation on Framework Content, Methodology Principles for development, update, comments and approval of the National Plan for Territory Development (PATN). <https://particip.gov.md/proiectview.php?l=ro&idd=6483>

Table 5-47: Sector-Specific Climate Change Adaptation Priorities

Sectors	Sectorial adaptation priorities	Main activities and actions in support of adaptation priorities
Agriculture and food security	Promote systemic efficiency and resilience of the agriculture sector	- Undertake agriculture specific impact assessment, considering stress combinations under the climate change to improve the understanding of agri-systems vulnerability and further measures for its reduction, including the gender perspective; - Establish an agriculture sector regulatory framework and identify market structure needs to ensure that the implementation of new climate-resilient technologies is aligned with the aims of public policy in the agriculture sector; - Integrate the information on climate impacts and changing ecosystems into resource use planning of agriculture sector; - Promote adaptive, sector-level management to address climate change impacts on agriculture; - Increase the capacity-building potential for agro-climatic risk management throughout the sector; - Promote the integration of land use planning, sustainable landscapes, agriculture activities, rural communities, and food security safeguards into a resilient food system; - Improve the availability and applicability of modelling and adaptation options to be used by farmers (provide data and results on the reaction of water resources to possible climate change scenarios, promote the use of GIS technology, etc.); - Promote the accessibility of small farmers to an efficient EWS and seasonal weather information; - Promote preventive approaches and integration of the environmental effects of changing climate into land-use planning; - Promote crop/farm insurance; - Support agricultural research and experimental production for the selection of crops and development of the best varieties that are better suited to the new climateconditions; - Increase climate resilience of rural livelihoods through social protection programmes, addressing the needs of vulnerable groups; - Address gender-related vulnerabilities in the agriculture sector and rural livelihoods.
	Actively promote the implementation of climate-resilient agricultural practice	- Promote optimization of fertilizer application; - Promote the provision of improved extension services tor farmers; - Increase the efficiency of pest and disease control; - Promote crops diversification, along with improvement in variety breeding. Introduce alternative crops and change the pattern of crops distribution toward varieties with low water demand; - Improve the access to irrigation and efficient use of irrigation water, along with improved drainage infrastructure in irrigation areas; - Assess the water requirements of the major crops in the context of climate change and promote the optimal use of local water sources for agricultural practices. - Promote sustainable soil management through the implementation of modern agronomic technologies and practices (conservation agriculture, changes in crop planting: crop rotation, interrow crops, etc.); - Create the mechanism of recording and monitoring of soil quality, preventing the degradation and destruction of the soil cover, other negative consequences caused by the natural, as well as the anthropic factors; - Improve or restore the quality of the degraded or damaged soil, combating soil erosion and stabilizing landslides, along with preventing soil pollution with chemicals, biological, radioactive, petroleum products, etc. - Introduce livestock species resilient to extreme temperatures and adapt the nutritional regime of livestock to demands imposed by climate change; - Promote landscape management by maintaining landscape elements that provide shelter tolivestock.
	Incentivize investments in the climate-resilient agricultural value chain through innovative technologies	- Develop infrastructure and technologies needed for local interventions to combat extreme weather events to protect crops and local communities; - Promote circular economy approaches for reutilizing, recycling and repurposing the resources which can lead to the improvements in food production; - Increase the uptake and adoption of climate-resilient technologies that will lead to job creation for both women and men. Provide incentives to the private sector, in particular to farmers, to lead the uptake of these technologies.
Forestry	Promote forest resilience and adaptability to climate change	- Promote awareness and a good understanding of climate change and how the forestry sector can make a positive contribution; - Implement planting of new forest areas adapted to the impacts of climate change and capable of effective carbon sequestration and biodiversity conservation; - Implement planting of protection forest belts (buffer zones) for agricultural land and water protection, along with those for the anti-erosion purposes; - Promote the protection and conservation of existing woodland; - Apply the monitoring of invasive species and phytosanitary regulations on imports or domestic products; - Facilitate ecological adaptation of forests through the ecosystem-based approach. Develop methodologies/technologies to assure forest ecosystems adaptability to climate change; - Adapt forest regeneration practices to the needs of adapting to climate change; - Promote incentives to foster private sector involvement in forest-based adaptation practices; - Adapt wood use to the impact of climate change; - Promote cross-sectoral collaboration of forestry sector with regulatory authorities in agriculture, water, local authorities, etc. - Promote restoration of degraded pastures.

Sectors	Sectorial adaptation priorities	Main activities and actions in support of adaptation priorities
Water	Promote IWRM, ensuring the cross-sectorial synergetic approach	- Apply Integrated Water Resources Management (IWRM) principles for water quantity and quality based on a water monitoring and maintenance system. - Increase advocacy of IWRM by strengthening engagement with international water sector donors; - Ensure the functional cooperation between relevant sectors and institutions for a coordinated approach and efficient use of available resources; - Promote awareness and water conservation and; - Protect the wetlands areas, allowing restoration of underground water and reducing peak discharges downstream; - Ensure flood risk management through the implementation of adequate measures. Develop an integrated action plan to prevent and reduce the consequences of floods; - Assess the danger of floods, droughts and water scarcity in the river basins under different climate scenarios; - Implement flood risk management plans for river basin districts (Dniester / Danube-Prut Rivers and the Black Sea); - Implement drought management plans for river basins (Dniester, Danube-Prut Rivers and the Black Sea); - Undertake measures to combat drought/water scarcity: implement services for monitoring and warning on the decreasing flow/drought at the national level; establish methodologies for drought thresholds and drought mapping; increase water storage capacity, other measures; - Promote efficient water and land use, protection and improvement of aquatic and forest ecosystems at the level of river watersheds; - Mange water demand via cost-reflective pricing, regulation and consumer awareness.
	Ensure water use efficiency and demand management	- Implement inter-basin transfers of water to compensate for water shortages in certain reservoirs; - Promote accumulation lakes with backup volumes to be used in exceptional circumstances or creation of accumulation lakes with special operation regime to supplement the available water resources in critical situations; - Operationalize an efficient water traffic control system. Apply methods to analyze and track correlations between previous water situations and the climate change data; - Extend solutions for recharging the ground layers of water; - Design and implement solutions for rainwater collection and usage; - Increase the level of water recycling for industrial and domestic needs.
	Promote sustainable and resilient access of the population to adequate quantities of acceptable quality water	- Undertake studies to assess available water resources, determine their vulnerability to climate change, water requirements and needs of the main categories of consumption, including from the gender equality and social inclusiveness perspectives; - Increase the efficiency of municipal and industrial water supply systems; - Develop water supply infrastructure in rural areas to improve water supply for the agriculture sector and rural population; - Set water quality targets and apply water quality criteria to prevent, control and reduce the transboundary impact, coordinate the regulations and issue clearances; - Improve treatment of wastewater and domestic water.
	Encourage investment in water security	- Build new infrastructure for transforming water resources into socio-economic areas (new accumulation lakes, new inter-basin derivatives, etc.); - Stimulate private sector investments in water resources development, water supply and sanitation; - Finance water sector infrastructure that is climate resilient; - Promote investment projects to ensure water-energy-food security.
Health	Prevent and reduce climate-related risks	- Promote information campaigns and raise public awareness of impacts of climate change and extreme weather events on human health, taking into account social, gender and age perspectives; - Develop integrated assessments of environmental, economic and health impacts of climate change; - Develop effective prevention, early warning management and control mechanisms of heatwaves impacts; - Mainstream health considerations with regard to climate change across national and sectoral regulatory framework with a focus on equity and inclusiveness; - Reduce the effects of air pollution and cold periods on population health; - Improve the prevention and control of climate change-related infectious diseases from social, gender and age perspectives; - Review and strengthen the existing disease surveillance systems with a view of including further climate-related health outcomes, such as heat-related morbidity and mortality.
	Establish climate-proofing of the health system	- Increasing the resilience of health institutions infrastructure as related to the impact of climate change and promote "green" health services; - Promote climate investment portfolios in the health sector, along with those sectors that contribute to indirect health benefits: water supply, sanitation and hygiene projects which can reduce vector-borne diseases; climate-resilient agriculture projects improving population nutrition; projects promoting well-being and safety of the urban population, other; - Increase access to health care in isolated communities of populations particularly vulnerable to the effects of climate change.

Sectors	Sectorial adaptation priorities	Main activities and actions in support of adaptation priorities
Energy	Ensure reliable, clean and affordable energy	- Reduce the incidence of energy poverty, mainly through the implementation of measures that contribute to reducing energy costs and making energy consumption more efficient; - Promote the development of «green» energy. Stimulate the interest for «green» energy production and consumption by capitalizing on renewable energy sources (wind turbines and hydraulic installations, photovoltaic solar systems, solar panels for heating and hot water production), including the use of efficient and clean biomass production technologies, as well as facilitating the connection of production facilities to existing distribution capacities; - Promote public street lighting projects; - Promote climate technologies that create jobs in the energy sector.
	Promote increased resilience of climate-smart infrastructure in the energy sector	- Develop quality, reliable, sustainable and resilient infrastructure throughout the country to support economic development and population well-being, with an emphasis on broad and equitable access for all; - Build storage facilities for the energy produced by wind and photovoltaic power units; - Promote decentralized generation of electricity (solar photovoltaic systems, hydraulic installations, micro-hydroelectric stations, etc.); - Promote energy efficiency (e.g.: use of modern energy generation and transport technologies, thermal insulation of buildings, construction of refrigerators near CHPs and producing steam cold for the preservation of fruits and vegetables, etc.); - Restore electrical stations equipment of energy distribution networks designed for defrosting/de-icing or introduce new defrosting technologies; - Improve the robustness of electricity transmission and distribution infrastructure; - Establish free economic zones (FEZs) close to CHPs for economic production of the sectors that use steam or hot water in technological processes (greenhouses, absorption refrigeration systems, processing of agricultural raw materials, etc.); - Promote climate-proofing buildings and infrastructure and increase their energy efficiency performance; - Revise existing building standards to ensure that new buildings are resilient, energy-efficient, have additional mitigation effects; - Contribute to the development of a robust project pipeline for climate-smart infrastructure.
Transport	Improve understanding of climate change-related risks and support planning capacities for climate-resilient infrastructure in the transport sector	- Provide training to decision-makers managing the construction of transport infrastructure on climate risk impacts; - Undertake periodic assessments of the level of resilience to climate change impact of the transport infrastructure; - Produce a research-analysis-assessment platform on climate change risks with impact on transport infrastructure, involving insurance companies; - Communicate transport sector climate risks to the targeted audience and general pubic using georeferenced data on climate hazards, social and gender vulnerabilities, risk mapping covering different scenarios of threats, other tools. - Carry out research on the design and development of advanced materials and technologies aimed at increasing the resistance of roads, railways, aerodromes, ports to climate hazards; - Adjust urban and land-use planning to future climate change-related risks for transport infrastructure (roads, bridges, railways, waterways, aerodromes); - Promote funding schemes to support climate action that fit specific transport sector related needs, geographic area, other specifics.
	Improve access to climate-resilient and safe public transport	- Ensure the access of citizens to safe transport systems with fair, accessible and sustainable prices for all, as well as improving road safety, in particular by expanding the public transport system; - Promote a well-developed cycling path network, accessible pedestrian routes; - Promote more sustainable consumer behavior in using transport.
	Create sustainable transport infrastructure	- Implement adaptation measures to combat the effect of temperature variation: heat-tolerant streets and highways, landscape protection, heat-resilient paving materials; milling out ruts; shifting construction schedules to cooler parts of the day; design for higher maximum temperatures in replacement or new construction; adaptation of cooling systems; - Promote and implement adaptation solutions for extreme precipitations such as climate-resilient paving materials and overlay with more rut-resilient asphalt; use of the most efficient technologies to assure sealing and renewal of asphalt concrete; wider use of efficient road maintenance methods, including preventive and corrective maintenance; improve flood protection; greater use of sensors for monitoring water flows; upgrading of road drainage systems and improved collection and disposal of rainwater from the roads; pavement grooving and sloping; implement increased standards for drainage capacity for new transportation infrastructure and major rehabilitation projects; - Identification and implementation of corporate management and advanced technological models for the management of transport infrastructure in response to the impact of climate change; - Purchase the necessary equipment for cleaning and widening riverbeds, and the development of a system for navigation monitoring, etc. - Contribute to the development of a robust project pipeline for climate-smart infrastructure.

5.5.2.4. Climate Change Adaptation Investment Priorities

The prioritization of adaptation investment areas was carried out as part of the development of the RoM Country Programme for the engagement with GCF using Multi-Criteria Analysis (MCA) methodology. The list of adaptation options for each of the key sectors: agriculture, water resources, human health, forestry, energy, and transport was produced based on the review of national and sectorial development planning documents, policies and documents related to climate adaptation and sustainable development, studies on climate impacts, risks and vulnerabilities, needs and opportunities for sector adaptation, and development partners reports.

The prioritization criteria for adaptation investment include the national interests and priorities and have been defined as: (i) alignment with the country's climate change adaptation strategies and plans as well as with the country's legislation; (ii) contribution to vulnerability reduction at the national level and increase in climate-resilient sustainable development; (iii) total number of direct and indirect beneficiaries (women and men); (iv) contribution to transformational adaptation; (v) contribution to improved economic performance with high level of environmental, social, and gender co-benefits; (vi) financing needs of vulnerable groups, target population, sectors, development regions, country; (vii) financial and economic feasibility based on which sectorial investment options have been prioritized. Table 5-48 provides information on climate change adaptation priority investment areas.

The list of investment priorities could be updated as necessary, within a stakeholder participation process, using relevant prioritization approaches.

Table 5-48: Climate Change Adaptation Priority Investment Areas of the Republic of Moldova

Priority Sectors	Climate change adaptation investment priorities of the Republic of Moldova
Agriculture	Strengthen the climate resilience of the agricultural sector by: • Sustainable soil management (conservation, precision, organic agriculture, etc.) • Promoting efficient irrigation systems • Promoting the diversity and resilience of agricultural crops • Increased food security • Promoting integrated food, water, and energy systems in a smart and climate change resilient agriculture
Water resources	Promote sustainable water management through: • Increased supply and efficient management of water demand, taking into account social and gender issues • Improved management of extreme events (floods, droughts) • Effective water treatment and reuse
Forestry	Promote sustainable management of natural resources by: • Afforestation/reforestation practices, applying the ecosystem approach • Sustainable management of forests and ecosystem services • Organic restoration of degraded pastures
Health	Increase health system climate resilience to identify, monitor, prepare and respond in a resilient manner to climate-induced health changes and diseases for both men and women (of different ages, abilities, social status, place of residence) through: • Improved health services for all citizens, with special focus on vulnerable groups • Promotion of "green" standards in hospital operationalization • Prevention, early warning, management and overcoming the impact of extreme weather events (heat and cold waves, floods)
Transport	Promote environmentally friendly and efficient transport in the country through: • Resilient urban infrastructure with reduced exposure to climate risks • Increased climate resilience of transport infrastructure (roads, bridges, viaducts, railways, tracks) • Adoption of climate resilience codes, protocols and standards • Improved access of the rural population to a climate-resilient road system and public transport that takes into account social, age and gender aspects
Energy	Ensure the country's energy security through: • Promotion of water-energy-land nexus with focus on renewable energy sources • Increased resilience of energy system infrastructure • Secure operation of energy infrastructure in any climatic conditions
Cross-sectorial priorities	Improving the resilience of rural and urban communities to the adverse effects of climate change, taking into account social and gender issues.

Note: * - based on Republic of Moldova's Country Programme for the engagement with GCF (2019).

5.5.3. Climate Change Adaptation Implementation and Support Needs and Provision of Support

5.5.3.1. Climate Change Adaptation Provision of Support

In tackling climate change, the RoM has used its domestic resources together with international co-financing. While domestic sources supporting climate action come mostly from the public sector, the country faces a growing challenge in committing to large scale transformational adaptation action perceived as an additional element to sustainable development. Due to domestic budget constraints, the external support received by the RoM to address climate change plays an important role in planning and implementing climate adaptation at the national and sub-national levels. Over the past few years, efforts have been made by the country to strengthen its capacity to implement large projects and to absorb external resources in accelerating the low carbon emission and climate-resilient course of development.

The overall Official Development Assistance (ODA) project portfolio addresses general climate change concerns, with some dedicated interventions to mitigation. While adaptation is mainstreamed within ongoing development co-operation activities that are at risk because of climate change, with several projects targeting dedicated adaptation planning and implementation. At the current stage of adaptation implementation in the country, both adaptation-dedicated and adaptation-relevant financing directions are important.

According to OECD statistics[307], gross Official Development Assistance (ODA) for the RoM has reached $370.7 million in 2015, with the two largest donors being institutions of the European Union at $134.8 million, and the United States at $108.6 million. About 80% of climate-related development finance flow was committed through multilateral channels: European Bank for Reconstruction and Development (EBRD), the European Investment Bank, and the World Bank Group using mainly loans, while the remainder was committed by bilateral sources (e.g., the European Union, Germany and Japan), mainly in the form of grants.

The Government of the RoM has developed the policy and development objectives that ensure better coordination and synergy in the process of programming, implementation, monitoring and evaluation of external assistance, by establishing a broad consultation process and dialogue between the Government, private sector and civil society. External support is monitored through the External Assistance Management Platform (AMP)[308] with the aim of increasing transparency in the use of external assistance, accountability in management and capitalization of financial resources that the RoM benefits from, as well as to provide good information to society on how the resources are spent. Moldova uses also thematic Donor Coordinating Councils to harness mitigation and adaptation support and align it with NDCs priorities.

Thus, according to the data and reports presented on the public portal amp.gov.md, during 2014-2019, the development partners' commitments to support the implementation of adaptation in the Republic of Moldova amounted to about EUR 1,117.3 million; however, only EUR 356.5 million (32%) were disbursed as of 2019-year end, of which 10% were allocated to the projects targeting adaptation, while 90% of the projects had adaptation co-benefits (updated NDC, 2020)[309].

The Government accesses money from the international funds on preferential terms through various financial instruments: credit schemes, grants or subsidies. Interest rates on these preferential funding is low or not applied under the grants and subsidy conditions. The repayment period of loans is several times longer than the one applied to commercial loans, many of the loans also having grace periods. Thus, from the total received funds, 68% were disbursed as grants, 33% as preferential loans, and about 3% in the form of credits. Regarding the type of assistance, the data show an almost equal share between technical assistance and project support with a low percentage allocated to budget support.

[307] <http://www.oecd.org/dac/stats/aid-at-a-glance.htm>
[308] <http://amp.gov.md/portal/>
[309] Government of the Republic of Moldova, updated Nationally Determined Contribution, 2020.

In 2014-2019, the largest disbursements through the projects with adaptation co-benefits were made by the European Union, Swiss Agency for Development and Cooperation, World Bank, International Bank for Reconstruction and Development (IBRD); Germany; Fund for Agricultural Development (IFAD); European Investment Bank (EIB), European Bank for Reconstruction and Development (EBRD) other, totaling about 320.5 million euros.

Donors that had significant contribution to adaptation implementation include IFAD, Denmark and GEF through projects, such as "Inclusive Rural Economic and Climate Resilience Programs (IRECR)" funded by IFAD (approx. EUR 19.5 million grants and concessional loans); "Disaster and Climate Risk Management in Moldova Project" funded by the World Bank (concessional loan of US$10 million); EU-funding with several projects on disaster risk reduction, flood protection, forest fire clearance, sustainable management of pastures and forests, integrated water and land use management, protection of natural areas and biodiversity, and others. Adaptation cross-cutting areas referring to planning, coordination, mainstreaming, gender equality, monitoring and evaluation, EWS, communication, other areas have been extensively addressed through ADA/UNDP Project "Supporting Moldova's National Climate Change Adaptation Planning Process" totaling 940,000 EUR. The European Investment Bank (EIB) disbursed about EUR 1.5 million in the framework of "Management and Technical Assistance Support to Moldova Flood Protection Project" in the framework of European Neighborhood Policy (ENP).

Agriculture sector received the largest share of adaptation-related aid and this is where adaptation is mostly implemented at the action level and this reflects the importance of this sector in country's economy. At the same time, it confirms agriculture sector's high exposure to climate change, including climate risks. During 2014-2019, the total value of the development partners' commitments to finance adaptation projects and those with benefits for adaptation in the agriculture sector amounted to about 360.9 million EUR. Of this amount, only 99.4 million EUR have been disbursed, with 52.6% being disbursed in 2019.

It should be mentioned, that 49% (about EUR 25.7 million) of the disbursements during 2019 were made by the International Development Agency (IDA) as a concessional loan, within the multilateral project "Agriculture Competitiveness" (the total budget of the project being 36,257,764.15 euros). The objectives of the project are to increase the competitiveness of the agri-food sector by supporting the modernization of the food safety management system, facilitating farmers' access to the market and integrating agro-ecological and sustainable land management practices. The co-financers of the project are the (GEF) and the Kingdom of Sweden, which granted EUR 4 and 2 million, respectively.

A number of other development partners have provided targeted adaptation support or development support with adaptation co-benefits. Among other, during 2013-2019, the Food and Agriculture Organization (FAO) supported the agricultural sector through a series of projects, such as "Review and preparation of a draft Land Code for the Republic of Moldova"; "Strengthening of the Food Safety System of the Republic of Moldova"; "Increasing small scale farmers' resilience to drought by adopting best irrigation practices and modern irrigation technologies"; "Support for adaptation and implementation of Integrated Pest Management in Moldova"; "Development of the National Strategy and Action Plan for animal genetic resources and dairy cattle genetic improvement program", and others.

During 2014-2019, the commitments for the implementation of the cross-sectoral adaptation projects and those with benefits for adaptation totaled about EUR 190.4 million, out of which only EUR 63.3 million were disbursed. The largest contribution of this period was made by the European Union, totaling EUR 61.85 million, of which, 48.96 million were disbursed as grants under the program "ENPARD Moldova Program - Support to Agriculture and Rural Development" which aims to provide budgetary support to the Government of the Republic of Moldova in the process of poverty eradication, promoting sustainable and inclusive growth and strengthening economic and democratic governance through policies and reforms in the field of agriculture and rural development; improving the delivery of services in the agricultural and rural sectors; sustainable management of natural resources, including water and biodiversity, etc.

Other disbursements were made through the projects with adaptation co-benefits: "Modernization of Local Public Services in the Republic of Moldova" and "Modernization of Local Public Services in the Republic of Moldova" (Phase II), supported by the European Commission (EC); German Development Cooperation (GIZ) and German Federal Ministry for Economic Cooperation and Development (BMZ); Swiss Agency for Development and Cooperation (SDC); Swedish International Development Authority (AIDS) and the Government of Romania. The total amount of the commitments under these multilateral projects amounted to approximately EUR 87.1 million, of which about 38.9 million have been disbursed so far. It should be mentioned that the main donors were GIZ and BMZ with current disbursements of EUR 17.9 and 5.4 million for the first and second projects, respectively, (updated NDC, 2020)[310].

5.5.3.2. Climate change adaptation implementation and support needs

Meeting updated NDC adaptation goal requires successful and timely implementation of many adaptation projects, interventions, programs, with the involvement of strong institutions able to develop and implement effective adaptation polices and other components of the enabling environment. This includes provision of leadership and coordination of adaptation action, monitor progress of adaptation implementation and many other capacity-related activities. Table 5-49 provides information on the most pressing capacity needs until 2025, associated interventions, indicators to measure the success of the intervention, responsible agencies and estimated financial resources. This framework is responsive to the identified sectorial, institutional and individual capacity gaps mentioned in the sub-chapter 5.5.5.

[310] Government of the Republic of Moldova. Updated Nationally Determined Contribution of the Republic of Moldova, 2020.

Table 5-49: Identified cross-cutting capacity development sectoral needs till 2025

Capacity category	Identified need	Intervention needed	Indicators	Responsible Lead Agency	Estimated financial resources required (US $)
Leadership and coordination mechanism	Establish and operationalize an effective coordination mechanism (CM) for climate adaptation	Effective coordination mechanism, with regularly convened progress review meetings Operationalize a coordinated M&E system	Operational CM with clear roles and responsibilities established as part of NAP process	MoE	300,000
		Operational authority with responsibilities for climate change coordination as well as monitoring, evaluating and reporting tasks on the climate change adaptation measures	Publication and sharing of annual progress report(s) on climate resilience and adaptation activities, Improved cross sectoral coordination	MoE, NCCC	200,000
Institutional and legal framework	Review and strengthen legislation, policies, action plans and development plans to improve the integration of climate adaptation in national development strategies, plans and programs	Incorporate climate adaptation into relevant sectoral policies	Relevant national and sectoral documents completed or updated	All ministries and sectors	To be identified depending on the number of reviewed policies, development plans
	Review and strengthen MoE climate related capacities, including CCO mandate and capacities	Improved and expanded MoE climate related capacities, including in inclusiveness and gender equality approach	MoE need and capacity assessment completed and operational requirements determined	MoE	To be determined by MoE following evaluation of needs and requirements
Budget mainstreaming	Develop options for climate resilience and how to best formulate budget lines for climate resilience in the national plans and annual Ministerial Strategies	Climate considerations integrated in sectorial budgets	Climate considerations integrated in sectorial and national budgets	MF with support from MoE	100,000
		Climate change indicators incorporated into planning and budgeting frameworks to ensure accountability	Climate change indicators incorporated into policy and budget reviews	MF and MoE	100,000
		Incorporate contingency budgets in each sector for specific CCA interventions as the need arises	Contingency budget in each sector for specific adaptation interventions	MF	100,000
Risk management information and technologies	Develop a climate related knowledge management strategy	Knowledge management strategy in place	Relevant document completed	MoE with support from technology offices	100,000
	Systemic inventory of existing and ad hoc DRR and climate information, tools and technologies, as well as agency functions and responsibilities Transposition of Disaster Risk Assessment EU Guidelines into legislative framework: HIGH	Mapping and systemic inventory of existing and ad hoc DRR and climate information, tools and technologies, as well as agency functions and responsibilities Modification of current legal framework	Low-cost, user driven ICT systems in place. Climate data widely available and updated regularly by responsible institutions Establish a multi-stakeholder WG on DRA. Development of the methodology for hazard assessment in line with DRA EU Guidelines and MSs good practices.	MoE with support from technology office CPESS (Civil Protection and Emergency Situations) (coordinator working group) Working Group (WG) on Disaster Hazard and Risk Mapping	200,000
	Hazard and risk mapping	Mapping of hazards	Climate hazards maps	WG on Disaster Hazard and Risk Mapping	300,000
	Evaluation of current data collection and dissemination practices and experiences	Evaluation and documentation of lessons and best practices related to current practices and experiences	Lessons learnt document that collates and disseminates CCA related information requirements	MoE with support from technology office	200,000
	A demand-based climate and disaster technology and tool in place to guide investment in and use of new tools and technologies	Establishment of low-cost, user driven ICT systems in place.	Operational ICT system use integrated into all sectors	To be determined by the climate related knowledge management strategy	300,000
Climate awareness	Develop a five-year gender-sensitive communication strategy to generate and increase awareness	Communication package on national policies for use during community consultations and awareness raising programs	Increased climate awareness measured against baseline survey	MoE	200,000
Adaptation mainstreaming	Incorporate climate adaptation into environmental impact assessments guidelines	EIA process guidelines	Completed integration of climate considerations into EIA process guidelines	MoE	15,000
	Analytical process to examine policies, plans or program from a climate perspective for each sector	Sector-specific climate screening tools to identify projects at risk criteria for selecting projects for implementation and financing	Climate screening tools to identify projects at risk. Prioritized (annual) list of climate related resource requirements	MoE MF Line Ministries	30,000
	Priorities and approaches for climate related sectoral development planning	Sector based approaches for integration of climate issues into sectoral development plans	Sectoral climate priorities established Relevant documents completed	MoE with relevant line ministries	30,000 per sector

Capacity category	Identified need	Intervention needed	Indicators	Responsible Lead Agency	Estimated financial resources required (US $)
Climate awareness and main-streaming	Key messages for the different groups/sectors about climate resilience	Formulate a set of key messages for the different groups/sectors about climate resilience and the specific actions that can be taken immediately	Relevant documents completed and programs initialized	MoE with relevant line ministries	15,000 per sector
		Climate related sectoral risk profiles	Climate related sectoral risk profiles completed and programs initialized	MoE with relevant line ministries	20,000 per sector
Climate knowledge and training	Sectoral training institutions mapped and climate related training programs developed	Map and identify sectoral training institutions and develop climate related training programs	Number of sectoral education programs that can incorporate climate change	MoE in conjunction of Ministry of Education and Research	1,000,000
		Climate considerations integrated in sectoral education curricula, taking into consideration gender aspects	Number of sectoral education programs that integrate climate into curricula	MoE in conjunction of MER	80,000
	Training for staff on leadership, coordination, mainstreaming, communication and project management	Identify/designate mentors and coaches among officials/staff	Established roster of trained climate mentors and coaches for each sector (women and men)	MoE based on discussions with relevant ministries and sectors	100,000
		Train identified mentors and coaches on climate issues	Number of participants in mentors and coaches' trainings (women and men)	Initially to be conducted by MoE	60,000 per training session
	Training on climate change, risks and vulnerability with the Academy of Public Administration	Training for civil servants on climate policy and climate considerations	Number of civil servants participating in trainings (women and men)	MoE	10,000
		Training for local governments on opportunities for making use of climate policies and conducting vulnerability assessment activities	Number of local governments that participated in training events (women and men)	MoE	50,000 per class/ session series
Spatial (urban, rural, land) planning	Mapping settlements vulnerable to flooding, landslides and other hazards	Mapping of vulnerable settlements	Settlement vulnerability maps available to all sectors for incorporation into sectoral action plans Map of vulnerable settlements	MoE in conjunction with MIRD	150,000
		MoE initiates integrated planning around geographically vulnerable areas to produce high-quality development plans for disaster-prone areas			
	Review, update and develop urban and spatial plans of localities	Updated urban and spatial plans of localities	Updated urban and spatial plans of localities	MoE in conjunction with MIRD	40,000 per locality
	Develop codes and regulations for limiting of residential and commercial facilities and homes in areas vulnerable to hazards	Codes and regulations for residential and commercial facilities and homes in areas vulnerable to hazards	Codes and regulations for residential and commercial facilities and homes in vulnerable areas	MoE in conjunction with MIRD	40,000 per locality
	Develop urban and rural post-disaster redevelopment plans	Post-disaster redevelopment plans	Post-disaster redevelopment plans prepared	MoE with support from relevant line ministries	40,000 per locality

Despite the difficulties to define concrete characteristics of future climate risks the country has to cope with, based on the already existing knowledge about them at national and sectorial levels, along with by now visible impacts of climate change on population, economy sectors, ecosystems (mentioned in the chapters above), it is obvious that a rapid economic, social and technological transformation is needed to pursue the sustainable path declared in the NDS "Moldova 2030".

While the magnitude of the climate action needed to build resilience at national and sectorial levels is under the constant consideration and estimation, it is clear, that the RoM will need considerable international support to cope with devastating effects of climate change and extreme weather events.

In 2016, in the RoM, with the help provided by the World Bank, an economic analysis was carried out aimed at identifying medium- and long-term investment needs of key sectors of the country's economy. The study applied a quantitative assessment of adaptation investment opportunities and returns across the target sectors, evaluating the cost of inaction in each sector, i.e., the expected annual opportunity cost of not being better adapted to prevailing climate conditions. According to these estimates[311], there must be a total adaptation investment of US$ 4.22 billion to mitigate the impact of climate change, with about US$ 1.85 billion being considered as a relatively high priority for the near future (Table 5-50). The priorities were identified based on estimated economic returns, the size of potential investments, and qualitative assessments of the impact on gender and poverty. The total cost of climate change adaptation inaction is estimated at about US$ 600 million, equivalent to 6.5 percent of the GDP, and it is expected that this value will exceed its double in real terms by 2050 and will amount to about US$ 1.3 billion, emphasizing the additional cost associated with delaying action to efficiently adapt to changes in the climate.

[311] World Bank. 2016. Moldova - Climate adaptation investment planning technical assistance (English). Washington, D.C.: World Bank Group. <http://documents.worldbank.org/curated/en/469311500273762091/Moldova-Climate-adaptation-investment-planning-technical-assistance>

Table 5-50: High Priority Investments in RoM Economy's Sectors through 2040 (million US$)

Sector	Investment	Investment period	Cost	Indicated Rate of Return	Uncertainty of C&B[312]	Poverty impact	Gender impact
Agriculture Water Management	Rehabilitate/modernize centralized irrigation systems	2017 to 2040	975	IRR: 8% to 15%	Medium	Medium	Medium
	Rehabilitation/modernization of drainage infrastructure in irrigated areas	2017 to 2026	120	IRR: 8% to 15%	Medium	Medium	Medium
	Institutional reforms/capacity building	2017 to 2024	140	n/a	Medium	High	High
Forestry	Ecological reconstruction of forests	2020 to 2029	91.3	IRR: 3% to 14%	Medium	High	High
	Ecological reconstruction of forest belts	2020 to 2029	4.9	IRR: 4% to 15%	Medium	High	High
Health	Heat health warning system	2017+	0.4[313]	BCR: 3.1-170	High	Medium	Medium
Water Supply	Improving municipal & industrial water system efficiency by 10% reduction in loss	2017+	2.8-5.5	BCR: 61-70	Low	Medium	Medium
	Water storage in Lower Dniester (100 MCM)	2030+?	18.4	BCR: 2.6-6.4	Low	Medium	Medium
	Water storage in Reut (1 MCM)	2020	0.3	BCR: 20-59	Low	Low	Medium
Flood Prevention	Structural measures	2020-2040	360.8	BCR: 2,1	Medium	Unknown	Unknown
	Non-Structural measures	2020-2040	13.6	BCR: 5.6	Medium	Unknown	Unknown
WSS	Rehabilitation of existing and construction of new WSS infrastructure	2020-2040	409 [350-439]	BCR: 2.5-3.2	Medium	High	Medium
Disaster Response Management	Improved training facilities; Create N&S Emergency Command Centers; Improved emergency response capabilities	2020	11	BCR: 2.1-4.1	Medium	Medium	Medium

Note: * - assessed by the World Bank (million US $).

[312] Ratings are given here for the significance of uncertainty of benefits for each investment, Red = high uncertainty, amber = medium uncertainty, and green= low uncertainty.
[313] Costs incurred in years with a heatwave.

Agriculture Sector: The biggest challenges and investment opportunities are in the agriculture sector. Rehabilitation/modernization of centralized irrigation systems and drainage infrastructure will make a major contribution to increasing current productivity and mitigating future climate impacts. These are expected to have good rates of return as long as they can be combined with successful institutional capacity-building for management of irrigation systems. Other options include small-scale on-farm irrigation systems, soil management and climate risk management technologies, in particular, conservation agriculture, and the potential for changes in crop mix towards perennial crops (i.e., grapes and fruit trees), which will be more resilient to climate change. The WB estimated the preliminary value of the average annual loss caused by extreme meteorological phenomena (drought, flood, hail, heavy rainfall, wind, frost, landslide) to US$ 34 million per year. The 2050 estimate of expected annual damage and loss is around US$ 335 million. The medium-term investment amount (by 2040) needed to address the current productivity gap in Moldovan agriculture and, at the same time, to increase the climate change resilience is US$ 2.409 billion.

Forest Sector: Ecological rehabilitation and expansion of forests and forest belts are expected to have high returns on suitable land, with a high poverty and gender impact. Restoration of degraded forests and pasturelands also promote agricultural productivity through improved watershed function and protection from harsh weather. Future climate change will affect both the tree growth, causing changes in species distribution and ecosystems structure, and the frequency and magnitude of damage caused by diseases, droughts, and fires.

The current annual climate-related damage is estimated at US$ 414 thousand (of which: US$ 18,000 due to fires, US$ 177,000 due to pests and US$ 219,000 due to droughts). In addition, about US$ 300,000 are spent annually for pest treatment remedies. By 2050, it is expected that these costs related to afforestation works and forestry maintenance will increase to about US$ 120 million.

Human Health Sector: Although there is an uncertainty around the scale of climate-related health impacts, it is anticipated that the effects of several diseases could be exacerbated by climate change (e.g., physiological stress caused by low or extremely high temperatures, prevalence of disease-causing vectors influenced by climate conditions, the range of acute health risks and physical and mental well-being influenced by extreme weather phenomena, in particular heat waves etc. According to WB estimates (2016), the current cost of climate-dependent health risks (namely, heat-related mortality and food poisoning) is about US$ 20 million.

According to the *Climate Change Adaptation Strategy* (2014)[314] and studies undertaken during the NAP-1, considerable investments are needed to provide healthcare in isolated communities to populations particularly vulnerable to the effects of climate change (the elderly and disabled people); equipping emergency departments for cardiovascular diseases according to WHO requirements; modifying hospital infrastructure for operationalization to "green" standards, developing the national information system for collection and processing of data, including gender disaggregated data on the effects of climate risks on public health, emergence and incidence of new diseases related to climate change; prevention, early warning, management and overcoming the impact of extreme weather events due to climate change (heat, cold, flood); eradicating malnutrition and ensuring access to safe, nutritious and sufficient food for particularly vulnerable population groups; protection of human health and consumers' interests with regard to food safety; development of continuous air quality monitoring stations, etc.

[314] GD no. 1009 of 10.12.2014 regarding the Republic of Moldova's 2020 Climate Change Adaptation Strategy and Action Plan for its implementation, Official Gazette No. 372-384 as of 19.12.2014.

Water Sector: According to undertaken assessments, improvement in municipal supply systems to reduce loss, and building a storage reservoir on the lower Dniester River, present immediate, modest investment opportunities with high returns. In the coming decades, larger-scale storage infrastructure will be needed. The ideal size and timing of these require more analysis and the institutional capacity to effectively manage a variety of water investments would also need to be strengthened.

According to undertaken assessment, the provisions for water demand will increase considerably by 2040, which will be amplified by climate change impact. The unsatisfied demand, dominated by municipal and industrial consumption, is estimated at about US$ 95 million, and the total cost of climate change inaction in the water sector is estimated at about US$ 205 million per year. Investments in water supply infrastructure in rural areas could be an adaptation option for improving water supply in the agriculture sector and for the rural population as well. The cost-benefit analysis of small-scale water supply shows a benefit-cost ratio of 2.5 to 21.3 in the pan-European region, which includes RoM (UNECE and WHO, 2011).

The EIB's (2016) Preliminary Flood Risk Assessment (PFRA) identified 84 structural and 30 non-structural flood management measures. For these, a detailed investment plan has been prepared with a total investment of €325 million for structural measures and €120 million for non-structural measures, including maintenance.

Substantial economic benefits to reducing damage and loss will be provided through investments for structural and for non-structural flood prevention measures, worth € 325 million and € 120 million, respectively[315]. These measures include: rehabilitation/construction of dams, dikes, small scale storage tanks, bank consolidation, wetlands, warning systems and their maintenance, informing/educating the population on flood risk and how to act in emergency situations. Other important investment opportunities for the water resources sector are: improving the quality of drinking water; improving sewage and domestic water treatment; increasing water recycling for industrial needs; protection of wastewater infrastructure against floods; water management by capturing surface water; land improvements to increase the probability of precipitation; technology implementation of groundwater layers recharge, etc.

Energy Sector. The energy sector faces several challenges, the main one being the dependence on imports (especially natural gas). The investments needed to implement the scenario recommended by the ESMAP[316] study (connection to the Romanian transmission network for the diversification of the country's external energy sources) are estimated in the range of US$ 421-441 million.

Renewable energy sources are most sensitive to extreme weather phenomena. The value of the current production of renewable energy related to the climate is estimated at only US$ 286 thousand annually (in the form of hydroelectric power), while the lost energy production is estimated to about US$ 150 million annually. The cost of wind technology may decrease over time, but now, wind power generation may be economically viable. The total investment potential is estimated at about US$ 235 million.

Lost heat production due to the current water supply deficit on Dniester River is estimated at US$ 4.6 million per year, based on the current import price and the assumption that energy production is affected proportionally by the water supply shortage.

The investments proposed in the measures of the Energy Strategy of the Republic of Moldova until 2030, Article 104, to promote energy efficiency related to the education and training of staff in the efficient use of energy, and the development of a series of educational programs to raise public awareness, organizing competitions and demonstrations of the achievements in this area will contribute to the viability of the entire energy sector against the risks of climate change.

Studies show that the total cost of renovating the private and public buildings in Moldova for heating and cooling efficiency could be hundreds of millions of US dollars per year over two decades[317].

Transport Sector: According to the WB Report (2016), the expected annual cost of climate change for infrastructure in Moldova by 2050 is around US$ 9-22 million, depending on climate scenario. It is expected that the investments in transport infrastructure will increase the resilience of the sector, provide essential gains for public security, as well as substantial economic revenues. The assessment undertaken in transport sector points to the need for enormous investments in the physical infrastructure, but also for associated measures, such as institution and policy change, capacity building and development of strategic documents for the Republic of Moldova to adapt and build resilience to climate change.

Taking into account the analysis carried-out by the development partners, along with those based on national expertise, it may be concluded that the current opportunities for supporting low-carbon development and climate resilience measures in RoM are visible, but the needs largely exceed the in-country availability of resources.

The Table 5-51 presents the aggregated summary of the imperative financing needs for 2020-2025 in the key sectors of economy based on the analysis of needs to implement actions and activities mentioned in the RoM Strategy for Climate Change Adaptation (2014); NC4 of the RoM to UNFCCC (2018); empirical estimates of the WB assessment, as well as cost-benefit analysis (CBA) carried out for prioritization of adaptation measures during the NAP1. The table incorporates also the outputs of adaptation investments' prioritization based on CBA, CEA, other relevant criteria, carried out during the development of RoM's Country Program for the engagement with GCF, currently part of country's project pipe-line to be submitted to GCF.

[315] EIB "Support for technical assistance and management to protect the territory of the Republic of Moldova from floods", 2016.
[316] Energy Sector Management Assistance Program (ESMAP), 2016.

[317] Cohen, F., Glachant, M and Söderberg, M. (2016), "Adapting the US Residential Sector to Global Warming". Working paper presented in 7th Atlantic Workshop on Energy and Environmental Economics, A Toxa (Spain), 27-28 June 2016.

Table 5-51: Summary of sector-specific needs for climate change adaptation in the RoM for 2020-2025

Identified need	Indicators	Responsible Lead Agency	Estimated Resources Required (mil. US$)
	Agriculture Sector		
Implement sustainable agricultural systems, less dependent on industrial inputs (mineral fertilizers, pesticides, fuel for mechanical soil tillage, irrigation, etc.) and climate-resilient by sustainable soil management (including management of Chernozems) and holistic approach to farm organization and management at the landscape level.	Sustainable and climate-resilient soil management and model farms implemented in different areas of the Republic of Moldova (north, center, south). Economic, ecological and social agro-environmental criteria for assessing sustainable and smart soil management in agricultural enterprises established.	MAFI	386.50
Develop program of measures to conserve water in the soil and provide adjustment periods for conducting agricultural activities on climate change.	Programme of measures to be developed, activities performed.	MoE, MAFI	0.14
Identify vulnerable areas and sectors and assess needs and opportunities related to alternative crops and varieties more resistant to climate change.	Study developed, vulnerable areas, needs and opportunities identified.	MAFI, ASM	1.40
Implement changes in crop mix towards perennial crops (i.e., grapes and fruit trees), which will be more resilient to the new climate conditions.	Thousands ha planted with orchards and vineyards.	MAFI	1.50
Strengthen scientific studies and research in the field of irrigation of agricultural land using modern innovative irrigation technics.	Scientific studied in the field of irrigation carried out.	ASM	0.70
Develop irrigation plans based on an assessment of their impact, future water availability and water needs, taking into account supply- demand balance.	Plans developed and approved.	MAFI	0.10
Extend rehabilitation of centralized irrigation systems and drainage infrastructure.	Irrigation and drainage systems rehabilitated.	MAFI	100.00
Promote efficient irrigation in the Republic of Moldova through low-flow, low-pressure and water serving drip Irrigation technologies.	Modern drip irrigation systems installed on an area of 133.5 thousand ha planted with orchards and 135.3 thousand ha of vineyards. Increased efficiency of irrigation, reduced costs for fertilizers.	MAFI, Private sector	161.00
Creating tools for risk and crisis management to cope with the economic consequences of events due to climate change.	Risk management tool (including agricultural insurance) created and supported in order to mitigate the negative consequences of climate risks and the negative effects of natural disasters on agricultural production and competitiveness of farming.	MAFI, Private sector	0.51
Develop an agricultural subsidy system based on farm compliance with integrated environmental management.	Subsidy system operational.	MAFI	5.00
Capacity building for adaptation to climate change through awareness of stakeholders using the FAS and supply essential information on farm management.	Information campaigns organized, advice, information published.	MAFI	0.43
		TOTAL	**657.32**
	Water Resources Sector		
Review and update regulations, codes and technical standards of design, construction, modernization and rehabilitation of hydro facilities to address and include climate considerations.	Updated regulations and technical standards.	MoE, MAFI, MIRD	0.035
Conduct studies to assess the available water resources, determine their vulnerability to climate change, water requirements and needs for the main categories of consumers. Support foundational capacity building and targeted research needs for joint, ecosystem-based management of trans-boundary water systems.	Studies and research conducted.	MoE, Apele Moldovei Agency ASM	0.87
Adopt ecosystem-based approach to manage water resources.	Ecosystem based approach incorporated into sectoral planning process.	MoE, Apele Moldovei Agency	0.035
Ensure the integrated water management based on river basin principle.	Water quality criteria established, wastewater treatment process improved, regulations on the limitation of discharge of hazardous substances into water established.	MoE, Apele Moldovei Agency Moldsilva Agency	0.56
Update the water sector National Development Plan to include risk reduction (floods, droughts, landslides, etc.), and include: risk assessment; definition and risk management; investment planning and water recovery.	National Development Plan updated based on the assessments undertaken.	GoM	0.12
Insure availability of water at source through the development of resilient infrastructure for transforming water resources into socio-economic ones.	New accumulation lakes created, infrastructure for collecting rain water created, technology of groundwater layers recharge implemented, wetlands developed.	MoE, Apele Moldovei Agency	35.70
Effective water treatment and reuse.	Innovative technologies for treating wastewater implemented.	MoE, Apele Moldovei Agency	5.80
Implement innovative solutions to improve the efficiency of the water use. Improve prioritization of issues (and policy-based budgeting) and program oversight.	Water management innovative solutions implemented.	MoE, Apele Moldovei Agency	9.00
Undertake measures to combat drought/water scarcity.	Monitoring and warning services provided, leakages in water networks reduced, mapping and drought thresholds established, water storage capacity created.	MoE, Apele Moldovei Agency	20.00
Ensure proper management of flood risks.	km of protective dams and small-scale storage reservoirs re-constructed/ constructed, flood forecasting, information and alert systems created.	MoE, Apele Moldovei Agency	125.00

Identified need	Indicators	Responsible Lead Agency	Estimated Resources Required (mil. US$)
Ensure implementation of adaptation measures of Programme of measure regarding the implementation of the Danube-Prut and Black Sea River basin management plan for the years 2018-2023.	Adaptation measures of Programme implemented.	MoE, Apele Moldovei Agency	6.00
		TOTAL	**203.12**
	Human Health Sector		
Implement an efficient Health Information System (HIS) for decision making and public access to environmental health data.	Working group established, approved procedures.	MH	0.20
Create the national database for collecting and processing data and information on effects of climate change risks onto public health, the emergence and incidence of new diseases related to climate change, including through gender perspectives.	Database established and accessible for use.	MH	0.20
Prevention, early warning, management and overcoming the impact of extreme weather events (heat and cold waves, floods).	Mechanism for early warning, management and control of extreme weather events effects established.	MoE, MH,	0.80
Reduce the effects of air pollution and cold waves on population health.	Measures to reduce impact of air pollution and cold waves on population health applied; air quality monitoring stations developed.	MH, MoE	1.00
Establish an integrated and efficient system for prevention, early warning, management and protection against ultraviolet radiation increased levels.	Early warning system operational.	MH, SHSM	0.05
Increase access to health care in isolated communities to populations particularly vulnerable to the effects of climate change, taking into consideration gender and age aspects.	Mechanisms to provide access to vulnerable populations created, established.	MH, MLSP	3.00
Evaluate existing disease monitoring systems and strengthen them by including certain consequences of climate change.	Disease monitoring systems improved and strengthened.	MH	12.0
Evaluate the existing disease surveillance systems and strengthen them by including certain climate-caused consequences.	Disease surveillance systems improved and consolidated.	MH	0.14
Increase public information and raising awareness about effects of climate change and extreme weather on health.	Constantly operational information system in place.	MH	0.10
Develop a plan to address care for vulnerable population groups (elderly people, women and men with children, isolated people, people without a place to live, etc.) in case of health and climate emergencies.	Plan developed.	MH, MLSP	0.05
Strengthen primary health care (including primary prevention) services to support capacity of local communities to become resilient to climate-related health risks.	Primary health care service support resilient to climate changes	MH	100.0
Equip emergency departments for cardiovascular diseases.	Emergency departments equipped.	MH	2.00
Promote modification of hospital infrastructure for operationalization to «green» standards.	Hospital infrastructure in Green Hospital principles implemented.	MH	45.00
		TOTAL	**164.54**
	Forestry Sector		
Enhance the process of scaling-up territories covered with forest vegetation, forest belts. Promoting the ecosystem approach.	ha of woodland, forest belt, green islands created.	MoE, Moldsilva Agency	120.00
Establish national forestry monitoring system.	Monitoring system developed and in place.	MoE, Moldsilva Agency	0.035
Create new forests adapted to the consequences of climate change and able to effectively capture carbon and produce wood biomass.	New forests planted and level of adaptation measured based on specific indicators.	Moldsilva Agency	20.00
Develop assessment process for monitoring forest plantations along water courses.	Assessment methodology developed and applied in practice.	Moldsilva Agency	0.05
Develop and implement river basin level management plans for water resources that include climate considerations.	River basin management plan developed and implemented.	MoE, Apele Moldovei, SHSM	1.50
Adapt forest regeneration practices to the needs brought about by climate change.	Regeneration practices in place.	Moldsilva Agency	0.04
Ensure protection and conservation of biological diversity.	Protection and conservation measures implemented.	MoE	1.70
Promote awareness and good understanding on climate change and on how the forestry sector can make a positive contribution	Awareness raising campaign and training provided	Moldsilva Agency	0.025
Sustainable management of forests and ecosystem services	Decrease of illicit deforestation achieved; effective control by local authorities implemented; knowledge and ecological culture promoted.	Moldsilva Agency	0,035
Organic restoration of degraded pastures.	ha of pastures restored.	Moldsilva Agency	27.00
		TOTAL	**170.37**
	Energy Sector		
Promote renewable energy sources that operated based on environment-friendly technologies.	Photovoltaic generators, wind facilities; biomass heated facilities used.	MIRD, MoE, EEA	80.00
Promote the gradual transition from the use of traditional fuel sources to biofuel use.	15% of the used fuel will be biofuel; Standards and technical regulations implemented.	MIRD, MoE, EEA	0.14

Identified need	Indicators	Responsible Lead Agency	Estimated Resources Required (mil. US$)
Promote efficient energy use and promote high energy efficient products.	Energy intensity reduced by 10%; 2% of energy efficiency assured every year.	MIRD, EEA	34.00
Improve sustainability and climate protection of energy transmission and distribution infrastructure.	Inspection and rehabilitation of the existing network; Operation of energy infrastructure in any climatic conditions ensured.	MIRD	8.00
Increase training of additional reserve maintenance teams and ensure viability of their full repair kits and other equipment.	Training provided to maintenance teams.	MIRD	0.035
Promote water-energy-land interaction with renewable energy sources.	Interaction water-energy-land interaction with renewable energy sources implemented.	MIRD	30.00
		TOTAL	**152.18**
	Transport Sector		
Review and amend sectoral policy documents (strategies, plans, programs) to address climate change risks and identify highly vulnerable assets.	Policy reviewed; vulnerable assets identified.	MIRD	0.035
Ensure the design of road infrastructure taking into account the need to adapt to climate change.	Regulations, standards approved.	MIRD	0.105
Ensure the sustainability of transport infrastructure through the use of materials resistant to temperature fluctuations, floods.	Regulations, standards approved.	MIRD	0.35
Develop process and mandate for channeling funds from the Road Fund towards sector-based climate change risk research, impact assessment, capacity building, planning.	Process and mandate developed.	MIRD	0.04
Increase climate resistance of the transport infrastructure (roads, bridges, viaducts, railways, tracks).	Climate resilient transport infrastructure re-constructed/ constructed.	MIRD	75.00
Access of rural population to a climate-resilient road system that takes into account social, age and gender aspects.	km of climate-resilient road in rural area developed.	MIRD	70.00
Ensure planning of urban transportation system in view of creating the needed infrastructure to promote alternative transportation such as cycling.	Infrastructure created for cyclists in urban area.	MIRD	14.00
		TOTAL	**159.53**
	Cross-cutting		
Improve resilience of Moldovan communities to the adverse effects of climate change through improved surface water management.	Small-scale water storage constructed; irrigation options improved; water efficiency and agricultural productivity increased; energy costs reduced; awareness of climate resilience issues among users of water services; water security increased; high value agricultural developed.	MoE, Private sector	200.00
Ecosystem Approaches in Disaster Risk Management (EA DRR).	Disaster risk assessment for three zones: Nistru National Park, Lapusna river basin and Biosphere Reserve «Prutul de Jos» effectuated; Measures/options to mitigate and reduce these risks identified and integrated in the local development documents.	MoE, MIRD	0.40
		TOTAL	**200.40**
	Regional Development Sector		
		TOTAL	**1,707.46**

* Sources: CCAS, 2014; CN4; MoE and WB Report.

Given the scale of adaptation challenge, to put in place an effective response and recovery system at national level in the RoM, aggregated effort of both domestic budget and international support is needed. It is expected that in addition to the domestic investments, the leading international finance and investment actors, through financial instruments tailored to the national circumstances, will contribute to building climate resilient sustainable and inclusive economic growth of the country and Eastern European region as well.

5.5.4. Implementation of Adaptation Plans and Actions

5.5.4.1 Progress and results achieved in the first cycle of NAP

The 1st cycle of RoM's National Adaptation Plan (NAP-1) was established through a four-year (2013-2017) project "*Supporting Moldova's National Climate Change Adaptation Planning Process*" supported by the Austrian Development Agency (ADA) with funding from the Federal Ministry of Agriculture, Forestry, Environment and Water Management of the Republic of Austria and implemented by the Climate Change Office, Ministry of Environment of the RoM, in partnership with UNDP Moldova.

The overall goal of the project was to ensure that the RoM has a system and capacities in place for medium to long-term adaptation planning and budgeting with the overall aim to reduce the vulnerability of the population and key sectors to the impacts of climate change.

Through the implemented activities and produced outputs and outcomes, the main components of RoM's National Adaptation Planning in line with UNFCCC Guide (*Technical guidelines for the national adaptation plan process)* was produced as a process that is dynamic, modifiable, and responsive to changing conditions of the country (political, economic, social) and latest information and knowledge on climate change impacts. Incorporation of adaptation into the Republic of Moldova's planning required a number of important decisions, taking into account future risks and prioritizing early options.

The NAP process in the RoM was established as a modality to assemble various adaptation efforts into coherent and sustainable national process. In its turn, the NAP was envisaged to assist the Government of Moldova to maximize synergies of existing or under development processes of NDCs, SDGs, Paris Agreement, CCAS and, to the extent possible, integrate and add value to a more sustainable and resilient development of the country.

Participation of stakeholders able to support adaptation in the political context, with a special focus on sector level was, therefore, critical. From this perspective, the combination of resource constraints, current and projected climate change impacts required support for the development of cross-sectorial approaches for six priority sectors: water resources, agriculture, forestry, health, energy, and transport – and created the priorities for the 1st iteration of the NAP (NAP-1). In addition, the regional development sector was considered as a priority because it is responsible for local level authorities and planning. Collaboration with Ministries and their subordinated institutions has brought a broad range of useful sector expertise, improving the understating of the sectoral context in relation to CCA and ensuring country ownership.

Implementation of NAP-1 was challenging due to lack of well-developed methodologies (nationally and internationally), constraints in the resources, the volatile political context of the country, affecting the progress and weakening the national ownership of the intended results. Despite these challenges, the project team was able to position the project as a catalyst for government planning on adaptation to climate change and has generated momentum to move up the issue of adaptation to climate change on the political priority agenda, as a distinct policy focus. The Table 5-52 summarizes the main achievements under the NAP-1 in the RoM.

Table 5-52: The main climate change adaptation activities implemented and achievements under the first National Adaptation Planning cycle

Activity	Main tasks	Results achieved
Development of the concept of coordination mechanism and supporting elements for adaptation processes	- Develop the concept of Climate Change Coordination Mechanism - Develop the concept of M&E system and sectorial/agency reporting format - Develop the concept on CCA Information System in support to M&E system.	- Government Decision on cross-sectorial multi-stakeholder mechanism written - Inter-sectorial and sector specific indicator fiches developed - Web-based portal for Climate Change Adaptation Information System and monitoring, reporting and evaluation of CCA action built and launched.
Adaptation mainstreamed in priority sectorial development plans	- Develop sectorial CCA strategies and measures for transport and energy sectors - Mainstream CCA measures into socio-economic development strategies of 6 districts - Produce sector specific CCA Strategy and its associated Action Plan for Health and Forestry sectors.	- Prioritized adaptation measures disaggregated into actions represent a focused and applicable response of sectors to climate risks - Adaptation measures identified and widely discussed at Ministry level and comments from subordinated institutions and agencies incorporated - Sector specific policy documents of health and forestry sectors respond to climate threats in a holistic and applicable manner.
Mainstreaming climate into national budget through climate budget tagging approach	- Develop the concept of mainstreaming climate into Moldova's Budget Development Process.	- The concept of climate tagging was developed. The approach is in line with MF reform initiatives and brings benefits for improved CCA - User's guide and methodological guidelines on climate tagging of the national public budget produced to support technical planners at the sector level monitoring.
Communication and outreach strategy developed and implemented	- Develop NAP1 Communication Strategy and Action Plan for its implementation - Organize awareness raising, communication, outreach and knowledge sharing events across the country - Develop knowledge management Strategy and climate change knowledge management plan with leverage of existing knowledge resources on climate change adaptation, enhance project's visibility for both domestic and international audience.	- Communication component brought about wide-spread visibility to adaptation planning activities, and helped build support for adaptation action - A visible campaign that showcased the results of implemented adaptation pilot projects, along with the achievements of State Hydrometeorological Service of Moldova (SHSM) – Zentralanstalt für Meteorologie und Geodynamik (ZAMG) partnership have been promoted through a portfolio of success stories complemented by the photo essays posted on the national and global UNDP platforms - Dedicated adaptation websites developed (www.adapt.clima.md;www.portal.clima.md) - Increased use of online tools for awareness-raising activities.
Sectorial planners are trained in the use of CCA tools and approaches	- Develop a combination of participatory approaches, tools and methods to increase stakeholders' CCA related knowledge.	- Information and training activities carried out during the NAP1 strengthened institutions at national, sector and district levels and improved understanding of CCA - The development of guidance materials was crucial for understating on CCA planning and implementation at different levels of governance, thematic areas and implementation scales - Training provided to: (a) sectorial planners in the use of the tools and approaches;(b) chiefs of policy monitoring and development departments of key Ministries on the screening of policy documents against climate risks the mainstreaming of CCA into sectorial planning; (c) district level decision-makers trained on the need and modalities to incorporate CCA into local development policies; (d) chief engineers and technical staff from the State forest enterprises; © health professionals, heads of district level public health units on thematic areas of climate impact on human health and sector level response - Guidance materials developed on: (a) Mainstreaming CCA into sectorial development planning; (b) Mainstreaming gender into sectorial policy documents; (c) CCA measures for energy and transport sectors; (d) Glossary of CCA terminology; © Cost-benefit analysis in evaluation of CCA for sector measures; (f) Applying conservation agriculture.

Activity	Main tasks	Results achieved
Data availability, management, dissemination and capacity to support adaptation planning	- Provide to SHSM staff advanced training for now-casting, forecasting and hydrology - Reconstruction and modernization of the SHSM website - SHSM to operate EWS of Meteoalarm platform.	- SHSM became member of EU Metnet and operates EWS following high quality capacity development - SHSM independently operates EU EWS platform www.meteoalarm.eu - SHSM site modernized and revamped www.meteo.md
Priority and innovative on-the-ground CCA measures implemented in the most vulnerable areas/sectors in each of the three Development Regions	- Develop Small Grant Scheme according to validated sectors of each Development Region - Establish post-project monitoring of implemented projects.	- Well-developed Grant Scheme - Seven pilot projects in the area of agriculture, water, and energy completed in each of the three Development Regions - Good tutorials for implementation of CCA technologies. - Good response at the community level - Pilot projects served as demo projects of CCA at household and community levels.
Development of CCA project feasibility study	- Develop a feasibility study on water management as a climate change adaptation intervention.	- The study is supporting the up-scaling of a piloted adaptation intervention in water resource management of rural area.
Promotion of gender equality in CCA	- Incorporate gender issues in all CCA activities and products.	- Gender component was mainstreamed into all activities related to adaptation planning and implementation - Climate chapter mainstreamed into Moldova Gender Equality Strategy for 2017-2021 - Awareness raising and information events on various thematic areas regarding gender and climate organized - Tools and methodologies for assessing gender responsiveness and sensitivity of programs and policies developed. - Guidance materials on gender incorporation from climate change perspective into development planning produced - Training of sectorial planners on gender mainstreaming in sectorial planning and of sectorial communicators on communication of CCA from gender perspective implemented.

Along with framing and implementing the first cycle of National Adaptation Plan, the actions implemented at sector level presented a significant contribution to reducing country's vulnerability to climate change impacts. Below recently implemented adaptation practices and actions at sector level are described, with some emerging conclusions

The **Agriculture Sector** of the RoM is working toward achieving sustainable agricultural development for food security under climate change. In this regard, efforts have been geared toward sustainable land use and management practices, as changing climate adds to already existing resource problems of water scarcity, soil degradation, and pollution. Within the Rural Program for Inclusive Economic-Climatic Resilience, along with delivered dedicated training on techniques and practices of conservation agriculture, grants were offered to purchase agricultural equipment for no-till, mini-till technologies, in some cases combined with precision agriculture. Through the Fund for subsidizing agricultural producers, the Government annually allocates financial resources to motivate investments in both the consolidation of agricultural land plots and for the acquisition of agricultural equipment. Implementation of these technologies aim at continued vitality of agricultural economy, while enhancing environmental benefits and building climate resilience. It seeks to promote the profitability of agricultural producers throughout the country while restoring or enhancing natural resources, with special focus on soil conservation.

The International Fund for Agriculture Development (IFAD), through *Rural Resilience Project* (2017-2023) contributes to the improvement of smallholder and agribusiness adaptive capacity providing support to enhance climate-resilient irrigation and rainwater harvesting infrastructures; promoting investments for the application of conservation agriculture, irrigation technologies, integrated pest management, crops diversification and investments in post-harvesting and processing technologies.

Despite the progress made in the sector, a number of serious gaps still persist, in particular related to methodological aspects of applying conservation agriculture technologies and practices, which are of particular importance for success of this type of agriculture.

Promoting tolerant seed varieties with increased resistance to drought is a measure that complements conservation agriculture. The Catalogue of Plant Varieties registers new varieties of plants with higher resistance to drought conditions. Through the FAO support, the State Commission for variety testing benefited from advanced laboratory equipment to identify the best seeds in the process of varieties testing, that helps in approval of early varieties resistant to adverse climatic conditions.

The introduction of new policies, based on an integrated approach within the different climate change scenarios, as well as the adoption of action plans for managing river basins with sustainable water use, are some of the most important current and long-term adaptation priorities of the **Water Sector** to achieve the goal of country's water security in support to sustainable development. The sector promoted the efficiency in the management of water resources through active involvement of created river basin committees and sub-committees, covering 80% of the country's territory, with the main objective to implement the two Water Management Plans for the Dniester River Basin and the Danube – Prut – Black Sea area. District level committees provided guidance and supervision in implemented adaptation measures oriented toward consolidation of river banks within the river districts, clearing the rivers, arranging and rehabilitating springs and streams, removing waste and garbage.

The project "*Strengthening the institutional framework in the water supply and sanitation sector in the Republic of Moldova*" implemented a Small Grants Program for Environmental NGOs, addressing local, sub-basin level issues.

Flood risk and drought risk management plans are being developed based on the hydrographic districts, that will include priority actions related to the rehabilitation and development of the flood protection infrastructure, as well as adequate water resource management measures in the case of drought.

Being one of the main priorities of the sector, water security involves maintaining and capitalizing on water resources, providing water services and mitigating water risks to optimize the benefits for the economy, people and the environment. As part of the World Bank Project *"Diagnosis and prospects for water security in the Republic of Moldova"* the risks of water shortage were evaluated.

In addition to the activities oriented toward development of sector-specific adaptation enabling environment during the NAP-1, the **Health Sector** implemented actions to strengthen the epidemiological surveillance of vector-borne diseases and health system capabilities to ensure the provision of medical assistance to the population during the heat waves. The data on air quality, surface water, ground-water and soil quality have been monitored and evaluated. In order to improve the capacity of the health sector to adapt to the climate change, a *"Guide for investigation and response to outbreaks caused by consumption of unsafe food and water"* was developed and widely distributed among health sector practitioners, along with guidance on the implementation of good practices for managing medical waste.

A number of awareness, education and prevention measures have been implemented to inform the general public about the danger of air pollution, the impact of increased air temperature in the context of global warming, in particular during heat waves, correct behavior of the population during the high heat. In this context, the Ethics Committee has undertaken an examination on the efficiency and correctitude of information disseminated to general public on the impact of and behavior during the heat waves and other extreme weather events through media channels.

Although there are well-established public policies in the RoM to promote human health, the country is not yet sufficiently prepared to deal with the range of problems associated with the consequences of climate change and more proactive action of health agencies, in particular of primary health care facilities, is to be adopted.

Similar to health sector, the **Forestry Sector** strengthened its sector-specific adaptation enabling framework within the NAP-1. At the action level, afforestation measures were implemented with benefits for both adaptation and mitigation of climate change, and contributed to increasing the biological diversity. Special attention was paid to the planting of forest belts for the purpose of agricultural land and water protection. Measures were taken to create forest plantations for industrial and energy needs, as well as planting energy crops to meet population needs for heating and food preparation.

Extensive ecological reconstruction works were carried out in forestry areas, along with identification of the degraded land for further afforestation, along with growth of forest reproductive material.

During the National Day for Greening of local communities, implemented with the aim to encourage local population to take part in green activities, the LPA have been provided with tree reproductive material in the amount of 1.0 million MDL, to be used for creation of urban and rural green spaces.

Managing the interactions between climate change, land use, and terrestrial ecosystems is still a challenge at sector and national levels, and it requires efficient policy instruments that can help in ensuring conservation and sustainable use of forests, implementation of ecosystem-based adaptation strategies and ecosystem services programme.

For the **Energy Sector** of the country, promoting the use of energy from renewable sources operating on environmentally friendly technologies is a major priority of the sector. In this regard, the existing regulatory framework provides for the support of investors in electricity generation installations from wind, photovoltaic, biogas and solid biomass cogeneration plants by granting fixed tariffs and a fixed price. Currently, wind power plants with a cumulative power of over 27 MW are installed, complemented by the photovoltaic power plants with a cumulative power of 3.9 MW and biogas cogeneration power plants with a capacity of 5.7 MW.

The promotion of gradual transition from the use of traditional fuel sources to the use of biofuel evolves actively in the country, according to the statistical data (Energy Balance Edition 2018) in 2017, with over 26% of the total energy used in the Republic of Moldova -originating from biomass or, over 47% of the total energy used for heating and cooling is biomass.

According to the Report of the National Agency for Regulation in Energy for 2018, the loss of thermal energy in the networks decreased from 21.1% in 2017 to 19.5%. The main national producers of electric and thermal energy (Termoelectrica S.A. and CET – Nord S.A.), implemented projects to streamline the process of energy production and supply.

Regarding the power sector, it is worth mentioning that, during the last years (2015-2018) there is a positive evolution of reducing the electricity loss in the grid; thus, for 2018 it represents on average 8.12-8.87% of the total volume of electricity; at the same time, the National Agency for Energy Regulation approved for 2018 investments of over 870 million MDL for the improvement of the electricity sector.

Promotion of energy efficiency and renewable sources is seen as an urgent priority of energy sector; therefore, the annual *Moldova Eco Energetica* event is organized as an umbrella concept. The campaign finalizes with an award event of the best implemented projects, technologies and ideas in the area of Energy Efficiency and Renewable Energy Sources.

In the **Transport Sector**, the technical projects for repair, reconstruction and construction of the national roads are designed according to the Practical Codes developed to meet the needs of the roads adapting to climate change. At the same time, the sustainability of the transport infrastructure is ensured by use of materials resistant to temperature fluctuations and floods.

Recently, a number of regulatory acts were approved for classification and periodicity of the execution of the works of maintenance and repair of public roads, prevention and combating snow on public roads, limitation of the movement of the high tonnage vehicles on some roads.

The construction of better-quality roads, resistant to climatic effects, would help to increase the competitiveness of the sector and the security on the roads. For this to be achieved, the transport sector of Moldova needs to catalyze public and private sector investments and enhance climate action for building a reliable transport infrastructure network.

5.5.5. Barriers, Challenges and Gaps Related to the Planning and Implementation of Adaptation

5.5.5.1. Cross-cutting and Sector-specific Barriers, Challenges and Gaps

A number of capacity-related assessments undertaken at the national and sub-national levels, in particular at sector level, have identified gaps and constrains that cumulatively act as barriers that impede progress in adaptation planning and its implementation in the key sectors of the RoM. More concretely, Institutional Capacity Assessment (ICA) carried out during NAP-1, application of Vulnerability and Resilience Indicators Model and Livelihood Vulnerability Index within NC3 to UNFCCC (2010)[318] and climate change impact sectorial assessments within the NC4 to UNFCCC (2018)[319], the Climate Change Adaptation Strategy and its implementation Action Plan until 2020[320], the Technology Needs Assessment[321], the National Human Development Report in Moldova (2009-2010)[322], World Bank Technical Assistance Document[323], the FAO comprehensive assessment of the impact of 2012 drought impact in the RoM[324]; development of the RoM's Country Programme for the engagement with GCF, stocktaking exercise for the preparation of NAP, other project-based assessments undertaken by the national and external stakeholders have revealed the barriers to effective sectorial adaptation arising from uncertainties of future climate and socioeconomic conditions, as well as financial, technologic, institutional, and individual knowledge limitations.

The main systemic impediments for an increased political commitment in addressing climate change adaptation include: (i) insufficient prioritization of climate change adaptation in national political agenda, with the focus of politicians on the immediate needs for economic growth; (ii) insufficient knowledge of high-level decision makers on the magnitude of the climate change impacts and the threat to economic growth and ecosystem services; (iii) insufficient statistical data and climate impact studies on health and wellbeing through a gender perspective.

The national actors, benefiting from the engagement and the participation in the climate change global agenda, have a limited awareness and knowledge of trends and opportunities presented by the climate change global agenda, particularly regarding the opportunities for a range of information, tools, technical assistance, and project funding.

Legislation and policy papers have the following weaknesses: (i) climate impacts are addressed insufficiently in sectorial legislation and policies, even in highly climate-sensitive sectors such as agriculture, forestry and health; (ii) the lack of a specific reference to climate change in many laws hinders the development of sectorial adaptation programs, because ministries and agencies cannot request funding for adaptation-related activities without explicit powers in the area of adaptation to climate change; (iii) strategies do not take into account or do not include climate change adaptation considerations in proposed sectorial measures and objectives, even when these objectives are directly affected by climate variability and climate change.

The government has clear lines of communication and skills within individual institutions and agencies, while cross-sectorial coordination of information and strategies needs improvement. These impediments are a major constraint on the national government's ability to link environmental and development strategies to the impact of climate change. Efforts are being made to move towards a more coordinated and integrated approach to climate change adaptation. The inter-sectorial Coordination Mechanism led by the National Commission on Climate Change, including the M&E component, combined with the National Adaptation Planning process, is expected to be a high-impact national strategic initiative specifically addressing climate change.

The number of climate-induced disasters in the RoM is increasing[325]; for this reason, additional efforts are required, first of all, to: (i) strengthen the forecasting capacities of severe weather conditions; (ii) increase disaster preparedness and emergency response; (iii) implement adaptation measures in agriculture and other highly-exposed sectors[326]. This situation needs to be addressed in order to allow adequate response to dangers and other challenges of the evolving climate.

The constraints and impediments on institutional capacities faced by the RoM presented in Tables 5-53 and 5-54 do not allow to respond effectively to the impacts of climate change; therefore, the Capacity Development Program (CDP) up to 2025 was developed based on institutional capacity assessment of seven key sectors (water, agriculture, energy, health, transport, forestry and regional development) of the RoM undertaken during the NAP-1.

It reflects the sectorial and cross-sectorial needs of the country and the priority capacity building actions to be pursued. When the Government's decision on the Climate Change Coordination Mechanism and the M&E framework is enacted, the NCCC will take over the surveillance of adaption activities.

318 Third National Communication of the Republic of Moldova, developed within the framework of the United Nations Framework Convention on Climate Change, the Ministry of Environment, Chisinau, 2014, <http://www.clima.md/doc.php?l=ro&idc=81&id=3506>

319 Fourth National Communication of the Republic of Moldova, developed within the framework of the United Nations Framework Convention on Climate Change, Chisinau, 2018, <http://www.clima.md/doc.php?l=ro&idc=81&id=4256>

320 GD no. 1009 of 10.12.2014 regarding the Republic of Moldova's 2020 Climate Change Adaptation Strategy and its implementation Action Plan, Official Gazette no. 372-384 of 19.12.2014.

321 <http://www.tech-action.org/Participating-Countries/Phase-1-Asia-and-CIS/Republic-of-Moldova>

322 UNDP: The National Human Development Report in Moldova (2009-2010). <http://www.md.undp.org/content/moldova/ro/home/library/human_development/nhdr-2009.html>

323 World Bank. 2016. Moldova - Climate adaptation investment planning technical assistance (English). Washington, D.C.: World Bank Group, <http://documents.worldbank.org/curated/en/469311500273762091/Moldova-Climate-adaptation-investment-planning-technical-assistance>

324 FAO, 2012: Comprehensive assessment of the 2012 drought impact in Moldova, <http://www2.un.md/drought/2012/Moldova_drought_report_RO.pdf>

325 <http://dse.md/sites/default/files/pdf/Indicii%20statistici%2010%20ani%202008-2017.pdf>

326 <http://www.old.meteo.md/bm20102013.htm>

Table 5-53: Summary of Cross-sectorial Climate Change Adaptation Barriers and Gaps

Policy framework and institutional capacities	Climate change adaptation capacity level barriers and gaps		
	Systemic	Organizational	Individual
National Development Policies	Climate change and adaptation are not sufficiently mainstreamed into national development strategies. Insufficient political will to prioritize climate change at national level.	Reporting on climate-related issues is not consolidated. The adaptation-related "portfolio" is not seen from a holistic and programmatic approach perspective.	Decision-makers do not perceive adaptation as a development issue.
Economic and Sectorial Development Policies	Laws in climate-sensitive sectors do not sufficiently address climate change and adaptation as an integral aspect of the sector.	Ministries and other agencies in climate-sensitive sectors do not have a clear legal mandate to conduct work on adaptation.	
Environment Policies	Climate related strategies are in their early stages and are not yet reflected in sectorial policies.	Restructuring and shifts in program mandates often lead to low availability of program-related information. There is need to prepare compelling budget requests that explain the development linkages of environmental programs.	Decision-makers and staff lack specialized knowledge to design and implement climate change adaptation programs.
Public Admin/Public Management	Frequent institutional reorganizations lead to lack of continuity; loss of data and institutional memory. Climate change adaptation portfolio is not sufficiently evaluated or monitored. Lack of ongoing support for adaptation initiatives leads to continuity gaps.	Government agencies may report on program implementation but they do not necessarily incorporate lessons learn into program design. Unclear alignment between agency budgeting and policy priorities.	Sectorial agencies may lack the skills to analyze the data they collect and utilize the findings from adaptation-related projects. Staff often lacks specialized training or mentoring.
Gender and Vulnerable Groups	Climate change adaptation is not sufficiently mainstreamed into legislation on human health and related social services.	Limited understanding of methodological approach to mainstream adaptation at organizational level. Limited gender disaggregated data on climate change impact.	Low level of awareness about climate adaptation and related practices hinders development of community resilience.
Disaster Risk Reduction	Climate change and climate change adaptation are not sufficiently mainstreamed into legislation on disaster preparedness.	Lack of a comprehensive strategy.	Low level of awareness about disaster risk reduction practices that may improve adaptive capacity.
Communication and Public Awareness	Insufficient guiding policies and/or strategies on communication and awareness raising with regard to climate risks.	Limited understanding within government and lead agencies on the need for communication and awareness raising.	Low level of awareness about communication practices that may improve community resilience.
Knowledge Management	Lack of guiding policies and/or strategies on knowledge management.	Limited understanding within government and lead agencies on knowledge management.	Climate change, its impacts are not prioritized or used in daily agenda of civil servants.

Table 5-54: Summary on Sector-level Climate Change Adaptation Barriers and Gaps

Sector	Sectorial climate change barriers and gaps	
	Enabling environment	Organizational
Agriculture	- Limited link between policy, functional programming and budgeting; - Lack of access to financial resources and distortions caused by underdeveloped capital markets that also inhibits private investments; - Insufficient incentives to develop and use climate resilient and sustainable technologies for soil conservation combined with neglected agricultural externalities (pollution, degradation, etc.); - Lack of professional institutions to promote sustainable markets and lack of research in development and adoption of technology systems adapted to climate change; - Macro-economic conditions that affect subsidies, import duties and creates market distortions; - Poorly developed logistics and supply system; - Limited methodologies for climate impact measurement of related policies, plans and available financial resources.	- Limited technical and financial ability to update and upgrade old and degraded infrastructure; - Poor prioritization of climate-related issues at sector and organizational level; - Limited technical knowledge and lack of a program to train officials on climate change and climate change adaptation issues; - Adaptation to climate change is not an opportunity for employment.
Water	- Lack of appropriate sectorial legislation linking CCA to IWRM; - Lack of a clearly defined inter-agency coordination mechanism with regard to integrated water management; - Lack of a coordinated system for monitoring the sector and for assessing/ responding to climate risks; - Limited link between policy, functional programming and budgeting; - Limited methodologies for climate impact measurement of related policies, plans and available financial resources.	- Lack of prioritization of climate related issues (and policy-based budgeting); - Limited oversight of programs; - Limited technical knowledge and lack of a program to train officials on climate change and CCA issues; - Limited financial capacity to update and upgrade old and degraded infrastructure; - Insufficient capacity to provide access to clean drinking water supply to the rural population; - Adaptation to climate change is not a focus for employment.
Forestry	- Limited integration of adaptation measures in the development plans of enterprises, national and sectorial plans due to lack of a regulatory framework that addresses climate change; - Lack of climate adaptation target requirements in the legal documents; - Limited financial and institutional capacity to improve governance and implementation capacity; - Limited ability to conduct economic analysis of costs and benefits of climate adaptation interventions to support increased adoption of new approaches; - Inadequate methodologies for climate impact measurement of related policies, plans and available financial resources.	- Shortage of highly qualified scientists specializing in forestry; - Insufficient administrative capacity.

Sector	Sectorial climate change barriers and gaps	
	Enabling environment	Organizational
Health	- Enacted strategy to address climate related health impacts; - Limited ability to expand service networks in the rural areas; - Limited staffing, equipment, and financing of the public health system; - Insufficient capacity to assess and monitor vulnerability to climate change-related health risks, including gender assessment; - Need to strengthen primary health care (including primary prevention) services to support capacity of local communities to become resilient to climate-related health risks; - Development (and ongoing assessment) of health and emergency management measures for reducing the impact of extreme events on health; - Need for improved integration of health considerations into other critical national polices and strategies.	- Limited implementation mechanisms, monitoring, and inter-sectorial coordination; - Limited staffing, equipment, and financing; - Limited support for adaptive approaches and technologies; - Limited climate related awareness, technical skills and knowledge; - Limited methodologies for climate impact measurement of related policies, plans and available financial resources; - Limited support for adaptive approaches and technologies; - Adaptation to climate change is not a focus for employment.
Energy	- Limited integration of adaptation measures in the development plans of enterprises, national and sectorial plans; - Lack of climate adaptation target requirements in the legal documents; - Limited financial and institutional capacity to improve governance and implementation capacity; - Limited capacity development and training for workers and service providers.	- Limited ability to provide training and exchange of experiences with other energy organizations on best practices and techniques to reduce facility vulnerabilities; - Need to improve hydro-meteorological warning systems and develop a coordination mechanism with service providers to ensure information flow in support of operational activities; - Limited ability to conduct economic analysis of costs and benefits of climate adaptation interventions to support increased adoption of new technologies and approaches; - Adaptation to climate change is not an opportunity for employment.
Transport	- The financial resources of the Road Fund are not channeled into research of climate related risks and/or impact assessment, capacity or planning for the transport sector and a change in its governing laws is needed; - The technical standards for the design, construction and operation of networks, especially the road network, are to be adjusted to the potential impacts of climate change; - Inadequate methodologies for climate impact measurement of related policies, plans and available financial resources; - Limited management capabilities (financial, technical and commercial) in the road maintenance system.	- Limited technical ability to organize and create the necessary technical adaptation options to climatic events; - Lack of floating units, new machinery and hydraulic structures that would allow entities to repair and rehabilitate infrastructure; - Lack of an efficient policy document (plan or program) to address the removal of obsolete and non-complying vehicles from the State Register and the monitoring of scrapping operations; - Limited integration of adaptation measures in the development plans of enterprises, national and sectorial plans; - Adaptation to climate change is not an opportunity for employment.

5.5.6. Climate Change Adaptation Monitoring and Evaluation System (M&E)

The RoM, in its efforts to establish an integrated NAP process at national level and SAP process at sectoral level, has aligned the functionality of Climate Change Adaptation Monitoring and Evaluation System to the planning cycle of NAPs and SAPs. The proposed M&E framework is based on the need to monitor progress towards achieving resilient economic growth. Using a sectoral planning approach aligned to NAP approach to adaptation requires monitoring of sector-based activity as well as their aggregate impact on the overall country's economy and further communication of adaptation efforts at sector and national levels.

The M&E system for the adaptation component was designed to serve the following purposes:

- create a set of overarching adaptation goals to which each sector will contribute,
- track and monitor individual sectoral objectives and indicators,
- allow for iterative planning and continuous, evidence-based adaptation planning,
- enforce the gradual integration of adaptation priorities in regular development planning,
- ensure transparency of adaptation process and data collection,
- measure and monitor the outcomes and impacts of adaptation activities, investments, programmes on women and men's resilience to climate change from a gender-responsive perspective.

Ultimately, the goal of the M&E system is to ensure the measurability of progress across geographic scales, time and sectors, and to be able to determine whether, as a result of its successive plans, the Republic of Moldova is less vulnerable to the impacts of climate change.

Through the M&E system, the National Commission on Climate Change will monitor:

- progress and evaluate impacts of implemented policies,
- implementation of adaptation related planning,
- development and dissemination of adaptation related knowledge and research, including guidance materials, methodology, tools and instruments,
- implementation of adaptation technologies and practices,
- adaptation related financing and investments, including the external support received,
- adaptation related quality assurance process.

The proposed M&E framework would allow for monitoring and planning along a 3-tier approach: (1) *micro-level monitoring* is targeted at assessing the adaptation result of individual actions (i.e., at the output level); (2) *meso-level monitoring* allows for tracking of adaptation achievements at the outcome level; (3) *macro-level monitoring* is conceived to evaluate or periodically assess the global, cumulative impact of all sectoral adaptation actions.

The reporting system adopts an *indicator-based reporting format* at different levels, consisting of indicators for tracking and evaluating the success of adaptation support and adaptation interventions.

The M&E system, therefore, includes several types of system – based indicators: (a) *driver indicators*: Indicators designed to measure the result of actions targeting the drivers of change; (b) *output indicators:* Indicators designed to measure the result of adaptation actions included in SAPs; (c) *outcome indicators:* Indicators designed to measure the result of SAPs in terms of reduced sectoral vulnerability and advance in adaptation/resilience; (d) *objective indicators:* Indicators designed to measure the aggregate result of a NAP cycle, in terms of impacts on the vulnerability of the national economy and progress in adaptation.

The developed indicator-based monitoring system is to be operated through the *Climate Change Adaptation Information System* consisting of:

- *A portal* intended for presenting the public information related to the sectors of the national economy: policy documents stipulating adaptation targets, reports on vulnerability & adaptation assessments, publications, reports on evaluations, other materials.
- *A monitoring platform* designed to create, monitor and evaluate indicators by domain, focus area, level of development, data provider, calculation methodologies/formulas, spatial level, reference period, frequency of data collection, expected adaptation trend and other monitoring and evaluation options based on templates.

Given its crosscutting nature, the adaptation action requires mobilization of internal and external financial resources, as well as scaling up national investments in climate finance, from both public and private sources. Therefore, as part of the M&E system, in the RoM a *Climate Budget Tagging* (CBT) process is under implementation, that aims at improving the understanding of how and how much is being spent on national climate change responses, through which programs funds are being spent, and which programs include climate change objectives (or co-benefits). This process supports the ability of the Ministry of Finance and the Ministry of Environment to track climate expenditures and improves their ability to ensure progress on climate change as related to the national development goals and international commitments.

Under the CBT tracking system, it is proposed that the monitoring of sectoral work plans is based on output indicators at the activity level and outcome indicators at the programme level.

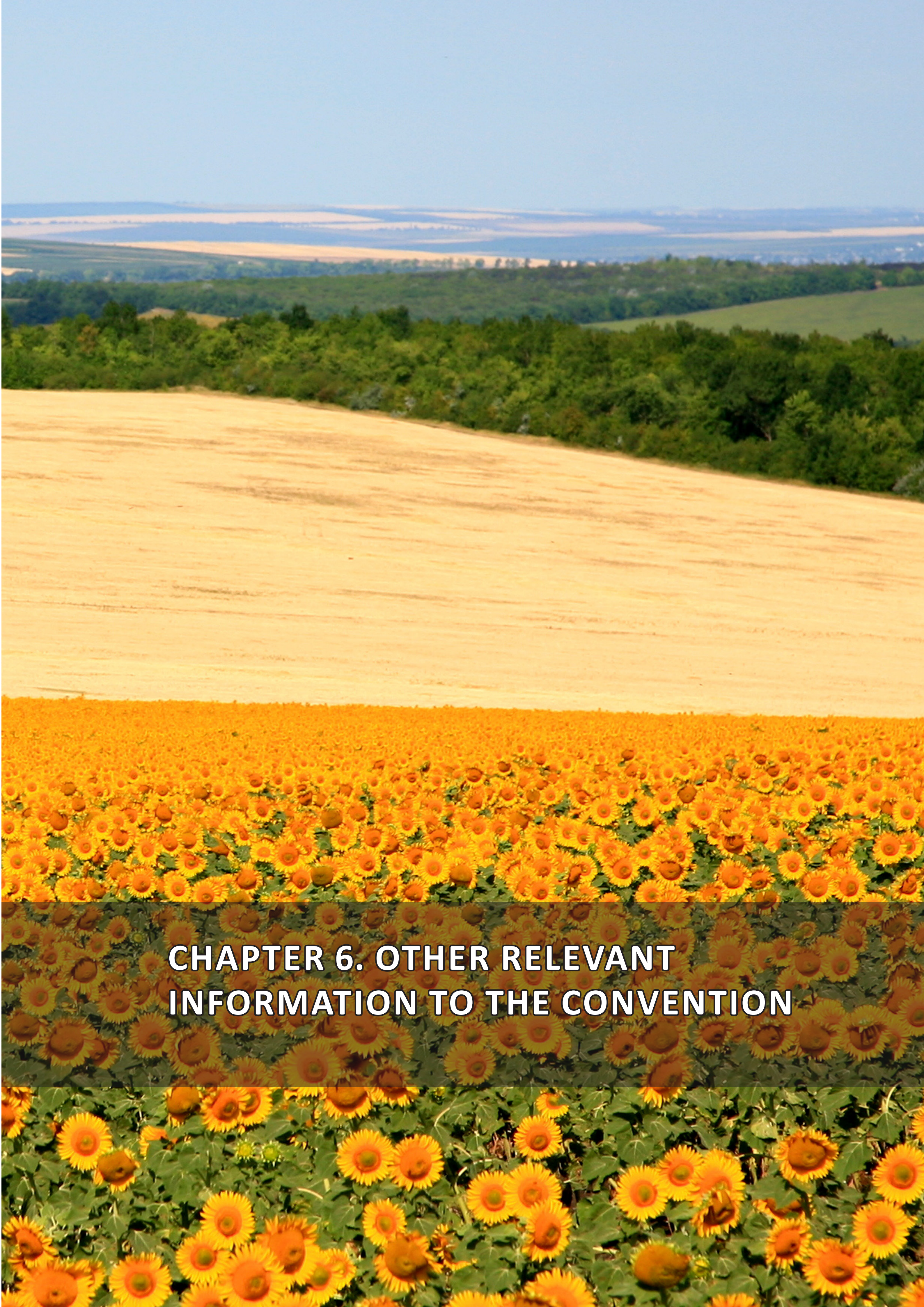
Four Climate Change Budget Indicators (CCBIs)/climate markers have been established: (1) Policy development and governance; (2) Research and development; (3) Knowledge sharing and capacity building; (4) Climate response and service delivery.

Table 5-55: Climate Change Adaptation Monitoring and Evaluation Priorities of RoM

Climate change adaptation monitoring, reporting and evaluation priorities	Actions in support to activity implementation
Increase the efficiency for delivering climate goals and finances at national level through operationalization of the M&E system in support to the Coordination Mechanism.	- Enforcement of Government Decision on CCCM, including M&E system
Use existing or develop new methods and tools to measure, monitor and report on country's adaptation commitment made under the current updated NDC.	- Apply the M&E system to measure the progress of implementation of adaptation component of NDC.
Develop an evaluation framework to capture how well climate risk management is integrated into national and sub-national development.	- Evaluate the extent of climate risk management integration into development policy and planning.
Evaluate country's institutional level capacities to address mid- and long-term adaptation issues.	- Assess institutional flexibility and resilience to respond to climate change and related risks uncertainty. - Undertake qualitative assessments of the management competency and performance of state institutions, climate-related agencies in addressing climate risks and related issues. - Climate risk management by key national and local authorities.
Operate the indicator-based system through the *Climate Change Adaptation Information System* components:	- Full operation of the portal presenting public information related to the sectors of the national economy. - Full operation of the monitoring platform to create, monitor and evaluate indicators.
Apply the indicator-based reporting and monitoring system to evaluate:	- the extent to which the adaptation intervention has reduced the vulnerability of individuals and households to hazards associated with climate variability and change; - the extent to which the adaptation intervention has increased the resilience of key sectors and natural/managed systems on which population depends; - the extent to which the adaptation intervention has helped the country to maintain the development performance and to reach SDGs.
Assess and track progress under the successive NAPs, SAPs through monitoring and measuring:	- the attainment of the overarching adaptation goals and individual sectoral objectives; - the enforcement of the gradual integration of adaptation priorities in regular development of planning, the implementation of adaptation related planning and the impacts of implemented policies, including guidance materials, methodology, tools and instruments; - the development and dissemination of adaptation related knowledge and research; - the transparency of adaptation process and data collection; - the outcomes and impacts of NAP/SAP adaptation activities; investments, and programmes on resilience to climate change, including from a gender-responsive perspective.
Monitor the implementation of adaptation technologies and practices.	- Monitor and assess the contribution of the programme or project to country's priorities for climate-resilient development and demonstration of low-emission development co-benefits.
Monitor adaptation related financing and investments, including adaptation-related external support received.	- Use the climate tagging of the national public budget for public scrutiny of government and donor spending on tackling climate change issues and generating data on climate investments.

All the above-mentioned components: CCCM, M&E system including Climate Change Adaptation Information System and climate budget tagging (CBT) will be operationalized through a dedicated Government Decision that has been developed and is under consideration for being approved.

CHAPTER 6. OTHER RELEVANT INFORMATION TO THE CONVENTION



CHAPTER 6. OTHER RELEVANT INFORMATION TO THE CONVENTION

6.1. Integrating Climate Change Mitigation and Adaptation Aspects into National Development Priorities, Social, Economic and Environmental Policies

The National Development Strategy "Moldova 2030"[327] (NDS 2030) mentions: *"Global climate change defines new challenges, which will become even more pronounced in the near future. Many of the impacts of global climate change and the associated costs are not yet fully realized. (...) Climate change affects all areas of a state's development. Most sectors are vulnerable to climate change and are affected by extreme phenomena occurring in the country. In this context, measures to adapt to the climate change phenomenon and reduce greenhouse gas emissions must be promoted"*.

According to the NDS 2030, a higher quality of life requires achieving sustainable and broad social progress in 10 dimensions, including the quality of the environment. The Strategy is aligned with the Sustainable Development Goals (SDGs).

In September 2015, the Republic of Moldova, together with 192 other UN Member States, committed to implement the 2030 Sustainable Development Agenda by adopting the Declaration on the New York Summit for Sustainable Development.

According to the NDS 2030, the progressive development of the RoM is approached in the light of an advanced regional cooperation, including in terms of overcoming the challenges related to climate change. In this regard, in the last ten years the RoM has ratified two documents of primary importance for the country's development:

- Association Agreement between the RoM, от the one part, and the EI and the European Atomic Energy Community and their Member States, of the other part[4] (AA RM-EU, 2014);
- Accession of the RoM to the Treaty establishing the Energy Community[328] (TEC, 2010).

The commitment to implement the European standards on climate change mitigation of the AA RoM-EU is set out in Chapter 17, in particular in Article 95, which provides for 'development and implementation of:

a) a global climate strategy and action plan for long-term climate change mitigation and adaptation;
b) a low-carbon development strategy;
c) long-term measures to reduce greenhouse gas emissions;
d) measures to prepare for carbon trading;
e) measures to promote technology transfer on the basis of technology needs assessment;
f) measures to integrate climate considerations into sectoral policies and measures relating to substances that affect the ozone layer."

According to the same document (Annex XII), the RoM undertakes to progressively approximate its legislation to the following EU legislation and international instruments in climate change:

- Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a system for GHG emissions allowance trading within the Community[329] – by 2022;
- Commission Regulation (EC) no. 619/2008 842/2006 on certain fluorinated greenhouse gases, replaced by Regulation (EU) no. 517/2014 of the European Parliament and of the Council of 16 April 2014[330] – by 2018;
- Commission Regulation (EC) no. 619/2008 1005/2009 on ozone-depleting substances[331] – by 2019;
- Directive no. 98/70/EC on the quality of petrol and diesel fuels[332] – by 2019.

Within the Energy Community, the following EU acquis are to be taken into account:

- Regulation (EU) no. 525/2013 on the mechanism for monitoring and reporting greenhouse gas emissions and reporting other information at national level (no longer in force as of 01.01.2021)[333];
- Directive 2009/28/EC on the promotion of use of energy from renewable sources[334];
- Directive 2012/27/EU on Energy Efficiency[335];
- Directive 2010/31/EU on Energy Performance of Buildings[336].

For climate change, the following two pieces of EC legislation are recommended for implementation:

1. Recommendation 2016/02/MC-EnC on preparation for the implementation of Regulation (EU) 525/2013

[327] Government Decision no. 377 of 10.06.2020 approving the draft Law on approval of the National Development Strategy "Moldova 2030", Official Gazette of the Republic of Moldova no. 153-158 of 26.06.2020, art. 508, <https://www.legis.md/cautare/getResults?doc_id=121920&lang=ro>

[328] Law no. 117 of 23.12.2009 on accession of the Republic of Moldova to the Treaty establishing the Energy Community, Official Gazette of the Republic of Moldova no. 8-10 of 22.01.2010, art. 06, <https://www.legis.md/cautare/getResults?doc_id=3445&lang=ro>

[329] EUR-Lex. Directive 2003/87 / EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Union and amending Council Directive 96/61 / EC. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02003L0087-20200101>

[330] EUR-Lex. Regulation (EU) 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing Council Regulation (EC) 842/2006. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014R0517>

[331] EUR-Lex. Commission Regulation (EC) 1005/2009 of the European Parliament and of the Council of 16 September 2009 on substances that deplete the ozone layer <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02009R1005-20170419>

[332] EUR-Lex. Directive 98/70/EC of the European Parliament and of the Council of 13 October 1998 relating to the quality of petrol and diesel fuels and amending Council Directive 93/12/EEC. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A31998L0070>

[333] EUR-Lex. Regulation (EU) 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32013R0525>

[334] EUR-Lex. Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02009L0028-20151005>

[335] EUR-Lex. Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02012L0027-20210101>

[336] EUR-Lex. Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02010L0031-20210101>

on a mechanism for monitoring and reporting greenhouse gas emissions[337];

2. Recommendation 2018/01/MC-EnC on preparing for the development of integrated national energy and climate plans[338].

Meanwhile, following Decision 1/CP21, in 2020, the RM updated the intended Nationally Determined Contribution (NDC) submitted in September 2015 to COP 21 of the UNFCCC. The updated NDC was registered by the UNFCCC on March 4, 2020[339]. In the updated NDC (2020), the RM intends to achieve more ambitious targets than in the intended NDC (2015). The new, unconditional target, encompassing the entire economy of the country, provides for the reduction of greenhouse gas emissions by 70% in 2030 compared to 1990, compared to the 64-67% assumed in the intended NDC. As regards the conditional target, instead of 78% under the intended NDC (2015), the reduction commitment expressed above could be increased to 88% below the level of emissions recorded in 1990, provided that a global agreement is reached, which would address important issues, including low-cost financial resources, technology transfer and technical cooperation, accessible to all on a scale commensurate with the challenge of global climate change.

In terms of the commitments assumed within the AA of the RM with the EU, the Energy Community Treaty as well as the intended NDC (2015) the following are already approved by now:

1. The LEDS until 2030 and the Action Plan for its implementation[340]. The LEDS 2030 contains 51 measures to reduce GHG emissions under the NDC.
2. The Law on ratification of the Paris Agreement, adopted on 4 May 2017[341] by which the country undertakes to achieve the objectives of the NDC.
3. The Law on Promoting the Use of RES[342]. The new amendments proposed to this law require 25% of energy demand to be covered by renewable sources by 2025.
4. The Sustainable Development Fund, which aims to continue activities to ensure the sustainability of projects funded by the Millennium Challenge Corporation and of programs and projects funded by other donors[343].
5. The Energy Roadmap 2015-2030[344]. The objective of the roadmap is to create the normative, institutional and organizational framework in the electricity and natural gas sector, as well as to ensure the security of electricity and natural gas supply, following the achievement of the specific objectives stipulated in the Energy Strategy of the RoM until 2030. The Roadmap for the Energy sector determines the process of evaluation, reporting and the mechanisms for monitoring progress in the implementation of the actions set out.
6. New modules in the vocational education system: “Energy Plants, Renewable Energy Sources” and “Solid Biofuel Heating Stations” with the related trade “Boiler Room Operator”[345] and “Installation of the Solar Thermal Installation” and “Operation of Heating and Solar Thermal Installations” with the related trades “Heating Installations and Solar Equipment Installer” and “Ventilation and Air Conditioning Installations, Appliances and Equipment Installer”[346].
7. Program for the promotion of the “green” economy for 2018-2020 and the Action Plan for its implementation (approved by GD no.160/2018). The program integrates the priorities for promoting “green” economy according to the Final Declaration of the United Nations Conference on Sustainable Development “The Future We Want” (Rio de Janeiro, 20-22 June 2012). The program introduces a short list of green growth indicators for Moldova, and the Program Implementation Plan provides for 84 actions.
8. The Greening of Small and Medium-Sized Enterprises (SME) Program, adopted by the Government Decision no. 592 of 27.11.2019[347], which provides for the implementation of actions to encourage SMEs to adopt more environmentally friendly business practices. The introduction of instruments and good practices aimed at greening of SMEs pursues the objective of fostering sustainable development and enhancing international economic competitiveness.
9. The Country Program of the RoM for employment with the Green Climate Fund for 2019-2024, takes into account the national development priorities, objectives and climate-related targets of the country that come from the strategic documents. The paper presents the analysis of existing capacities and gaps, needs and funding opportunities related to climate change mitigation and adaptation at national and sector level. By engaging with GCF, the MAFI, as the National Designated Authority (NDA), will improve its capabilities and leadership in providing technical knowledge and expertise in climate change, along with improved capabilities for managing the national mechanism for coordinating trans-sectoral climate change planning and implementation. The Country Program (CP) is conceived as a living document, with subsequent regular updates of the priority investment areas, depending on the country’s internal circumstances and climate change impact, as well as updating the flow of ideas and project proposals.

[337] Energy Community. Recommendation 2016/02/MC-EnC on preparing for the implementation of Regulation (EU) 525/2013 on a mechanism for monitoring and reporting greenhouse gas emissions. <https://www.energy-community.org/legal/other.html>

[338] Energy Community. Recommendation 2018/01/MC-EnC on preparing for the development of integrated national energy and climate plans by the Contracting Parties of the Energy Community. <https://www.energy-community.org/legal/other.html>

[339] <https://www4.unfccc.int/sites/ndcstaging/Pages/LatestSubmissions.aspx>

[340] Government Decision 1470 of 14.12.2016 approving the Low Emission Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation, Official Gazette of the Republic of Moldova no. 85-91 of 24.03.2017, art. 1470, <https://www.legis.md/cautare/getResults?doc_id=98493&lang=ro>

[341] The Law no. 78 of 04.05.2017 on ratification of the Paris Agreement, the Official Gazette of the Republic of Moldova no. 162-170 of 26.05.2017, art. 282, <https://www.legis.md/cautare/getResults?doc_id=99251&lang=ro>

[342] The Law on promoting the use of energy from renewable sources no. 10 of 26.02.2016, Official Gazette of the Republic of Moldova no. 69-77 of 25.03.2016, art. 117 <https://www.legis.md/cautare/getResults?doc_id=106068&lang=ro>

[343] Government Decision no. 903 of 31.12.2015 on the public institution “Fund for Sustainable Development Moldova”, Official Gazette of the Republic of Moldova no. 2-12 of 15.01.2016, art. 08, <https://www.legis.md/cautare/getResults?doc_id=90499&lang=ro>

[344] Government Decision no. 409 of 16.06.2015 on the roadmaps in the field of energy for 2015-2030, Official Gazette of the Republic of Moldova no. 177-184 of 10.07.2015, art. 472, <https://www.legis.md/cautare/getResults?doc_id=77316&lang=ro>

[345] Ministry of Education of the Republic of Moldova, Order no. 858 of 04.10.2016 approving the curriculum for secondary technical vocational education.

[346] Ministry of Education of the Republic of Moldova, Order no. 783 of 22.09.2016 approving the curriculum for secondary technical vocational education. <https://mecc.gov.md/sites/default/files/curriculum_ventilare_incalzire.pdf >

[347] Government Decision no. 592 of 27.11.2019, approving the Greening of Small and Medium-Sized Enterprises Program, Official Gazette of the Republic of Moldova no. 360-366 of 06.12.2019, art. 907, <https://www.legis.md/cautare/getResults?doc_id=119235&lang=ro>

10. National Program for Research and Innovation for 2020 to 2023[348]. The strategic priorities in research and innovation for 2020-2023 set out in the Program correspond to the priorities in the country's strategic development document – the National Development Strategy "Moldova 2030", the sectoral strategies and the EU framework research and innovation programs. The strategic priority no. III of the document corresponds to 'Environment and Climate Change', and looks at: Impact of biotic and abiotic factors on the environment and society; Safe, clean and efficient energy; Waste, plastics and pollutants; Ecological security; Biodiversity conservation. In 2019, the National Agency for Research and Development (NARD) announced the launch of the competition "State Program" (2020-2023) to finance fundamental and/or applied scientific research projects, including strategic priority III. The results of the contest are posted on the NARD website[349].
11. Regulation on measures to reduce emissions from air conditioning systems of motor vehicles (approved by the GD no. 1242/2016)[350]. The document sets out provisions regarding the installation of air-conditioning systems for vehicles with a view to placing it on the market and on the recharging of such systems with fluorinated greenhouse gases with a global warming potential greater than 150. Directive 2006/40/EC of the European Parliament and of the Council of 17 May 2006 related to emissions from air-conditioning systems in motor vehicles and amending Council Directive 70/156/EEC.
12. The Law on Environmental Pollution Payments no. 1540/1998[351,] amended in 2019, establishes payments for environmental pollution from the use of fluorides.
13. The mechanism for coordinating climate change activities (approved by the GD no. 444/2020)[352].
14. The methodology for determining fixed tariffs and cap prices for electricity produced from renewable energy sources (approved by ANRE's Decision no. 375/2017)[353]. By ANRE Decision no. 54/2020[354], the coefficients underlying the respective tariffs and cap prices for 2020 were made public.
15. Greenhouse gas emissions and the Sustainable Development Goals (SDGs) of the country regularly reported by the NBS of the Republic of Moldova[355].
16. The National Action Plan on energy efficiency for 2019-2021 (approved by the GD no. 698 of 27.12.2019)[356].
17. The Law on Energy Efficiency no. 139 of 19.07.2018[357].

It is worth noting that climate change mitigation objectives of the of the RM are also achieved by implementing the priority economic, social and environmental policies approved before signing the AA RM - EU and the declaration of the country's NDC, which were updated, respectively, including the NDC in 2020. These are described in detail in Chapter 3. The most relevant of these include:

1. The National Energy Efficiency Program for 2011-2020 (approved by the GD no. 833/2011)[358];
2. The Energy Strategy until 2030 (approved by the GD no. 102/2013)[359];
3. The National Action Plan on Renewable Energy for 2013-2020 (approved by the GD no. 1073/2013)[360];
4. The Law on Heat and Promotion of Cogeneration no. 92/2014[361];
5. The Law on Energy Performance of Buildings no. 128/2014[362];
6. The Law on Labeling of Energy-related Products no. 44/2014[363];
7. The Soil Conservation and Fertility Enhancement Program for 2011-2020 (approved by the GD no. 626/2011)[364] and the Action Plan for implementation of the Soil Conservation and Fertility Enhancement Program for 2014-2016 (approved by GD no. 138/2014)[365];
8. The National Agricultural and Rural Development Strategy for 2014-2020 (approved by the GD no. 409/2014)[366];

[348] Government Decision no. 381 of 01.08.2019 approving the National Program on research and innovation for 2020-2023 and the Action Plan on its implementation, Official Gazette of the Republic of Moldova no. 256-259 of 16.08.2019, art. 506, < https://www.legis.md/cautare/getResults?doc_id=115747&lang=ro>

[349] Government of Moldova. National Agency for Research and Development. <https://ancd.gov.md>

[350] Government Decision no. 1242 of 14.11.2016, approving the Regulation on measures to reduce emissions from air conditioning systems of motor vehicles, Official Gazette of the Republic of Moldova no. 405-414 of 25.11.2016, art. 1353, <https://www.legis.md/cautare/getResults?doc_id=96376&lang=ro> (amended by GD no. 1143 of 21.11.2018 on the approval of the changes that are operated in some Government Decisions, the Official Gazette of the Republic of Moldova no. 13-21 of 18.01.2019 , art. 7, <https://www.legis.md/cautare/getResults?doc_id=112021&lang=ro>)

[351] The Law on Environmental Pollution Payments no. 1540 of 25.02.1998, Official Gazette no. 54-55 of 18.06.1998, art. 378 <https://www.legis.md/cautare/getResults?doc_id=125113&lang=ro>

[352] Government Decision no. 444 of 01.07.2020 on the establishment of the mechanism for coordinating climate change activities Official Gazette no. 188-192 of 24.07.2020, art. 635 <https://www.legis.md/cautare/getResults?doc_id=122314&lang=ro>

[353] Decision of the National Agency for Energy Regulation no. 375 of 28.09.2017 on the approval of the Methodology for determining the feed-in tariffs and the prices of electricity produced by eligible producers from renewable energy sources, Official Gazette of the Republic of Moldova no. 390-395 of 10.11.2017, art. 229, <https://www.legis.md/cautare/getResults?doc_id=130191&lang=ro>

[354] Decision of the National Agency for Energy Regulation no. 54 of 28.02.2020, regarding the fixed tariffs and the cap prices for the electricity produced from renewable energy sources by the producers who will obtain the status of eligible producer in 2020, the Official Gazette of Moldova no. 94-98 of 27.03.2020, art. 229, <https://www.legis.md/cautare/getResults?doc_id=130191&lang=ro>

[355] National Bureau of Statistics of the Republic of Moldova. <https://statistica.gov.md/pageview.php?l=en&id=6306&idc=605>

[356] Government Decision no. 698 of 27.12.2019 approving the National Energy Efficiency Action Plan for 2019-2021, Official Gazette of the Republic of Moldova no. 7-13 of 17.01.2020, art. 12 <https://www.legis.md/cautare/getResults?doc_id=119890&lang=ro>

[357] The Law on Energy Efficiency no. 139 of 19.07.2018, Official Gazette no. 309-320 of 17.08.2018, art. 476, <https://www.legis.md/cautare/getResults?doc_id=105498&lang=ro>

[358] Government Decision no. 833 of 10.11.2011 on the National Program for Energy Efficiency 2011-2020, Official Gazette of the Republic of Moldova no. 197-202 of 18.11.2011, art. 914, <https://www.legis.md/cautare/getResults?doc_id=110334&lang=ro> (amended by Government Decision no. 738 of 20.07.2018 on the amendment and repeal of certain Government Decisions, the Official Gazette of the Republic of Moldova no. 309-320 of 17.08.2018, art. 850 <https://www.legis.md/cautare/getResults?doc_id=108888&lang=ro>)

[359] Government Decision no. 102 of 05.02.2013 on the Energy Strategy of the Republic of Moldova until 2030, Official Gazette of the Republic of Moldova no. 27-30 of 08.02.2013, art. 146 <https://www.legis.md/cautare/getResults?doc_id=68103&lang=ro>

[360] Government Decision no. 1073 of 27.12.2013 approving the National Action Plan on renewable energy for 2013-2020, Official Gazette of the Republic of Moldova no. 4-8 of 10.01.2014, art. 01, <https://www.legis.md/cautare/getResults?doc_id=11752&lang=ro> (amended by Government Decision no. 327 of 17.04.2018 on the approval of the amendments and completions operated in some Government Decisions, the Official Gazette of the Republic of Moldova no. 126-132 of 20.04.2018, art. 369, <https://www.legis.md/cautare/getResults?doc_id=108888&lang=ro>)

[361] The Law on Heat and Promotion of Cogeneration no. 92 of 29.05.2014, Official Gazette of the Republic of Moldova no. 178-184 of 11.07.2014, art. 415 <https://www.legis.md/cautare/getResults?doc_id=48676&lang=ro> (amended by the Law no. 74 of 21.06.2020, Official Gazette of the Republic of Moldova no. 153-158 of 26.06.2020, art. 278 effective since 26.06.2021, <https://www.legis.md/cautare/getResults?doc_id=121896&lang=ro>)

[362] The Law on Energy Performance of Buildings no. 128 of 10.10.2014, Official Gazette of the Republic of Moldova no. 297-309 of 10.10.2014, art. 609, <https://www.legis.md/cautare/getResults?doc_id=95262&lang=ro> (amended by the Law no. 160 of 07.07.2016 amending and supplementing certain legislative acts, Official Gazette of the Republic of Moldova no. 306-313 of 16.09.2016, art. 647, effective since 16.09.2016, <https://www.legis.md/cautare/getResults?doc_id=95000&lang=ro>)

[363] The Law on Labeling Energy-related Products no. 44 of 27.03.2014, Official Gazette of the Republic of Moldova no. 99-102 of 25.04.2014, art. 249, <https://www.legis.md/cautare/getResults?doc_id=21702&lang=ro> (amended by the Law no. 79 of 24.05.2018 amending and supplementing certain legislative acts, Official Gazette of the Republic of Moldova no. 195-209 of 15.06.2018, art. 338, effective since 15.06.2018, <https://www.legis.md/cautare/getResults?doc_id=105456&lang=ro>)

[364] Government Decision no. 626 of 20.08.2011 approving the Soil Fertility Conservation and Enhancement Program for 2011-2020, Official Gazette of the Republic of Moldova no. 139-145 of 26.08.2011. 696, <https://www.legis.md/cautare/getResults?doc_id=21540&lang=ro> (amended by Government Decision no. 691 of 11.07.2018 for the approval of the Regulation on the conditions and procedures for carrying out the activities of land improvement, soil fertility protection, conservation and increase Official Gazette of the Republic of Moldova no. 295-308 of 10.08.2018, art. 833, <https://www.legis.md/cautare/getResults?doc_id=108824&lang=ro>)

[365] Government Decision no. 138 of 24.02.2014 approving the Action Plan on the implementation of the soil fertility conservation and enhancement Program for 2014-2016, Official Gazette of the Republic of Moldova no. 49-52 of 28.02.2014, art. 154, <https://www.legis.md/cautare/downloadpdf/13424>

[366] Government Decision no. 409 of 04.06.2014 approving the National Agricultural and Rural Development

9. The Waste Management Strategy for 2013-2027 (approved by the GD no. 248/2013)[367].

At the same time, it should be noted that the will to achieve the objectives set out under the AA RM-EU and the TEC on climate change faces several difficulties in achieving the measures undertaken to mitigate GHG emissions. The RoM is limited in institutional, technical and financial capacities to fulfil its commitments under these agreements and to proactively promote national climate change action. In order to remove these barriers, in autumn 2019, the EU4Climate project carried out an analysis of the shortcomings of the RM's current legislation and developed a roadmap describing the support provided by EU4Climate to the RoM[368].

According to the study:

- Only one of the four EU acquis set out in the AA RoM-EU is transposed into national law. Directive 98/70/EC (quality of petrol and diesel) is fully integrated into GD no. 1116/2002[369], amended in 2019. Three other EU acquis are partially transposed into national law for which the transposition deadline has already expired (in 2018-2019), with the exception of Directive no. 2003/87/EC establishing a scheme for GHG emission allowance trading (until 2022);
- Only one of the two EC recommendations on climate is transposed into national legislation: Recommendation 2016/02/MC-EnC – by the approval of GD no. 1277/2018[370]. The second Recommendation 2018/01/MC-EnC is being implemented.

The implementation status of all commitments under the TEC, including the climate chapter (55%) is described in the Country Report of 01.11.2021, posted on the Energy Community's website [371]. The level of accomplishing the indicator "Monitoring of greenhouse gas emissions and national reporting systems" is evaluated at 82%, and the aim of updating LEDS 2030 will be achieved, based on the more ambitious targets set out in the updated country's NDC. At the same time, the accomplishment of the indicator "National Energy and Climate Plan (NECP)" is evaluated at 28%.

With reference to the acquis of the AA RoM-EU on climate, partially transposed into national legislation, the above recommended roadmap identifies the following:

1) By transposing Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading, the RoM relied heavily on joining the EU carbon market, where it could have traded the emission reductions produced on its territory in a cost-effective and economically efficient manner. The transposition of this Directive into national law should be seen as the first step in the creation of an Emission Trading System (ETS) that will be compatible for later connection to the EU-ETS. In order to be part of the EU-ETS, at least seven other EU directives and regulations should be implemented, including those governing the MRV, GHG emissions registration, benchmarking, auctioning, etc. The maintenance and use of all these systems has been shown to cost much more than the effect of the potential GHG reductions expected in the country under the Directive[372]. As a result, at the National Consultative Webinar of 27 May 2020[373], the Energy Community decided on the simplified transposition of Directive 2003/87/EC in the RoM, namely the establishment of emission levels for the undertakings covered by the Directive, with their subsequent tightening up to the level established in the EU. However, under this approach these companies in the country will not be able to trade emissions on the carbon market. As a result, RoM is to assess the opportunity of initiating negotiations with the EU to overcome this problem. In line with the recommended route, the new deadline for transposition of Directive 2003/87/EC is 2023.
2) Of the 6 clauses of Regulation (EC) 842/2006 on certain fluorinated greenhouse gases, replaced by Regulation (EU) 1907/2006 of the European Parliament and of the Council of 17 December 2006 establishing a common organization of the markets in agricultural products and repealing Council Regulations 517/2014, none is transposed into national legislation, except for art. 5 (2, establishing national training and certification requirements) and art. 10 (4, holding of certificates by the companies' personnel), which are partially transposed in the GD 483/2019[374], the last transposition of Regulation (EU) 517/2014. Due to the fact that:
   a) the RM is in the process of ratifying the Kigali Amendment to the Montreal Protocol, whose complexity of implementation requires it to have a full-fledged legal act;
   b) the quantity of imported refrigerants containing F-gases is increasing every year and their GWP is still very high;
   c) in the updated NDC, the RoM intends to achieve more ambitious objectives than in the first NDC, the transposition of EU Regulation 517/2014 becomes a key priority action for the country. According to the above-mentioned roadmap, a new deadline for transposing the Regulation is recommended, by approving the F-gas Law - 2022, instead of 2018. Together with the approval of the F-gas Law, there shall also be fines, respectively, GD no. 483/2019, as well as the Code of Offences no. 218/2008[375], to reflect the sanctions applicable in case

Strategy for 2014-2020, Official Gazette of the Republic of Moldova no. 152 of 10.06.2014. 451 <https://www.legis.md/cautare/getResults?doc_id=76222&lang=ro> (amended by Government Decision no. 785 of 01.08.2018 approving the changes operated in some Government Decisions, the Official Gazette of the Republic of Moldova no. 366-376 of 28.09.2018, art. 962, <https://www.legis.md/cautare/getResults?doc_id=108950&lang=ro>)

[367] Government Decision no. 248 of 10.04.2013 approving the Waste Management Strategy of the Republic of Moldova for 2013-2027, Official Gazette of the Republic of Moldova no. 82 of 12.04.2013, art. 306 <https://www.legis.md/cautare/getResults?doc_id=114412&lang=ro> (amended by Government Decision no. 1143 of 21.11.2018 approving the changes operated in some Government Decisions, the Official Gazette of the Republic of Moldova no. 13-21 of 18.01.2019, art. 7, <https://www.legis.md/cautare/getResults?doc_id=112021&lang=ro>)

[368] Energy Community. EU4Climate. Development of a Roadmap for EU4Climate support outlining priority actions for the Republic of Moldova. <https://eu4climate.eu/download/development-of-a-roadmap-for-eu4climate-support-outlining-priority-actions-for-the-republic-of-moldova/>

[369] Government Decision no. 1116 of 22.08.2002 approving the Regulation on the storage and wholesale, by automated system, of identified petroleum products, Official Gazette of the Republic of Moldova no. 122-123 of 29.08.2002, art. 1239, <https://www.legis.md/cautare/getResults?doc_id=113761&lang=ro#>

[370] Government Decision no. 1277 of 26.12.2018 on the establishment and functioning of the National System for monitoring and reporting greenhouse gas emissions and other climate change relevant information, Official Gazette no. 38-47 of February 8, 2019, art. 67, <https://www.legis.md/cautare/getResults?doc_id=112485&lang=ro>

[371] Energy Community. Moldova: Annual Implementation Report. 1 November 2021. <https://www.energy-community.org/implementation/Moldova.html>

[372] Feasibility Study on Introducing the Emission Trading System in Moldova,.<https://www.undp.org/content/dam/moldova/docs/Publications/ETS_Feasibility_Study_UNDP.pdf>

[373] Energy Community. UNDP. EU4CLIMATE Program Webinar on EU Acquis Strategic Roadmap for EU4Climate Moldova of EU4Climate Project. 27 May 2020. Zoom online platform.

[374] Government Decision no. 483 of 18.10.2019 approving the Regulation on training and certification of specialists on techniques of cold containing hydrochlorofluorocarbons and fluorinated greenhouse gases, Official Gazette of the Republic of Moldova no. 320-325 of 01.11.2019, art. 726 <https://www.legis.md/cautare/getResults?doc_id=118488&lang=ro>

[375] Contravention Code if the Republic of Moldova no. 218, Official Gazette of the Republic of Moldova no.

of violation of the provisions of Regulation (EU) no. 517/2014. The Government's Action Plan for the period 2020-2023[376] sets forth the year 2023 for the Law on F-gas approval.

3) Analysis of the transposition of Regulation (EC) 1005/2009 on ozone layer depleting substances showed that out of the 26 clauses of this act 5 (19%) are transposed into national legislation, 10 (38%) are partially transposed, 9 (35%) are not transposed, and the transposition of 2 (8%) is not necessary. The respective amendments to the Law no. 852/2002 are required, as well as adoption of secondary legislation on substances that destroy the ozone layer. The new deadline for transposition of Regulation (EC) 1005/2009 is hereby established for the year 2021 instead of 2019.

At present, several aspects of GHG mitigation continue to be reflected in a number of policies of the country currently being developed or in the stage of projects being prepared for public debate. These include:

1. The National Energy and Climate Plan in accordance with Recommendation 2018/01/MC-EnC;
2. LEDS 2030 and the Action Plan for its implementation, revised to incorporate the updated NDC targets (2020);
3. Draft Government Decision amending GD no. 689/2018 approving capacity limits, maximum quotas and categories of capacity for electricity from renewable sources until 2020 (currently in public consultations)[377]. The project provides for the approval of the maximum quotas and capacity categories for electricity from renewable sources, valid until 31 December 2025, in order to apply the support schemes provided for in Article 34 of the Law no. 10/2016 on promoting the use of energy from renewable sources.
4. The Energy Strategy until 2030 sets out three general strategic objectives that the RoM intends to achieve by 2030, namely: ensuring the security of energy supply, developing competitive energy markets and integrating them into the regional and European market, as well as promoting energy efficiency, RES and sustainable development of the energy sector.

6.2. Technology Transfer Related Activities to Mitigate and Adapt to Climate Change

The transfer of modern technologies is a key factor in reducing GHG emissions. Given that technologies in general – especially the old ones – are direct sources of massive greenhouse gas emissions, replacing them by modern and advanced technologies has entails considerable reduction of GHGs released into the atmosphere.

There are many definitions of technology transfer notion. For example, the one proposed by the Global Environment Facility mentions, that technology transfer represents:

'… a broad set of processes comprising flows of know-how, experience and equipment for mitigating and adapting to climate change between different stakeholders, such as governments, private sector entities, financial institutions, non-governmental organizations and research/education institutions… ;

…The term 'transfer' includes the dissemination of technologies and technological cooperation between and within countries. It covers technology transfer processes between developed countries, developing countries and countries with economies in transition. It encompasses the study process to understand, use and reproduce technology, including the ability to choose and adapt it to local conditions and integrate it with indigenous technologies "[378].

Intergovernmental Panel on Climate Change identifies three major dimensions necessary to ensure the efficiency of technology transfer: (i) capacity building; (ii) enabling business environment; (iii) technology transfer mechanisms[379].

6.2.1. Capacity Building

In accordance with the provisions of the Law no. 182 of 15.07.2010[380], starting with 2011 ten industrial parks (IP) were established in the RoM: IP "Tracom" and IP "FAIP" (Chisinau municipality), IP "Raut" (Balti municipality), IP "Cimislia" (Cimislia town), IP "Edinet" (Edinet town), IP "Comrat" (Comrat town), IP "CAAN" and IP "Triveneta Cavi Divelopment" (Straseni town), IP "Bioenergagro" (Drochia town) and IP "Cahul" (Cahul town). Industrial parks have technical and production infrastructure in which economic activities are carried out, mainly industrial production, service provision, capitalization of scientific research and/or technological development as specific facilities aimed at capitalizing on the human and material potential of the region. These entities comprise more than 60 businesses that have created almost 4300 jobs, and in nine years of activity the investments made amount to almost 2.4 billion lei in infrastructure development, the amount of taxes and fees paid by resident businesses being over 1.8 billion lei[381].

Industrial platforms that offer attractive conditions for investors, such as Industrial Parks or Free Economic Zones, have recently ensured the industrial development of the regions in which they are located. At the same time, it is found that the uneven diversification of these industrial platforms contributes to deepening the inequalities in relation to the territorial-administrative units where such entities do not exist. In this context, in order to increase the competitiveness, productivity and employment of the industrial sector, in 2020

78-84 of 17.03.2017, art. 100 (amended by the Law no. 59 of 22.04.2021, Official Gazette of the Republic of Moldova no. 122-128 of 21.05.2021, art. 149 <https://www.legis.md/cautare/getResults?doc_id=124835&lang=ro#>)

[376] Government Decision no. 636 of 11.12.2019 approving the Government's Action Plan for 2020-2023, Official Gazette of the Republic of Moldova no. 378-379 of 13.12.2019, art. 976, <https://www.legis.md/cautare/getResults?doc_id=119405&lang=ro> (amended by Government Decision no. 848 of 30.11.2020 for the approval of the changes that are operated in the Government Action Plan for 2020-2023, approved by the Government Decision no. 636/2019, Official Gazette of the Republic of Moldova no. 319-328 of 04.12.2020, art. 1004, <https://www.legis.md/cautare/getResults?doc_id=124183&lang=ro>)

[377] <https://particip.gov.md/ro/document/stages/proiect-hotararii-guvernului-pentru-modificarea-hotararii-guvernului-nr-6892018-cu-privire-la-aprobarea-limitelor-de-capacitate-cotelor-maxime-si-categorilor-de-capacitate-in-domeniul-energiei-electrice-din-surse-regenerabile-pina-in-anul-2020/7841>

[378] O. Davidson, B. Metz *et al*, 'Methodological and Technological Aspects in Technology Transfer' – Summary for Policy Makers of the IPCC Special Report III (2000), p. 3. <https://www.ipcc.ch/site/assets/uploads/2018/03/srtt-en-1.pdf>

[379] *Idem.*, p. 4

[380] The Law on Industrial Parks no. 182 of 15.07.2010, Official Gazette of the Republic of Moldova 155-158 of 03.09.2010, art. 561, <https://www.legis.md/cautare/getResults?doc_id=106588&lang=ro> (amended by Law no. 79 of 24.05.2018 amending and supplementing certain legislative acts, Official Gazette of the Republic of Moldova no. 195-209 of 15.06.2018, art. 338 <https://www.legis.md/cautare/getResults?doc_id=105456&lang=ro>)

[381] *Industrial parks.* Informative material published on the *website* of the Ministry of Economy and Infrastructure on 15.07.2020. <https://mei.gov.md/ro/content/parcuri-industriale>

the Government decided to create Multifunctional Industrial Platforms (MIPs) in regions that do not have IP type platforms or Free Economic Zones (FEZ). The pilot program for the creation of Multifunctional Industrial Platforms was approved by Government Decision no. 748 of 13.10.2020[382]. It provides for creation of 18 MIPs in various districts of the country. Fully equipped from the point of view of access to utilities, the designated locations for the establishment of the MIP will become true centers of excellence for industrial development at local level. Unlike IP or FEZ, the operating model of the Multifunctional Industrial Platforms is based on ensuring easier access for investors rather than on providing tax incentives, which would boost the efficiency of industrial projects implementation in a short timeframe. The Organization for the Development of the Small and Medium Enterprises Sector (ODIMM) was appointed as the Implementation Unit of the pilot program Creation of Multifunctional Industrial Platforms[383]. According to the updated information at the time of writing this report (March 2021), ODIMM signed 7 Cooperation Agreements with Local Public Authorities of level II on creation of MIPs in the districts of the Republic of Moldova[384].

6.2.2. Enabling Business Environment

Paragraph 10 "Ensuring the fundamental right to a healthy and safe environment" of Chapter III "The Sustainable Development Goals of the Republic of Moldova" included in the National Development Strategy "Moldova 2030" details the strategic vision for reducing GHG emissions and the implementation of climate change adaptation measures.

The list of measures includes *"... implementation of the green economy principles, which contributes to the efficient use of resources and energy, to the application of cleaner technologies in the economic sector, with low carbon emissions and pollution, and to the minimization of environmental risks. The green economy is a new model of economic growth, a generator of decent jobs and a vital strategy for eliminating poverty"*.

The priority actions mentioned in point 2 "Increasing access to physical infrastructure, public utilities and housing conditions" of the same chapter of the Strategy include: *"... development of "green" energy. Stimulating interest in production and consumption of "green" energy by harnessing renewable energy sources, including the use of efficient and clean biomass combustion technologies, and facilitating connection of production facilities to existing distribution capacities"*[385].

The international ranking on business facilitation, developed by the World Bank (2020) shows that in 2017 RoM ranked 48th out of 190 countries, along with Armenia (47th) and Belarus (49th)[386]. The value of this country indicator for 2020 was 74.4, a slight increase compared to 2019 (73.1). A slight improvement in the business climate can be seen from the point of view of the "starting a business" indicator, which increased in 2020 by 0.1 points compared to 2019, the RM ranking 13th in the world ranking[387]. At the same time, the administrative system of the state in terms of granting permissions and carrying out inspections is far from perfect: for example, under the "granting construction permits" indicator the RM ranks 156 out of 190 countries in the same ranking[388].

Within the ranking of global competitiveness, in 2019 RoM ranked 86th out of 141 countries[389], being surpassed by most countries in the region and almost all CIS countries. According to the same report, entrepreneurs highlighted the following factors as the main problems in business, in order of priority: (i) corruption; (ii) political instability; (iii) instability of government; (iv) access to finance; (v) inefficient government bureaucracy, etc.

Another international benchmark is the Index of Economic Freedom, developed by *The Heritage Foundation*[390]. This index assesses the degree of state intervention in economic activity on the basis of twelve sub-indicators: property rights, government integrity, efficiency of the judiciary, tax burden, state expenditure, fiscal health, business freedom, labor freedom, monetary freedom, trade freedom, investment freedom and financial freedom. In 2021, the RM is ranked 85th in the Index of Economic Freedom of 178 countries and territories, with a value of 62.5 – a slight increase of 0.5 points compared to the previous year[391].

For the development of small and medium-sized enterprises in the medium and long term, a favorable legal framework has been created in the RoM. In this context, the following pieces of legislation have been approved:

- The Small and Medium-Sized Enterprises Sector Development Strategy for 2012-2020[392], approved in 2012 and updated in 2016;
- The Strategy for the entrepreneurial activity regulatory framework reform for 2013-2020 of 2013, updated in 2016 and 2018, and Action Plan for its implementation in 2018-2020[393];
- The Law on Small and Medium-Sized Enterprises[394] approved in 2016;

[382] Government Decision no. 748 of 13.10.2020 approving the pilot program for the creation of multifunctional industrial platforms, Official Gazette of the Republic of Moldova no. 272-277 of 23.10.2020, art. 888, <https://www.legis.md/cautare/getResults?doc_id=123627&lang=ro>
[383] *Idem.*
[384] *Basarabeasca district, on the brink of creating the Multifunctional Industrial Platform.* Informative material published on the *website* of the Organization for the Development of the Small and Medium Enterprises Sector, on 10.03.2021. Available at: <https://odimm.md/ro/presa/comunicate-de-presa/4931-raionul-basarabeasca-la-un-pas-de-creare-a-platformei-industriale-multifunctionale>
[385] Government Decision no. 377 of 10.06.2020 approving the draft Law on Approval of the National Development Strategy "Moldova 2030", Official Gazette of the Republic of Moldova no. 153-158 of 26.06.2020, art. 508, <https://www.legis.md/cautare/getResults?doc_id=121920&lang=ro>
[386] The World Bank's Business Facility ranking. <https://www.doingbusiness.org/en/rankings>
[387] *Doing Business Data - Moldova.* Data collected by the World Bank <https://www.doingbusiness.org/en/data/exploreeconomies/moldova>
[388] *Idem.*
[389] K. Schwab, "2019 Global Competitiveness Report", World Economic Forum. <http://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2019.pdf>
[390] *Index of Economic Freedom* ranking, developed by *"The Heritage Foundation"* for 2021. <https://www.heritage.org/index/ranking>
[391] *Idem.*
[392] Government Decision no. 685 of 13.09.2012 approving the Strategy for the Small and Medium-Sized Enterprises Sector Development for 2012-2020, Official Gazette of the Republic of Moldova no. 198-204 of 21.09.2012, art. 740, <https://www.legis.md/cautare/getResults?doc_id=110186&lang=ro> (amended by the Government Decision no. 463 of 23.05.2018 approving the additions to be operated in the Government Decision no.685 of September 13, 2012) (approval of the Action Plan on the Strategy implementation), Official Gazette of the Republic of Moldova no. 167-175 of 25.05.2018, art. 514, <https://www.legis.md/cautare/getResults?doc_id=101733&lang=ro>)
[393] Government Decision no. 1021 of 16.12.2013 approving the Strategy for the entrepreneurial activity regulatory framework reform for 2013-2020 and of the Action Plan for its implementation in 2013-2015, Official Gazette of the Republic of Moldova no. 297-303 of 20.12.2013, art. 1129, https://www.legis.md/cautare/getResults?doc_id=49476&lang=ro (amended by Government Decision no. 369 of 19.04.2018 for the amendment of the Government Decision no. 1021 of 16 December 2013 (approval of the Action Plan on the implementation of the Strategy for 2018-2020), Official Gazette of the Republic of Moldova no. 133-141 of 27.04.2018, art. 411, https://www.legis.md/cautare/getResults?doc_id=103017&lang=ro)
[394] The Law on Small and Medium-sized Enterprises no. 179 of 21.07.2016, Official Gazette of the Republic of Moldova no. 306-313 of 16.09.2016, art. 65, https://www.legis.md/cautare/getResults?doc_id=105839&lang=ro (amended by the Law no. 23 of February 27, 2020 for the amendment of certain legislative acts, the Official Gazette of the Republic of Moldova no. 87-93 of 20.03.2020, art. 112, effective since 20.04.2020, <https://www.legis.md/cautare/getResults?doc_id=120841&lang=ro>)

- The law on Peasant Farms approved in 2000[395] and updated in 2017;
- The Law on Investments in Entrepreneurial Activity approved in 2004[396] and updated in 2020;
- The Law on Entrepreneurship and Enterprises approved in 1992[397] and updated in 2020.

The elimination of regulatory constraints and ungrounded costs in the domestic business environment create premises for a more dynamic and sustainable economic growth, encouraging national and foreign investments. Thus, the Small and Medium-Sized Enterprises Sector Development Strategy for 2012-2020 aims to eliminate the currently existing barriers, so that the risks and costs associated with each stage of the business life cycle, including the transfer of technologies, are lower than in the countries of the region by 2020. The Action Plan on the Strategy implementation for 2018-2020 shall contain priorities aimed at:

- Assessing the innovative potential of SMEs and improving their development possibilities by carrying out studies on technology transfer projects (Action 7.3.1);
- Development and implementation of innovative financial support instruments for SMEs promoting the principles of the green economy (technology transfer projects) (Action 8.2.2).

According to the Working Document on the AA RoM - EU Implementation Report, the European External Action Service of the European Union[398], corruption, lack of confidence in the judicial system and incoherent policies in the economic field have affected the business environment and the investment climate. The RoM currently lacks coherent and effective industrial and business policies. In this context, the development of a strategy for industrialization of the country by 2030 is welcomed. The report on the implementation of the AA between the RoM and the EU adopted by the European Parliament on 20 October 2020[399] refers to the fact that in 2019 the RoM ranked 120th out of 180 countries and territories assessed (the first place being the lowest level of corruption) in *Transparency International*'s ranking regarding the corruption perception index. It should be mentioned that *Transparency International* ranking regarding the corruption perception index in 2018 ranked RoM the 117th, and in 2020[400] it ranked RoM the 115th. At the same time, the *Freedom House* reports of 2020[401] show very little progress in the RoM in the most recent past, while the general evolution within these indices, as well as in the Democracy Index, shows a long-term deteriorating trend in terms of the state of democracy, corruption, political rights and civil liberties in the RoM.

In the above-mentioned report, *the European Parliament "… recalls that further progress needs to be made in implementing [the Association Agreement] in order to fully exploit its potential and benefits, with particular emphasis on the independence of state institutions, their resilience against the influence of oligarchs, the fight against corruption, the strengthening of the rule of law and the improvement of the living conditions of citizens"*.

6.2.3. Technology Transfer Mechanisms

According to the IPCC Report on Methodological and Technological Aspects of Technology Transfer[402], the mechanisms for technology transfer comprise: (i) the national innovation system; (ii) official development assistance; (iii) the Global Environment Facility; (iv) multilateral development banks; (v) the Kyoto Protocol mechanisms.

The following is a brief overview of the current situation regarding the implementation and the real impact of the national innovation system (information on the other three mechanisms for technology transfer are provided in chapter 9.3.1 "The Level of Support Received").

Thus, the national innovation system is regulated by several normative acts:

- Code on Science and Innovation, approved in 2004 and updated in 2018[403];
- The 2014 Education Code, updated in 2020[404];
- The Innovation Strategy for 2013-2020 "Innovations for competitiveness", approved in 2013, updated in 2016 and repealed in 2019;
- Research and Development Strategy until 2020, approved in 2014 and repealed in 2019[405];
- The National Program in research and innovation for 2020-2023[406] and Methodology for financing research and innovation projects[407].

An extensive reform of the national innovation system began in 2017, when, with the restructuring of all ministries in the

[395] The Law no. 1353 of 03.11.2000 on Peasant Farms, Official Gazette of the Republic of Moldova no. 14-15 of 08.02.2001, art. 52, https://www.legis.md/cautare/getResults?doc_id=62932&lang=ro (amended by the Law no. 178 of 21.07.2017 amending and supplementing certain legislative acts, Official Gazette of the Republic of Moldova no. 301-315 of 18.08.2017, art. 537, https://www.legis.md/cautare/getResults?doc_id=101256&lang=ro)

[396] The Law no. 81 of 18.03.2004 on Investments in Entrepreneurial Activity, Official Gazette of the Republic of Moldova no. 64-66 of 23.04.2008, art. 344, https://www.legis.md/cautare/getResults?doc_id=27421&lang=ro (amended by the Law no. 111 of 18.06.2020 for the amendment of certain normative acts, the Official Gazette of the Republic of Moldova no. 161-164 of 03.07.2020, art. 315, effective from 01.09.2020, https://www.legis.md/cautare/getResults?doc_id=122019&lang=ro)

[397] The Law no. 845 of 03.01.1992, on Entrepreneurship and Enterprises, the Parliament Gazette no. 2 of 28.02.1994, art. 33, https://www.legis.md/cautare/getResults?doc_id=17094&lang=ro (as last amended by the Law no. 257 of 16.12.2020 on the amendment of certain normative acts, Official Gazette of the Republic of Moldova no. 353-35 of 22.12.2020, art. 288, in force since 01.05.2021, https://www.legis.md/cautare/getResults?doc_id=124566&lang=ro)

[398] *Joint Staff Working Document: Association Implementation Report on Moldova*, 11.09.2019, European External Action Service. <https://eeas.europa.eu/sites/default/files/swd_2019_325_f1_joint_staff_working_paper_en_v10_p1_1045191.pdf>

[399] 'Report on the implementation of the EU-Republic of Moldova Association Agreement' of 20.10.2020, European Parliament. Reference: P9_TA (2020)0279. <https://www.europarl.europa.eu/doceo/document/TA-9-2020-0279_EN.html>

[400] Corruption Perception Index for 2020, *Transparency International website*. <https://www.transparency.org/en/cpi/2020/index/nzl>

[401] *Nations in Transit Report 2020* by *Freedom House*. The chapter related to the Republic of Moldova is available at: <https://freedomhouse.org/country/moldova/nations-transit/2020>

[402] O. Davidson, B. Metz *et al*, "Methodological and Technological Aspects in Technology Transfer" – Summary for Policy Makers of the IPCC Special Report III (2000), p. 7. <https://www.ipcc.ch/site/assets/uploads/2018/03/srtt-en-1.pdf>

[403] Code on Science and Innovation of the Republic of Moldova no. 259 of 15.07.2004, Official Gazette of the Republic of Moldova no. 125-129 of 30.07.2004, art 663, <https://www.legis.md/cautare/getResults?doc_id=110232&lang=ro> (amended by the Law no. 271 of 23.11.2018 for the amendment of certain legislative acts, the Official Gazette no. 441-447 of 30.11.2018, art. 717, effective since 01.12.2018, https://www.legis.md/cautare/getResults?doc_id=109826&lang=ro>)

[404] The Education Code of the Republic of Moldova. 152 of 17.07.2014, Official Gazette of the Republic of Moldova no. 319-324 of 24.10.2014, art. 634, https://www.legis.md/cautare/getResults?doc_id=110112&lang=ro (amended by the Law no. 182 of September 11, 2020 amending Article 134 of the Code of Education of the Republic of Moldova no. 152/2014, Official Gazette no. 259-266 of 09.10.2020, art. 551, https://www.legis.md/cautare/getResults?doc_id=123432&lang=ro)

[405] Government Decision no. 920 of 07.11.2014 approving the Research and Development Strategy of the Republic of Moldova until 2020, Official Gazette of the Republic of Moldova no. 386-396 of 06.12.2013, art. 1099, <https://www.legis.md/cautare/getResults?doc_id=115801&lang=ro>, (repealed by Government Decision no. 381 of 01.08.2019 approving the National Program in research and innovation for 2020-2023 and the Action Plan on its implementation, Official Gazette of the Republic of Moldova no. 256-259 of 16.08.2019, art. 506, https://www.legis.md/cautare/getResults?doc_id=115747&lang=ro)

[406] Government Decision no. 381 of 01.08.2019 approving the National Program on research and innovation for 2020 – 2023 and the Action Plan on its implementation, the Official Gazette of the Republic of Moldova no. 256-259 of 16.08.2019, art. 506, https://www.legis.md/cautare/getResults?doc_id=115747&lang=ro (amended by Government Decision no. 832 of 18.11.2020 on the amendment of Annex no.1 to the Government Decision no. 381/2019 approving the National Program on research and innovation for 2020-2023 and the Action Plan on its implementation, the Official Gazette no. 304-312 of 20.11.2020, art. 978, <https://www.legis.md/cautare/getResults?doc_id=123994&lang=en>)

[407] Government Decision no. 382 of 01.08.2019 approving the Methodology for financing projects in research and innovation, Official Gazette no. 256-259 of 16.08.2019, art. 506, <https://www.legis.md/cautare/getResults?doc_id=115748&lang=ro>

Government and the reallocation of financial resources, the entire architecture of the research, development and innovation field was restructured. Thus, on 20 February 2018, a series of amendments to the Code on Science and Innovation came into force. According to the new version of the Code, all scientific research institutes of the Academy of Sciences of Moldova (ASM) were subordinated to the Ministry of Education and Research (MER). The ASM was deprived of the right to be the founder of these institutes: starting with 2018, the ASM's role became rather symbolic, its responsibility being reduced to drafting an annual report on the state of the R&D and innovation field in the country and to symbolic or consultative duties in evaluating projects or in formulating management proposals. The Supreme Council for Science and Technological Development was dissolved, while the responsibility for developing the state policy in research and development – including formulation of priority research and development themes or management of state programs – was transferred to the Ministry of Economy. At the same time, the Ministry of Economy was vested with the responsibility to develop state policies in innovation and technology transfer.

On theoretical level, the purpose of this institutional transfer was to ensure more efficient ways of administering and financing research and innovation, activities which are the responsibility of the MER. As a result, at the time of reform implementation, a substantial increase in allocations for financing research projects was foreseen. Other major developments stemming from the recent R&D and innovation reform included:

a. transmitting the policy development functions from the ASM to the central specialized body of the state that ensures development of the national policy in research and innovation (MER);
b. creation of the National Agency for Research and Development (NARD) according to the provisions of GD no. 196 of 28.02.2018[408], as an entity subordinated to the Ministry of Economy, responsible for implementing the policies;
c. creation of the National Agency for Quality Assurance in Education and Research (ANACEC), according to the provisions of GD no. 201 of 28.02.2018[409];
d. transferring the status of the founder of all public law organizations in research and innovation to the central specialized body of the state.

In its original version, the Concept of the National Research and Innovation System Reform provided that, in order to ensure a relevant expertise for science and innovation policies development, an impartial cross-sectoral approach will be adopted, and in order to monitor the NARD's activity, the Council for Research, Development, Innovation and Technology Transfer by the Prime Minister will be established[410].

In the process of managing public finances allocated for R&D and innovation, the Ministry of Economy takes into account the assessment of the institutions operated by ANACEC – an institution which currently has extensive powers in evaluation and accreditation of institutions and training programs at all levels. A new element in this regard was the streamlining the procedure for financing research projects on a competitive basis, in all fields. Competitions for research projects funding are organized by the National Agency for Research and Development. The proportion of institutional funding (the amount of financial resources allocated from the national public budget directly to R&D and innovation institutions, i.e. higher education institutions, line ministries, etc.) in the R&D and innovation sector is currently around 40%, with the remaining 60% being allocated on the basis of competitive mechanisms for research projects. At practical level, however, the implementation of the reform faces a number of difficulties generated by certain institutional bottlenecks. Administrative inertia causes delays in the approval process of ANACEC methodology and in organizations evaluation. Accordingly, institutional financial allocations are made on the basis of criteria inspired by the methodology applicable to project competitions. It is also difficult to finance long-term projects (longer than 4 years) and the distribution of resources is often considered arbitrary and unfair.

The list of priority areas financed through the Competition of Innovation and Technology Transfer Projects for 2021, launched by the NARD in July 2020, includes the field "Environment and Climate Change" (Priority III)[411]. The projects submitted within the 5 Strategic Directions including the *Strategic Direction "Secure, Clean and Efficient Energy"* – will receive a total financing of 1.92 million lei for 2021[412]. The additional contest in 2021, launched by the NARD in March 2021, provides for a total financing of 2.52 million lei for projects under Priority III "Environment and climate change"[413].

Despite the difficulties and bottlenecks characteristic of the initial implementation period, the 2017 reform brought the institutional and organizational architecture of the R&D and innovation closer to that of the member states of the European Union. The current system ensures separation of the duties for development and coordination of the state policy in this field, of the institutional and project-based financing, of research evaluation, selection, supervision and monitoring processes. At the theory level, the generalized conflict of interest, characteristic of the previous way of operation of this field, is avoided.

Currently there are 50 research organizations subordinated to the following ministries: Ministry of Education and Research (32 institutions), Ministry of Health and Ministry of Labor and Social Protection (9 institutions), Ministry of

[408] Government Decision no. 196 of 28.02.2018 on organization and operation of the National Research and Development Agency, Official Gazette of the Republic of Moldova no. 68-76 of 02.03.2018, art. 227, https://www.legis.md/cautare/getResults?doc_id=119172&lang=ro (amended by Government Decision no. 559 of November 19, 2019 on the amendment of certain Government Decisions, Official Gazette of the Republic of Moldova no. 352-359 of 29.11.2019, art. 864, effective as of 29.12.2019, <https://www.legis.md/cautare/getResults?doc_id=119036&lang=ro>)

[409] Government Decision no. 201 of 28.02.2018 on organization and operation of the National Agency for Quality Assurance in Education and Research, Official Gazette no. 68-76 of 02.03.2018, art. 232, https://www.legis.md/cautare/getResults?doc_id=115471&lang=ro (amended by Government Decision no. 559 of November 19, 2019 on the amendment of certain Government Decisions, Official Gazette no. 352-359 of 29.11.2019, art. 864, effective as of 29.12.2019, <https://www.legis.md/cautare/getResults?doc_id=119036&lang=ro>)

[410] *Reform of the national research and innovation system, in the attention of the Prime Minister.* Informative material published on the *website* of the Government of the Republic of Moldova on 10.03.2021. <https://gov.md/ro/content/reforma-sistemului-national-de-cercetare-si-inovare-atentia-premierului>

[411] *Competition of innovation and technology transfer projects for 2021.* Informative material published on the *website* of the National Agency for Research and Development on 08.07.2020. <https://ancd.gov.md/ro/content/concursul-proiectelor-de-inovare-si-transfer-tehnologic-pentru-anul-2021>

[412] *Idem.*

[413] *The additional competition of innovation and technology transfer projects for 2021.* Informational material published on the *website* of the National Agency for Research and Development on March 10, 2021. <https://ancd.gov.md/ro/content/concursul-suplimentar-al-proiectelor-de-inovare-si-transfer-tehnologic-pentru-anul-2021>

Agriculture and Food Industry and Ministry of Environment (8 institutions) and State Chancellery (1 institution)[414].

The Law no. 226 of 01.11.2018[415] regulates the process of creation and operation of science and technology parks and innovation incubators. These two types of entities are part of the research, development and innovation infrastructure of the country, and the aforementioned law brought their operation in line with the complex reform of the field, implemented since 2017. In the sense of the cited law, a scientific-technological park is a *"form of organization of innovation and/or technology transfer activities that are carried out under a state-provided facilities regime, involving research, development, innovation and technology transfer organizations, with the participation of higher education institutions, businesses regardless of their legal form of organization, as well as of individuals whose purpose is development and/or manufacture of innovative products, elaboration and assimilation in practice of new or upgraded technologies and services better than those used in the previous country"*[416]. At the same time, an innovation incubator is an *"innovation organization established on the basis of an association contract between legal entities and individuals, intended to develop the potential for development and implementation of innovations by small and medium-sized enterprises, as well as researchers and private inventors whose activity is carried out under a state provided facilities regime"*[417]. The scientific-technological park and/or innovation incubator is created by the Government's decision for a term of operation of at least 10 years. Currently, one science-technology park and 8 innovation incubators of different specializations are operational in the RoM[418].

The architecture of the innovation system also includes the State Agency for Intellectual Property (AGEPI) and the Organization for the Development of the Small and Medium Enterprises Sector (ODIMM).

International experience has shown that in order to reduce barriers to technology transfer, it is necessary to involve intermediate bodies associated with the flow of information, management, technology and funding. The role of intermediaries in the process of technology transfer may be assumed by specialized government agencies, energy and service companies, non-governmental organizations, university liaison departments, regional technology centers, research and technology organizations, electrical utilities and transnational networks, etc.[419].

Like other important areas of the RoM, research and development and continuous innovation are facing the problem of extremely low institutional and human capacities, caused by the endemic lack of financial resources. The latest public policy documents, drawn up by the new institutional players, reveal serious shortcomings in R&D and innovation management [420].

[414] List of research organizations on the *website* of the National Agency for Research and Development. <https://ancd.gov.md/ro/content/organizatii-de-cercetare>
[415] The Law no. 226 of 01.11.2018 on scientific-technological parks and innovation incubators, Official Gazette no. 448-460 of 07.12.2018, art. 725, <https://www.legis.md/cautare/getResults?doc_id=109755&lang=ro>
[416] *Idem*.
[417] *Idem*.
[418] List of scientific-technological parks and innovation incubators on the *website* of the National Agency for Research and Development. <https://ancd.gov.md/ro/content/parcuri-si-incubatoare>
[419] O. Davidson, B. Metz *et al*, 'Methodological and Technological Aspects in Technology Transfer' – Summary for Policy Makers of the IPCC Special Report III (2000), p. 4. <https://www.ipcc.ch/site/assets/uploads/2018/03/srtt-en-1.pdf>
[420] A. Chiciuc, Gh. Cuciureanu, V. Lie, *The National Research and Innovation Program for 2020-2023 as a reflection of the science policy of the RoM*, Intellectus no. 3-4/2019, pp. 124-131

6.3. Climate Information Networks

The National Climate Change Adaptation Strategy (NCCAS) until 2020[421] establishes that climate change mitigation is a responsibility of society as a whole.

Specific objective 1 of the NCCAS specifies the Course of Action no.3 as: developing communication and institutional cooperation in view of implementing adaptation policies, which states that *"… the main tool for strengthening the cross-sector coordination will be Communication Strategy on climate change adaptation, which will establish an effective mechanism to disseminate, among relevant ministries, the information on implementation of climate change adaptation strategies, and as a feedback link inclusive, to have a two-way information flow"*.

In addition to the Communication Strategy on Climate Change Adaptation, the Action Plan of the NCCAS provides for the following actions to develop institutional communication and cooperation:

- *Creation of a platform of specialized resources on climate change and a network of climate change experts (independent experts, non-governmental organizations, scientific institutions, financial institutions), which could provide services to central and local public authorities in adapting to climate change;*
- *Establishment of a cooperation and coordination mechanism with neighboring countries to link disaster and climate risk management activities;*
- *Connecting the national early warning system on natural disasters, including climate disasters, to the regional early warning system on natural disasters of climate origin;*
- *Developing international cooperation and donor bodies to provide the necessary assistance for the implementation of climate change adaptation measures;*
- *Developing public-private partnerships to ensure the implementation of climate change adaptation measures*[422].

Raising public awareness and sharing knowledge and experience with other countries on the need to adapt to climate change is one of the Strategy's priorities and is part of the Specific Objective 2: establishment of a mechanism to monitor the impact of climate change, associated social and economic vulnerability and to manage/disseminate information on climate risks and disasters.

Course of action 1 to achieve this specific objective shall relate to the monitoring and research of the climate change impact and shall provide, inter alia, for the following activities:

- *Strengthening capacities for collecting, monitoring, statistical reporting, analysis and distribution of information needed for climate modelling, climate risks and impacts assessment;*
- *Assessment, research and mapping of regional (for the north, center and south of the country) and sectoral risks and vulnerabilities (agriculture, forestry, energy, transport, human health, etc.);*

[421] Government Decision no. 1009 of 10.12.2014 approving the Climate Change Adaptation Strategy of the Republic of Moldova until 2020 and the Action Plan for its implementation, Official Gazette no. 372-384 of 19.12.2014, art. 1089, <https://www.legis.md/cautare/getResults?doc_id=49220&lang=ro> (as amended by Government Decision no. 1143 of 21.11.2018 on the approval of the changes that are operated in some Government Decisions, the Official Gazette 13-21 of 18.01.2019, art. 7, <https://www.legis.md/cautare/getResults?doc_id=112021&lang=ro>)
[422] *Idem*.

- *Development and distribution of high-resolution maps for future climate conditions on the territory of the RoM, taking into account various emission scenarios: A2 (high emissions), A1B (medium emissions), B1 (low emissions)*[423].

Course of action 2 of the same Specific Objective provides for the creation of a national climate change database, by implementing the following steps:

- *Evaluation of the current system for collecting, monitoring and reporting periodic hydrometeorological and climate information, in order to identify gaps and ways to overcome the existing problems;*
- *Collecting all existing information on climate change and strengthening the national data collection, monitoring, statistical reporting system;*
- *Setting up the national climate change database, which focuses on regular hydrometeorological and climate information, information on current climate change adaptation projects and activities;*
- *Creating local databases*[424].

All stakeholders, and in particular the population, must be aware of the risks associated with climate change and adaptation measures. Transparent communication in this area will contribute to a correct understanding of the climate change effects, which is a prerequisite for developing appropriate public policies, and will contribute to the development and optimal implementation of effective financial mechanisms.

Thus, the Course of Action 3 of the Specific Objective 2 provides for:

- *Setting up a mechanism to raise public awareness of the climate change risks and adaptation measures;*
- *Organizing awareness-raising, information and education campaigns on climate change, in media and by other methods of information dissemination;*
- *Reviewing and completing the school curriculum for primary, secondary and high school education, to include the "climate change" topic in the reference disciplines;*
- *Development and implementation of e-training programs and accessible materials (books, brochures, etc.) on climate change adaptation to improve the ability of farmers, health professionals, civil protection and exceptional situations officers, energy engineers, transport and construction sector professionals, other specialists;*
- *Establishment of an early-warning system on natural hazards of climate origin, providing public access to data and information needed for climate risks and impacts assessment* [425].

The Communication Strategy for 2014-2016 was developed under the "Support for the National Process of Adaptation of the RoM to Climate Change" project funded by the Austrian Agency for Development and Cooperation (ADA) and implemented by the UNDP Moldova in partnership with the Ministry of Environment (hereinafter – the ADA/UNDP project)[426].

[423] *Idem.*
[424] *Idem.*
[425] *Idem.*
[426] Communication strategy of the project "Support to the national climate change planning the adaptation process of the RoM". <http://adapt.clima.md/public/publications/3639318_md_strategia_comu.pdf>

The study "Republic of Moldova: the population's knowledge about climate change" conducted in 2012[427] established that, generally, the mechanisms for collecting and disseminating climate information are poorly developed in the RoM, and the population has a relatively low level of knowledge in this field.

Political decision-makers and civil society are generally not sufficiently aware of the importance of issues related to climate change and sectoral adaptation. At the same time, the complexity of the climate change issue creates situations of confusing messages to the general public: climate change issues are often dealt with by the media in a superficial manner, and are sometimes given a touch of sensation.

At institutional level, communication related to climate change issues is sporadic: there is insufficient coordination between stakeholders (ministries, institutions, LPAs, academic institutions, civil society organizations, etc.) and a common communication agenda is lacking.

The communication strategy within the ADA/UNDP Project is based on two distinct and interconnected components: advocacy and communication.

Both components are oriented towards specific target groups and aim to achieve the communication objectives within the Project: streamlining the internal communication process and increasing the awareness and general understanding by the target groups of the climate change impact. The communication strategy defines the key message, the main and specific messages, and provides an overview of the main tools/activities and methods used to convey these messages to the target groups.

The advocacy component of the communication strategy of the ADA/UNDP Project was achieved through: development and dissemination of internal communication materials, production and dissemination of electronic brochures for the general public (guides, glossaries, etc.), dissemination of information about the activity of the public-private group for development of the National Adaptation Plan (NAP), inclusion of the issue related to the need to develop the NAP in the agenda of civil society organizations, academia, etc.

The communication component of the Strategy was achieved by: organizing training courses for communicators of state institutions responsible for the development and implementation of the NAP, developing and disseminating publications on related climate change topics, organizing information sessions and training on climate change for the media, organizing thematic periodical events (workshops, conferences, round tables, public debates, etc.), producing and broadcasting video and audio spots and a documentary film, promoting key messages through radio and TV broadcasts and on social networks, organizing a journalistic contest, etc.

Advocacy and communication activities within the project were also carried out at local level by capacity building in close collaboration with local public authorities. In this respect, the project implementation support provided in 6 districts was very important for rural communities with significant presence of disadvantaged population groups.

[427] National survey "Republic of Moldova: people's knowledge about climate change", IMAS, Chisinau, 2012. <http://www.clima.md/public/files/Constientzare/Raport_IMAS_EN.pdf>

Civil society organizations have a key role to play in the effective dissemination of knowledge on climate change impact. In partnership with public institutions, businesses and academia, they contribute to ensuring adequate level of knowledge among population and promote the necessary change of attitudes and behavior in society.

The NGO "National Environmental Centre" (NEC) is among the most involved civil society organizations that actively contribute to raising public awareness of the climate change consequences.

Thus, the "Climate Box" project implemented by the NEC provides the young generation with a set of thematic informative materials, developed with the purpose to raise the students' interest about climate change. The "climate box" contains an educational support for students and teachers illustrated with educational materials and a variety of questions and tasks, intended to be carried out both individually and in groups, with questions on the "Climate Change" subject, as well as methodological guidance for teachers on the use of the set-in different classes. It also includes a set of quizzes in the form of a game, a wall map illustrating the possible effects of climate change on nature and people in various regions by the end of the 21st century, and a poster with suggestions for reducing the carbon footprint[428].

In the framework of the Green Moldova project, funded by NGO "EcoContact" and implemented during 2019-2020 by the NEC in partnership with the Environmental Protection Inspectorate (EPI), an electronic service for reporting environmental problems "Green Moldova" was launched.

The online platform allows citizens to easily and quickly notify EPI and other institutions responsible for dedicated segments about the environmental problems observed in the Republic of Moldova (including those related to the climate change impact), to monitor online the evolution of the situation and to receive notifications about the process of settling the reported irregularities.

Project activities include:

- Developing the national platform "Green Moldova" for online civic participation and a mobile application on environmental protection;
- The organization of a workshop with the participation of IPM, the MoE, SE "Moldsilva", LPAs (representatives of the Town Hall of Chisinau municipality, etc.), NGOs and other relevant institutions;
- Preparation of training materials and carrying out of trainings on the platform use;
- Involvement of the population in protection measures and information campaigns on the "Green Moldova" platform;
- Promotion campaign regarding the removal of the sources of pollution, detected by the citizens and informing the competent authorities.

[428] Source: <https://www.environment.md/ro/cutia_climatica>

The project also provides for the development and launch in the online environment of a mobile application for reporting environmental incidents[429].

In 2020, the NEC launched the ECO ALERT electronic service for reporting environmental problems in Moldova, which will be managed by the Environmental Protection Inspectorate.

Users of the service may have a personal account to which all complaints will be registered, will be able to follow up online and receive notifications about the process of remedying the complaints.

The application allows the geographical location of the environmental problem through GPS, which will facilitate the notification by the author, but also the identification of the location by the responsible bodies. Each alert sent through the ECO ALERT application will reach EPI in electronic referral format and will be processed. As a beneficiary, the EPI is to use an innovative tool that will streamline internal work processes for processing complaints[430].

Ecopresa.md is a site of environmental news and analysis, green energy, ecological tourism, etc. created and managed by the Association of Environmental Journalists and Ecological Tourism of Moldova (AJMTEM).

The site is a platform for ecological information and awareness, for promoting people from the field of environmental protection, energy efficiency and green energy and ecological tourism; for publicizing the most important events in the reference fields. The online platform offers news, analyses and interviews, multimedia reports, space to promote environmental projects and initiatives, tourism, green energy, energy efficiency. Ecopresa.md was launched in October 2013, as part of an AJMTEM project, within the SECTOR Program of the Regional Environmental Centre for Central and Eastern Europe (REC) and with the financial support of the Swedish Government[431].

The Forum of Environmental NGOs is held periodically in Chisinau. The purpose of the event is to strengthen the cooperation of the associative environmental sector to ensure the process of connection to European standards for the rational use of natural resources and environmental protection in the RoM.

Among the topics addressed by the representatives of environmental NGOs within the Forum are: the environmental legislative framework – understanding and contributing to its implementation, the NGOs position in relation to polluters that cause degradation of the quality of the environment, protected areas and ecosystems of the RoM, identification, establishment and ensuring of functionality, the role of NGOs in this process, etc.

The Forum offers participants the opportunity to interact with national experts, representatives of donor organizations, government officials, etc. During the event, thematic workshops are organized to strengthen partnerships between participating NGOs and journalists, including other partners, in order to promote the results of funded projects, etc.[432].

[429] Source: <https://www.environment.md/ro/proiecte/green_moldova>
[430] Source: <www.ecoalert.md>
[431] Source : <www.ecopresa.md>
[432] *Idem.*

6.4. Gender and Climate Change

Gender equality is fundamental to achieving sustainable development, as recognized by the Sustainable Development Goals (SDGs) – explicitly in SDG 5 on achieving gender equality and empowering all women and girls, but also as a prerequisite for achieving other SDGs, from education, health, decent work to tackling climate change[433].

By actively involving both women and men in all sectors of society, countries can unlock the potential of all citizens and make the transition to more resilient societies, including truly sustainable low-carbon ones.

For example, women often play a central role in sectors where emissions can be substantially reduced together with the benefits of development, such as the efficient use of household energy, support for income generation activities and target consumption patterns of low emission products.

Emphasizing women as active members of society and promoting their participation in new/non-traditional climate-related jobs, for example as technicians and entrepreneurs in the field of renewable energy, refrigeration and air conditioning, etc., can contribute to poverty reduction and economic growth.

Studies show that the peer involvement of women and men in decision-making processes has a positive impact on business performance and investments in general, serving as evidence of the better performance of companies with more women on their board, in terms of return on investments, sales and equity[434].

There is undeniable empirical evidence that *"inclusion of both sexes in public policy-making leads to a better policy making that is better suited to the diversity of citizens"*[435].

Similarly, studies show that groups with a mixed representation of women and men tend to be more innovative and make better decisions, especially for more complex tasks. A better representation of women in teams offers a greater diversity of views, namely a better collection of ideas and making relevant decisions. A higher share of women in high-level decision-making positions generate better institutional efficiency and improve the organizations' performance[436].

At international[437] and national level[438] it is recognized that climate change adaptation and mitigation are essential to protect means of well-being and to achieve continued progress in sustainable development. Climate change affects all members of society, but its impact may be different on men and women. Women and girls are disproportionately affected by climate change, environmental degradation and biodiversity loss, which reduces their ability to adapt[439]. It is important to understand and take advantage of gender aspects when developing measures to adapt and/or mitigate climate change, including the reduction of greenhouse gas emissions, taking into account the roles and responsibilities, different consumption patterns of women and men in society.

Scientific evidence shows that anthropogenic climate change is currently responsible for a large proportion of extreme weather events around the world[440]. Climate change affects everyone in all countries, yet women, girls, men and boys are affected differently by climate change and natural disasters, with many women and girls facing greater risks, responsibilities and impacts[441]. Women and men have different life and work experiences, perceive and identify risks differently with regard to health, activity and life in the context of climate change. Vulnerability and risk reduction capacities are determined by several factors: poverty, social class, education, age, ethnicity and gender norms/relationships, etc.

The European Parliament resolution on women, gender equality and climate justice also recognize that men and women are affected differently by climate change, and calls on the EU to finance both adaptation to climate change and mitigation of its gender responsive effects[442].

The impact of climate change targets the combined factors of natural risks and human vulnerability. These vulnerabilities are manifested by physical exposure, socio-economic vulnerability, limited capacity to reduce the vulnerability/risk of climate change and to cope with them.

Climate change has a stronger impact on marginalized groups, as women and girls are the most at risk, with higher rates of morbidity, mortality and economic impact due to reduced resilience to climate risks[443]. In the case of natural disasters, women are at greater risk of injury or death due to physical conditions. The impact of these disasters may also have adverse consequences on reproductive health. Another relevant example refers to the fact that well water (in cases of contamination) is used by women in higher proportions, thus the degree of exposure of this risk is higher. The increased incidence of all types of hazards increases the likelihood of social conflicts, which often affect predominantly women and girls, especially those from vulnerable groups. At the same time, across society as a whole, *"... the negative consequences of climate change undermine a country's development prospects, exacerbating already existing inequalities such as gender disparities"*[444].

The Strategy for ensuring equality between women and men for 2017-2021 identifies, in Chapter 2.6, the climate change

[433] UNDP Moldova. *2030 Agenda for Sustainable Development and the Sustainable Development Goals in the Republic of Moldova. Goal 5: Gender Equality* <https://www.md.undp.org/content/moldova/ro/home/sustainable-development-goals/goal-5-gender-equality.html>

[434] Carter, N.M. and Wagner, H.M. (2011) The bottom line: Corporate performance and women's representation on boards (2004–2008). New York: Catalyst

[435] Council of Europe. A.E. Woodward, *pursuing gender balance. A guide for balancing the decision-making process (EG-S-BP, 2001)* <https://rm.coe.int/16805916b8>

[436] Profeta P., *Gender equality in decision-making positions: the efficiency gains* Intereconomics, Vol. 52, No. 1, pp. 34–37 (2017) <https://www.intereconomics.eu/contents/year/2017/number/1/article/gender-equality-in-decision-making-positions-the-efficiency-gains.html>

[437] 2030 Agenda for Sustainable Development < https://sdgs.un.org/2030agenda >

[438] Government Decision no. 1009 of 10.12.2014 approving the Climate Change Adaptation Strategy of the Republic of Moldova until 2020 and the Action Plan for its implementation, Official Gazette of the Republic of Moldova no. 372-384 of 19.12.2014, art. 1089 <https://www.legis.md/cautare/getResults?doc_id=49220&lang=ro> (as amended by Government Decision no. 1143 of 21.11.2018 on the approval of the changes that are operated in some Government Decisions, the Official Gazette no. 13-21 of 18.01.2019, art. 07, <https://www.legis.md/cautare/getResults?doc_id=112021&lang=ro>)

[439] European Committee of the Regions Gender equality and climate change: towards gender mainstreaming in the European Green Pact. Commission Working Document on the Environment, Climate Change and Energy (ENVE-VII/018) <https://webapi2016.cor.europa.eu/v1/documents/COR-2021-02509-00-00-DT-TRA-RO.docx/content>

[440] Hassol S. et al., '(Un) Natural Disasters: Communicating Linkages Between Extreme Events and Climate Change', WMO Bulletin 65 (2), 2016.

[441] General recommendation no. 37 on the Gender Dimension in Natural Disaster Risk Mitigation in the Context of Climate Change of 07.02.2018, Committee on the Elimination of Discrimination against Women (CEDAW). <https://tbinternet.ohchr.org/Treaties/CEDAW/Shared%20Documents/1_Global/CEDAW_C_GC_37_8642_E.pdf>

[442] European Parliament resolution of 16 January 2018 on women, gender equality and climate justice (2017/2086(INI)) <https://www.europarl.europa.eu/doceo/document/TA-8-2018-0005_EN.html>

[443] European Parliament Report on the impact of climate change on vulnerable populations in developing countries (2020/2042 (INI)) <https://www.europarl.europa.eu/doceo/document/A-9-2021-0115_EN.pdf>

[444] *Idem.*

intervention area as a strategic concern at national level[445]. In the context of climate change policies, international bodies emphasize, among other things, the importance of gender equality. Climate change and its negative effects should also be seen as a development problem with a gender impact affecting all sectors (social, cultural, economic and political). Joint efforts by all stakeholders are needed to ensure that climate change mitigation and disaster risk mitigation measures respect the gender dimension. The main problems identified in the Strategy include: the non-inclusion of the gender dimension in sectoral environmental and climate-related policies and lack of research on climate change adaptation and impact on different demographic groups (including sexes)[446]. It should be noted that an insufficient approach to the gender dimension may result in incomplete assessments of the situation and underestimation of risks. However, the correct identification of risks and their assessment, taking into account gender specificities, can contribute to more effective interventions (including in terms of financial costs) to reduce climate change risks[447].

Specific objective 1.10 of the Action Plan for the implementation of the aforementioned Strategy provides for the adjustment of sectorial climate change adaptation strategies aimed at including gender dimension. This objective will be achieved by:

- amending the sectoral policy documents related to climate change from gender perspective in 7 relevant sectors (transport and road infrastructure, agriculture, energy, water and sewerage, food security, regional development and construction, health),
- training civil servants on the impact of global warming and climate change on health, poverty, accessibility of natural resources and gender roles in this context,
- organizing information campaigns on the impact of climate change in terms of gender.

The number of areas of the 7 relevant sectors that have adjusted the public policies by gender dimension and the proportion of civil servants with relevant duties trained on global warming and climate change in the light of gender impact will be the main progress indicators for the Action Plan implementation evaluation[448].

A visible progress on gender mainstreaming in public climate change related policy documents has been achieved following the development of the draft Low Emission Development Program (LEDP) 2030[449]. The document recommends focusing efforts on the following dimensions:

– improving the sustainability of the LEDP 2030 design and implementation by ensuring the full and active participation of women and men, including in decision-making;
– gender mainstreaming of actions targeting key sectors with a high share of greenhouse gas emissions;
– identifying and providing solutions to lift women and men out of poverty;
– understanding how differentiated consumption patterns of women and men affect their carbon footprint[450]; helping to reduce carbon emissions;
– encouraging women on an equal footing with men to make use of efficient energy technologies in agriculture and households, solar energy, sustainable land management practices, etc.;
– gender disaggregated data collection to estimate the social and gender impact of the LEDP 2030[451].

Therefore, the inclusion of gender aspects[452] in the design, implementation, monitoring and evaluation phases of the LEDP 2030 is an important precondition of an efficient process. On the other hand, the impact of low-emission development on gender equality should be reiterated. The LEDP 2030 can contribute to improving gender equality by creating equal opportunities for women to benefit from improved services and conditions (including transport and infrastructure, access to water and affordable and efficient energy services, etc.) and by promoting income generation opportunities.

The Government has acknowledged in the nationally approved documents that women are not only affected differently by climate change, but can also contribute differently to climate change adaptation/mitigation actions.

Respectively, a LEDP-type document that harnesses the potential of men and women in reducing emissions in various sectors and taking into account their respective social roles and responsibilities, will not only contribute to climate change mitigation, but will also be able to provide access to services and income opportunities that can mitigate gender inequalities.

At the same time, the LEDP 2030 can have a positive gender impact if it also includes measures that provide opportunities for women's access on an equal footing with men to the development of new skills, financing and technologies, health, education, decision-making and markets, etc.; if they support women's entrepreneurship in low-emission development; and by reducing unequal social burdens (in the context of traditional work division in the family/household), which are mainly women's responsibility. Thus, gender dimension in the LEDP is important not only from political correctness perspective (international standards), but also as a practical necessity.

The project "Supporting the National Planning Process of the RoM in Climate Change Adaptation (Stage 1)" funded by ADA and implemented by the UNDP Moldova in partnership with the Ministry of Environment during 2013-2017 included a number of components that related to the inclusion of gender perspective in the climate change adaptation process[453].

[445] Government Decision no. 259 of 28.04.2017 approving the Strategy for ensuring equality between women and men in the Republic of Moldova for 2017-2021 and the Action Plan on its implementation, Official Gazette no. 171-180 of 02.06.2017, art. 410, <https://www.legis.md/cautare/getResults?doc_id=99875&lang=ro>
[446] *Idem*.
[447] V. Bodrug-Lungu, *Guide on Inclusion of Gender Dimension in Health in the Context of Climate Change* (2015). Source: <http://adapt.clima.md/public/files/Ghid_Gen_Sanatatea_2015.pdf>
[448] *Idem*.
[449] Low Emission Development Strategies Global Partnership. Promote gender equality. To achieve the benefits of low emission development /LEDs in Practice, June 2016. <https://www.climatelinks.org/resources/leds-practice-promote-gender-equality-realize-benefits-low-emission-development>

[450] Amount of carbon dioxide and other carbon compounds emitted due to consumption of fossil fuels by a particular person, group, etc.
[451] Draft Low Emission Development Program up to 2030. The document was subject to public consultation on June 17, 2021.
[452] Gender analysis is a tool for diagnosing the differences between women and men in terms of specific activities, conditions, needs, access to/control over their resources, as well as their access to development and decision-making benefits. Thus, the analysis of different situations of men and women, directly or indirectly related to climate change and the reduction of greenhouse gas emissions, can provide an understanding of the impact of different practices, policies and programs on women and men and their relevant adjustment.
[453] The Final Project Report contains detailed information on a number of activities that have harnessed the

Thus, the gender aspects have been incorporated in the project activities and in the drawn up deliverable documents. Actions to adapt to climate change have been included in public policy documents on ensuring gender equality. The indicators collected and analyzed were disaggregated by gender. Technical specialists and representatives of line ministries and other public authorities (including LPAs) have been trained on the gender aspect in the climate change adaptation process [454]. Awareness materials/information on gender equality and climate change were developed in 4 sectors (energy, transport, health and forestry), as well as the Guides on gender dimension inclusion in climate change context in the same 4 sectors[455].

Incorporating the gender perspective in sectoral climate change mitigation measures

In the context of climate change, when incorporating the gender perspective into climate change policies and actions, it is necessary to take into account the following key issues:

- considering men and women to be users of resources (energy, water, land, transport, etc.) with varying levels of responsibility and understanding of their importance in the climate change context;
- differentiated access for men and women to resources (energy, land, water, forests, etc.) and products and services derived therefrom in the climate change context;
- the involvement of men and women as providers of services based on different resources in the climate change context;
- the participation of men and women as workers in different sectors affected by climate change, which contribute to greenhouse gas emissions reduction;
- participation of men and women in decision-making and consultation processes in the context of low-emission climate change and development.

In planning and implementing low-emission adaptation and development, it is important to involve all stakeholders, especially those representing vulnerable groups. Respectively, given that the groups of women and men are not homogeneous, participation involves intersectionality: addressing the needs of women and men in connection with other variables, such as age, residence area, disability, socio-economic status, family status, etc.

Gender-specifics by main sectors covered by the draft LEDP 2030

Energy Sector

- Energy contributes significantly to the development of human habitat. Identifying and addressing the needs of women and men are key to ensuring the success of policy in the energy sector.
- Women and men have different types of energy-related knowledge/experience, whether through their traditional or non-traditional roles (especially in households run by women), or as professionals in the energy sector. Respectively, the promoted policies and interventions in energy sector must take into account gender differences, different capacities to anticipate the risk, the response and recovery.
- Women have a key role to play in the use of energy, especially in poor communities. Building on these experiences will contribute to more efficient implementation of energy projects.
- Access to modern energy services contributes to reducing the domestic burdens of women, giving them more time for other activities, such as education, health protection, entrepreneurship, etc.

Recommended activities:

- Creating equal opportunities for women and men in terms of developing entrepreneurship, employment in the energy sector, including decision-making positions.
- Providing equal access to information for women and men by training in sector related modern technologies, business opportunities, etc..
- Organizing information campaigns on the benefits of green energy and impact of greenhouse gas emissions on health and economic aspects, taking into account gender dimension.
- Involvement of representatives of women's NGOs in coordination committees of sectoral enterprises and relevant projects.
- Involvement of women in consultation processes at the stage of developing energy projects concepts.

Transport Sector

- Women and men have different types of knowledge/experience related to transport, either through their roles as drivers/passengers/pedestrians or as professionals in the transport sector. Respectively, policies and interventions in this sector must take into account gender differences, different risk anticipation, response and recovery capacities.
- Current activities note that car travel and the ideas of mobility and freedom associated with the car are closely linked with the image of men. Men are more often represented travelling – as owners and drivers; and women – as being in charge of household chores and as a user of public transport. For these reasons, the gender aspect is an important factor in meeting transport needs at all levels.
- A high level of economic development is associated with equal access of men and women to resources (including transport), reduction of gender inequalities with reference to income, etc. Respectively, access to modern and safe transport services contributes to the restructuring of the domestic tasks of women, giving them more time for entrepreneurship activities, while contributing to economic and social development.

Recommended activities:

- Creating equal opportunities for women and men in entrepreneurship, employment in the transport sector, including in decision-making positions.

gender perspective in the process of climate change adaptation. Source: <https://www.md.undp.org/content/moldova/ro/home/projects/climate-change-adaptation-planning-process-in-moldova.html>

[454] Source: <http://www.clima.md/public/files/Constientzare/Seminare/semcn4/Druta.pdf >

[455] The awareness/information materials and the respective Guides can be accessed at: <http://adapt.clima.md/pageview.php?l=en&idc=311>

- Offering to women, on an equal footing with men, access to information by training in transport infrastructure, business opportunities, etc..
- Organizing information campaigns on the benefits of eco-transport; traffic safety, taking into account gender aspects .
- Involvement of representatives of women's NGOs in coordination committees of sectoral enterprises and relevant projects .
- Involvement of women in the processes of project consultation, allocation of resources and development of the relevant infrastructure.

Buildings Sector

- Women and men have common but also specific needs in relation to their place and living conditions.
- Studies confirm that development of women's capacities in energy efficiency can contribute to increasing women's motivation to participate in activities related to thermal modernization of residential buildings, traditionally associated with men.
- At the same time, in the context of prevalence of women among elderly population, given the gender difference in salaries, respectively in pensions, the category of women over 63 can become economically vulnerable in terms of financial opportunities (personal investments) to participate in programs of thermal insulation of the housing fund. Such aspects should be taken into account while designing such programs.
- In order to make the sector more efficient, it is necessary to develop partnerships between the local government and the tenants' associations to coordinate efforts and resources for the implementation of programs related to thermal upgrades of residential buildings taking into account gender aspects.
- Information to the public on importance of thermal upgrading of residential buildings should be provided by highlighting the benefits of reducing greenhouse gas emissions and improving the health and well-being of women and men.

Recommended activities:

- Developing women's capacities in energy efficiency can help increase their motivation to participate in activities related to thermal upgrades of residential buildings, traditionally associated with men.
- Providing women, at a level equal to that of men, with access to information by training related to buildings, associated services, relevant business opportunities, etc.
- Conducting information campaigns on opportunities to reduce greenhouse gas emissions in the buildings sector, taking into account the specific needs of women, men, children and the elderly.
- Involvement of women and men in residential buildings maintenance activities to keep the buildings in good technical condition.
- Involvement of women in the processes of project consultation, allocation of resources and infrastructure development.

Industry Sector

- In industry there are gender discrepancies at the level of engineering and qualified technical staff, women being under-represented in the fields related to production of glass, construction materials and others. At the same time, women predominate in industrial branches that manufacture social products (for example, dairy products, bakery products).
- Although female participation in entrepreneurship has improved in recent years, women continue to represent little used growth potential and a minority in the business community, owning and managing about 33.9% of businesses[456].
- Women, more frequently than men, own micro businesses and rarely own medium-sized and large businesses.

Recommended activities:

- Creating equal opportunities for women and men in entrepreneurship, employment in industrial sector, including decision-making positions.
- Providing women, at a level equal to that of men, with access to information by training on financial possibilities of purchasing and maintaining modern equipment and business opportunities.
- Organizing information campaigns on the harmful impact of emissions from obsolete equipment on the health of employees, taking into account gender aspects.
- Involvement of women in the processes of project consultation, allocation of resources and infrastructure development.

Agriculture Sector

- In the RoM, women in rural areas account for almost 30% of the total population of the country and 51% of the stable population in rural areas.
- The time allotted by rural women as food producers (growth, collection and preparation of agricultural production) and the care of other household members is rarely included in the income measurement system or taken into account in the policy-making process. At the same time, the unequal distribution of labor in households significantly limits women's economic prospects for productive and decent work.
- As a gender-specific aspect, it should be mentioned that agricultural production of the Republic of Moldova is completely dependent on agrochemical products, seeds and fuels, which affects the competitiveness of agricultural products.
- The climate impact and vulnerability of agricultural sector is clearly traced to reduction of population incomes in rural areas; poverty worsening as a result of food prices growth, especially among people from socially disadvantaged groups (women with children, women and older men, etc.).

[456] NBS presented the results of the study on business development from gender perspective, 06.08.2020: <https://statistica.gov.md/newsview.php?l=en&idc=30&id=6724>

Recommended activities:

- Creating equal opportunities for women and men in terms of developing entrepreneurship in crops and livestock sector and access to markets, based on modern technologies.
- Providing preferential financial support for procurement of seeds, inputs for agricultural products subject to processing; financial possibilities for procurement of installations and equipment for processing agricultural products.
- Providing women equal opportunities with men on access to information by agro-ecological, agro-forestry and renewable energies training, business opportunities for producing high value-added products, etc.
- Involvement of women in the processes of project consultation, allocation of resources and infrastructure development, etc.

Forestry Sector

- Women have a significant role in the collection, production, distribution and use of forest products, especially in poor communities. Harnessing these experiences would help forestry-related projects to be carried out more efficiently.
- Empowering women in the forestry sector can create significant opportunities for development and generate important spill-over benefits for households and their communities, especially in rural areas. Given their knowledge and role in the forestry sector, women must be sufficiently represented in the relevant institutions, accepted as stakeholders with specific views and interests and persons who can make the transformation decisions.
- At the same time, access to modern energy services, including based on agroforestry energy plantations, can contribute to reducing the domestic tasks burden, giving women more time for other activities, such as education, health protection, entrepreneurship activities, etc.

Recommended activities:

- Creating equal opportunities for women and men in terms of developing forestry sector related entrepreneurship, including by creation of energy agroforestry plantations, beekeeping, collection and use of medicinal plants and forest fruits based on modern technologies.
- Providing financial and preferential support for setting up private forest plantations.
- Organizing information campaigns on the importance of forest protection and development, taking into account gender aspects.
- Informing the public about the role of forests in carbon sequestration and their contribution to reducing greenhouse gas emissions.
- Involvement of women in the processes of project consultation, allocation of resources and infrastructure development, etc.

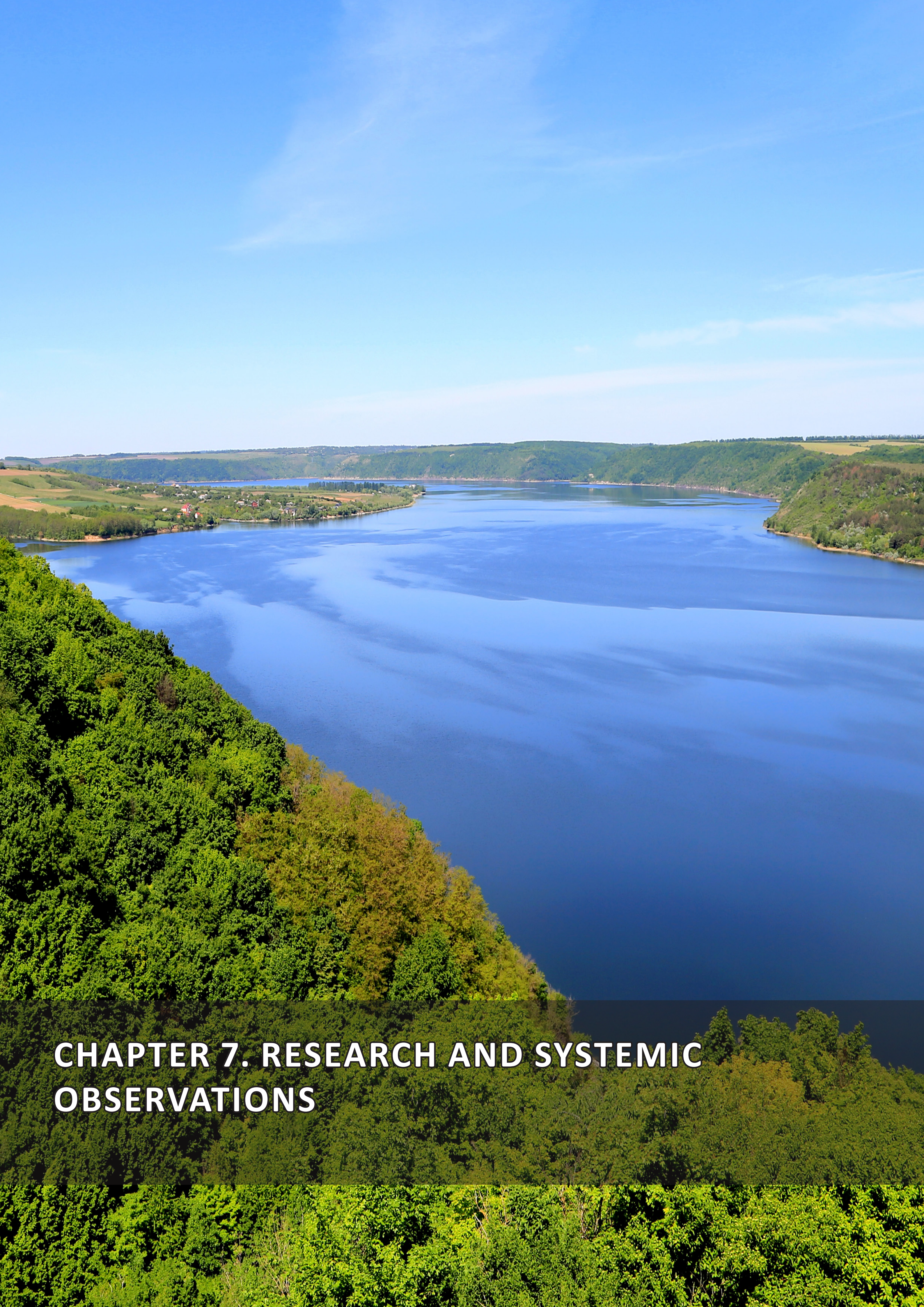
Waste Sector

- Gender issues are directly linked to good waste management, as women and men have different sensitivities and roles in the family and society that can influence decision-making and exposure to waste.
- The impact and effects of exposure vary depending on such factors as geographical location, behaviors, age, nutritional status, socioeconomic status, biological effects and/or exposure to certain chemicals. Therefore, in order to ensure population safety in the waste management process, gender aspects must be considered together with the abovementioned factors.
- Inequality often affects waste management and the associated access of women and men to various services (health, social protection, information, etc.), to safe jobs, to safe products and resources, including decision-making processes, etc.

Recommended activities:

- Creating opportunities for involvement of men and women as service providers in waste management with a maximum share of reducing or capturing greenhouse gas emissions.
- Creating opportunities for participation of men and women as workers in sectors contributing to waste reduction.
- Conducting educational-information campaigns focusing on fostering responsible consumer behaviors (use of eco-bags, waste separation, especially hazardous waste), taking into account gender aspects.
- Providing access to services related to transportation and storage of waste, taking into account gender aspects.
- Informing the public about the harmful impact of waste on women's and men's health.
- Involvement of women in the processes of project consultation, allocation of resources and infrastructure development, etc.

Strengthening the capacities of women and men in these sectors will enable them to develop a sustainable resilience to climate change.



CHAPTER 7. RESEARCH AND SYSTEMIC OBSERVATIONS

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7.1. Historic Background

The first meteorological observations were made in Chisinau in 1844. In 1878, the first hydrological post on the Dniester River was organized in Bender (1878). During the years 1880-1900 meteorological observations started at five stations of the country: Briceni (1887), Soroca (1890), Comrat (1892), Ploti (1894) and Tiraspol (1898).

At the beginning of the 20th century, the stationary meteorological observations were made at 11 stations, and hydrological observations were made at five stations. But at most stations and posts the observations were episodic, often interrupted by military action during the two world wars.

The Hydrometeorological Department of the RoM was established in October 1944 to ensure development of regular hydrometeorological observations. In the same year, the Meteorological Bureau with forecasting groups was set up in the structure of the Department. The Meteorological Bureau worked extensively on evaluation of the methodology used by the Moscow Central Forecasting Institute and its adaptation to the conditions of the RoM, as well as on development of new methodologies. The Hydrological Forecasting Group has developed hydrological forecasting methods on the Dniester and Prut rivers.

The first rainflood forecast was issued in 1950, and the first forecast of the rainflood flow volume was made in 1953. In the post-war period, the restoration of previously functioning observation stations and posts and the opening of new posts began, including organization of new types of observations.

The first aerological survey was conducted in Chisinau in 1946, and with the opening of the Chisinau Aerological Station in 1957, this process became continuous. The hydrological balance station was opened in 1953, and the hydrological station on Dubasari reservoir was opened in 1957.

In the middle of 50's the hydrometeorological network has reached its optimal allocation density. The development of the hydrometeorological network required a continuous methodological assurance, for which purpose a series of summaries of hydrometeorological observations materials were developed. Observations on the components of the radiative balance began in 1954. In order to ensure the needs of the agricultural sector, the network of agrometeorological observations was developed, especially for determination of moisture reserves in the soil (from 3 posts in 1947 to 24 points in 1963). To this end, the Hydrometeorological Observatory was organized in 1956 (reorganized in 1982 into the Hydrometeorological Center), which ensured the methodological direction of the observation network, its endowment with equipment and machinery, development of new types of observations, aggregation of observation materials in the form of monthly reports, yearbooks, guidelines, but also by carrying out a series of scientific research works.

Environmental pollution monitoring in the RoM has started in 1950, by studying the hydrochemical regime of two rivers at 5 posts. At present the extent of these activities has considerably increased. Observations of 45 indices are made on 13 rivers on 32 posts, in 42 sections, and in three water basins. Since 1976, the quality control of surface waters has been organized according to five hydrobiological indices. Observations on atmospheric air pollution started in Chisinau in 1969 at three stationary posts on four indices and gradually expanded both in terms of the number of observation posts and the determined components. Currently, these observations are made on seven components at stationary posts in four cities of the country.

Air pollution forecasts are issued since 1979. Use of chemical products in agriculture preconditioned the need for soil quality monitoring and pesticide control.

The monitoring began in 1976 with establishment of the laboratories on soil pollution monitoring that nowadays are widely dispersed across the whole territory of the country, in places where chemical products are used.

According to the Resolution of the Parliament of the RoM of 29 July 1994, the State Hydrometeorological Service is a member of the World Meteorological Organization (WMO).

Since 2001, a forward-looking plan has been put in place to develop and strengthen the SHS potential. To achieve this goal, the Government and the National Ecological Fund provided financial support for a number of important activities for modernization and optimization of the SHS main production departments, including the National Observational Network. Automatic weather stations for all the meteorological posts, up-to-date equipment for the hydrological and hydrochemical posts were purchased. Automatic weather stations have been purchased and installed in all weather stations, as well as modern equipment for several hydrological and hydrochemical stations.

7.2. Institutions Involved in the Systemic Observations

Climate change has an extreme impact on RoM, on many applications and socio-economic sectors, on the well-being and health of its population, causing an increase in occurrence and frequency of extreme events, such as droughts and major floods, as well as the uneven distribution of precipitation throughout the year.

In addition, all socio-economic sectors, public and private agencies, academia and individuals are in dire need of high-quality meteorological services, including observational data, short, medium and long-term weather forecasts, and early warnings.

The SHS plays a key role as a responsible and empowered governmental agency for the provision of the necessary meteorological, hydrological and climatic services.

7.2.1. Legal Framework, Organization and Functioning of the State Hydrometeorological Service

Starting with 2020, the State Hydrometeorological Service (hereinafter referred to as SHS) launched an extensive process of institutional and functional reform aimed at strengthening the hydrometeorological sector in the RoM, in order to establish the position and role of the SHS in the structure of public authorities with environmental competences, in accordance with international directives[459] and institutional needs in the legal, administrative and functional context. The process comprises the following stages and strategic development timelines:

- *Stage I (2020-2021):* Preparation of institutional changes. Assessment of the sector's capacity regarding coverage with resources. Analysis of the necessary legal, organizational and functional framework.
- *Stage II (2022 – 2023):* Implementation of recommendations of the functional analyses carried out with the support of the UNDP, through the national project on climate change adaptation planning in the RoM. Develop and promote the necessary legal framework and institutional policies. Institutional reorganization of SHS.
- *Stage III (after 2024):* Ensuring the sustainability of the started reform process. Strengthening the institutional and functional capacities related to the hydrometeorological field. Development of hydrometeorological monitoring networks infrastructure. Updating and substantiating the services provided by the SHS, including new climate services in the RoM.

On 12 August 2021, by GD No.117[457], the Ministry of Agriculture, Regional Development and Environment (MARDE) was reorganized by separation. The environmental protection functions, climate change and the field of natural resources were taken over by the newly created Ministry of Environment *(hereinafter MoE)*, as field related successor of rights and obligations.

The MoE was created on August 28, 2021, by GD No. 145[458], with the central apparatus structure and the list of subordinate administrative authorities and public institutions in which MoE is a founder. The SHS, along with other authorities with competences in the field of environment, was included in the list of administrative authorities subordinated to the MoE.

At the end of 2021, the Law No. 221/2021[459] amended the Law No. 1536/1998 on hydrometeorological activity, according to which: *"The hydrometeorological activity in the RoM is carried out by the State Hydrometeorological Service, which is an administrative authority promoting and implementing the state policy in the meteorological, hydrological and related fields."*

The environmental monitoring powers (water, air and soil quality) which previously had been assigned to the Environmental Agency by GD No. 549/2018[460] "On the establishment, organization and functioning of the Environmental Agency" were abrogated by Law No. 221/2021.

[457] <https://www.legis.md/cautare/getResults?doc_id=127381&lang=ro>.
[458] <https://www.legis.md/cautare/getResults?doc_id=127621&lang=ro>.
[459] <https://www.presedinte.md/app/webroot/Decrete/297.pdf>.
[460] <https://www.legis.md/cautare/getResults?doc_id=119162&lang=ro>.

Therefore, according to the *Law on hydrometeorological activity*, as amended, the hydrometeorological activity in the RoM is carried out by the SHS, as administrative authority with functions of promoting and implementing the state policy in the meteorological, hydrological and related fields. The SHS is an administrative authority subordinated to the MoE, who's the activity of which is regulated by the GD No. 401 of April 3, 2003[461] "On some aspects of hydrometeorological activity in the Republic of Moldova".

The main tasks of the SHS are:

a) monitoring the state and evolution of hydrometeorological conditions in order to protect the population against dangerous hydrometeorological phenomena, to prevent damages caused by them;
b) meeting the needs of the population, national economy and national defense, as well as public authorities on hydrometeorological information;
c) observing the hydrometeorological conditions and the radiation level within the hydrometeorological monitoring network and analyzing the collected data;
d) systematic analysis and synthesis of data on hydrometeorological and agrometeorological conditions created on the territory of the country, ensuring the development and publishing of informative documents;
e) ensuring the functionality and endowment of the observation network with equipment and tools ensuring the acquisition, collection, processing and dissemination of hydrometeorological information;
f) participating in the information exchange within the global system of hydrometeorological observations and fulfilling the obligations arising from international conventions and agreements to which the RoM is a party.

7.2.2. Special Service for Active Influences on Hydrometeorological Activity

The Special Service for Active Influences on Hydrometeorological Processes was created by GD no. 1120 of 27.10.2005[462] through the reorganization of the State Enterprise "Antihail Service" and is a public institution, financed from the state budget and special means, subordinated to the Ministry of Agriculture and Food Industry (hereinafter referred to as MoAFI), empowered with functions of a national body in the field of active influences on meteorological and other geophysical processes.

Fundamental tasks of the Special Service:

a) state regulation in the field of active influences on meteorological processes and other geophysical processes;
b) development of technological and methodological documentation, monitoring in the field of active influences on meteorological processes and other geophysical processes;
c) departmental control of compliance with the standards, regulations and norms regarding active influences on clouds;
d) execution of works to combat hail and other works aimed at active influences on meteorological processes and other geophysical processes.

[461] <https://www.legis.md/cautare/getResults?doc_id=31653&lang=ro>.
[462] <https://www.legis.md/cautare/getResults?doc_id=28602&lang=ro>.

7.2.3. Environmental Agency

The Environmental Agency was created by GD No. 549/2018, through the merger of the State Ecological Inspectorate with the Environmental Reference Laboratories of the SHS and the acquisition of competences and staffing positions from the Agency "Apele Moldovei", "Moldsilva" Agency and the Agency for Geology and Mineral Resources.

The Environmental Agency is an administrative authority subordinated to the MoE and has the mission to ensure the implementation of the environmental protection policy, in the following areas:

- prevention of environmental pollution;
- atmospheric air protection and climate change;
- protection and regulation of the water resources use;
- protection and regulation of the use of the animal and plant kingdom, of aquatic biological resources;
- waste management and biosecurity.

7.2.4. International Civil Aviation Organization

Aiming at ensuring flights, improving the use of airspace and directing air traffic according to the recommendations of the International Civil Aviation Organization, the GD No. 3/1994[463] provided for creation of the State Enterprise for the Use of Airspace and Air Traffic Direction "MOLDATSA" (SOE "MOLDATSA").

Pursuant to the Civil Aviation Law No. 1237/1997, the Aeronautical Meteorological Service was established within SOE "MOLDASTA" in 1998 and the duties of the Aeronautical Meteorological Service were established by GD No. 645/2014[464]. The Aeronautical Meteorological Service operates in accordance with the standards, practices and recommendations of the International Civil Aviation Organization, the WMO and the Technical Requirements, based on the meteorological instructions in the field of international air navigation.

Aeronautical meteorological activity represents all the activities intended to carry out meteorological observations on the country's aerodromes, ensuring the development, issuance and distribution of aeronautical meteorological forecasts with the aim to contribute to the safety, regularity and efficiency of international air navigation.

This objective is ensured by the provision of meteorological information needed to fulfil the set tasks to air operators, crew members, air traffic services, search and rescue service units, airport management and other parties involved in the conduct and development of international air navigation.

7.3. National Hydrometeorological Monitoring System

7.3.1. General Context

The national hydrometeorological monitoring system reproduces, at the country's scale, the world meteorological system. It has a complex character and ensures the registration, transmission and processing of meteorological information, according to the internal needs, directives and agreements of the WMO, bilateral agreements and other treaties and conventions to which the RoM is a party.

Systematic climate observations present the main source of activity data for scientific analysis in the field of climate and climate change.

The SHS terrestrial monitoring network includes approximately 90 hydrometeorological stations and posts as well as checkpoints to monitor air, water and soil pollution. Observation of meteorological, hydrological and agrometeorological parameters and ecologic monitoring is carried out in a non-stop regime at stations and posts. The permanent observation points form the network and are equipped with the same type of equipment and operate in in accordance with the international classical method. The placement of hydro-meteorological stations and posts on the territory of the RoM is in line with the international requirements contained in the WMO's Global Observation System Manual[465].

At present, the number of weather stations located on the territory of the country is close to optimal density and is in line with international standards. At the same time, taking into account that the RoM is considered to be a region with a high risk of heavy shocks, the density of the meteorological network is considered to be slightly below the optimum limit.

The information obtained from monitoring is used for meteorological, agrometeorological forecasts and for air, water and soil pollution assessments, for warning on hydrometeorological disaster phenomena, for the global and regional exchange of hydrometeorological data, for the assessment of the climate change in the RoM, and for supplementing the National Hydrometeorological Database.

7.3.2. Meteorological Monitoring System

The Meteorological Monitoring System (MMS) consists of the central meteorological and climatological structures and the meteorological monitoring network of the SHS.

The main tasks of the MMS are defined below:

- organizing, developing and methodologically guiding the meteorological and agrometeorological observations system;
- issuing public weather forecasts and warnings of dangerous weather phenomena, which are regularly disseminated to central and local public authorities, to the media;
- providing specific information on occurrence and intensity of hazards, controlling the use of hydrometeorological information by individuals and legal persons;
- systematic analysis, synthesis of meteorological and agrometeorological conditions;
- development and publication of information material and systematic transmission of information to local and central public authorities, businesses and population.

The results of meteorological observations received at the stations in accordance with the WMO Guidelines include

[463] <https://cdn01.moldatsa.md/moldatsaprod/140de78484090cc66256b9df653a84a7.PDF>.
[464] <https://www.legis.md/cautare/getResults?doc_id=66686&lang=ro>.
[465] <https://library.wmo.int/doc_num.php?explnum_id=4236>.

more than 80 measurements, recordings and visual features of different meteorological dimensions.

They form the basis of meteorological data banks of all types and destinations, are used for development of hydro-meteorological forecasts, providing consumers with the information on actual meteorological observations in the observation points, notifications and warnings on dangerous phenomena and natural disasters, as well as for describing the local meteorological regime and climate.

In 2004-2008, the Vaisala semi-automatic stations (soft SAIM "Pogoda") were installed at 14 weather stations. The SAIM "Pogoda" stations allow to measure air temperature and humidity, atmospheric pressure, wind speed and direction, soil temperature up to 320 cm depth, and to promptly transmit the operational information in non-stop automatic mode. Other meteorological parameters are measured by using classical equipment.

In 2016 of the national meteorological networks was modernized. New automated weather stations (ADASA, Spain) have been installed at 14 weather stations, measuring all the basic meteorological characteristics, as well as the amount of precipitation.

In 2016 the automatic actinometric complex was installed to measure all solar radiation components followed by the installation of 34 automatic meteorological mini-stations, which measure the temperature and humidity of the air, the soil temperature and the amount of precipitation.

After every 3 hours, the basic meteorological information, encoded in SYNOP telegrams, is collected by the Communication and Information Technology Center. This data is transmitted to the Regional Meteorological Center (Moscow, Russia) for distribution within the framework of global and regional exchange between WMO member countries.

Monthly meteorological information, obtained at 4 stations and coded in "Clima" telegrams, is transmitted to the Regional Meteorological Center (Moscow, Russia), DWD (Germany), World Climate Data Center (Asheville, North Carolina, USA).

These data are subsequently used by the WMO for the preparation of monthly climatological reports and climate modelling in scientific research.

Information on occurrence of dangerous meteorological phenomena or natural disasters, encoded as "WAREP", is promptly transmitted through the Telecommunications and Information Technologies Centre (Chisinau) to the Meteorological Forecasting Centers at all the stations.

The Global Climate Observing System (GCOS) network includes Chisinau weather station, its data being used for global information exchange. At regional level data from all stations of the national network are used.

Data on adverse climatic events are transmitted and posted annually in the WMO Bulletin for region VI.

In November 2010, as part of a regional project of EUMETSAT, the DAWBEE satellite data reception and visualization station was installed in the National Weather Forecast Centre, through which the near real-time monitoring of the state of the atmosphere, evolution of cloud systems, humidity field parameters, weather phenomena, etc., is carried out.

In 2010, the "Disaster and Climate Risk Management in Moldova" project implementation started with the World Bank financial support. The project includes the SHS with a series of activities aimed at upgrading the MMS.

In 2013 the Doppler weather radar system with dual polarization has been installed and put into operation. The SHS has a modern laboratory for equipment calibration. In 2016, the installation of the Data Processing, Processing, Editing and Automated Data Production System was completed in the SYNERGIE and METEOFACTORY forecasting process together with Meteo France International.

Under the UNDP Project "Supporting Moldova's National Climate Change Adaptation Planning Process" and partnership with colleagues from ZAMG (Institute of Meteorology and Geodynamics in Austria), SHS became a member of the EUMETNET (EMMA/Meteoalarm and OPERA) as of 1 January 2016.

1) *The Meteorological Monitoring Network (MMN)* represents the totality of information systems, stations and posts, organized for observations and measurements on weather conditions and collection of data on them and is structured into 18 meteorological observation stations, 16 agrometeorological posts and 34 mini-AMS (Fig. 7-1). These stations are of the following types: manual meteorological observation stations (4 in the Transnistrian region), automatic and manual (mixed) meteorological observation stations (14), mini automatic meteorological stations (34) and manual agrometeorological stations (16).

Figure 7-1: Meteorological observation network of the SHS of the RoM.

From the information available on meteorological stations and environmental exposure it was concluded that their location is relatively appropriate for observations in general and in line with the WMO recommendations, although there are certain deficiencies in terms of spatial coverage.

In order to understand the spatial coverage and density of meteorological stations, the distribution of stations at each elevation band of 100m and a horizontal coverage within a 20 km radius were analyzed taking into account the size of the area at each elevation band (Fig. 7-2).

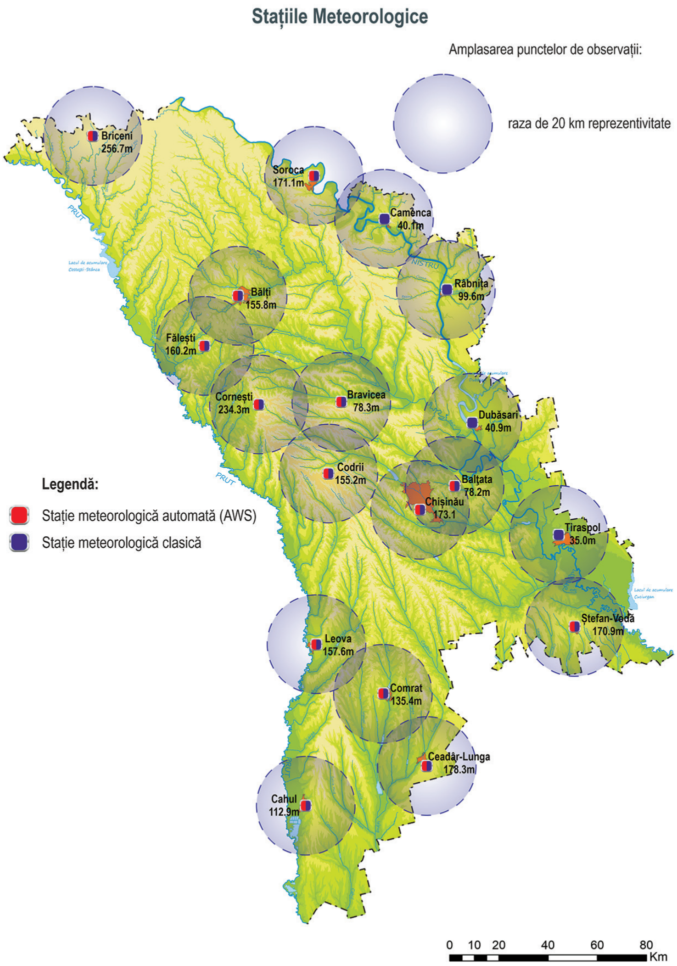


Figure 7-2: Distribution of weather stations at each elevation band of 100 m and within a radius of 20 km.

Although most stations are located in the 101-200 meters elevation band with the largest size, new stations are still needed even for this elevation band and other bands in order to have an optimal observation network as well as to achieve the required density recommended by the WMO. Moreover, the horizontal distribution of the stations was also analyzed to determine the representativeness and coverage of the stations based on a radius of 20 km.

This assessment also shows that it is necessary for new stations to have optimal horizontal station coverage. The analysis of the 18 stations showed that the lowest station was installed at a height of 40 meters, and the highest one is at a height of 261 meters.

- There are 5 stations at an elevation band of 0-100 m. These are: Traspol (40 m), Dubăsari (42 m), Ceadar-Lunga (65 m), Bravicea (78 m), Balțata (79 m). The station density in this elevation band is 1/1789 km^2. Optimal coverage can be ensured by adding 5 new stations.
- There are 11 stations at an elevation band of 101-200 m. These are: Cahul (110 m), Ribnița (119 m), Comrat (133 m), Codrii (152 m), Camenca (154 m), Balti (156 m), Leova (158 m), Falesti (162 m), Chisinau (168 m), Soroca (172 m) and Ștefan-Voda (173 m). The station density in this elevation band is 1/1661 km^2. It is proposed to add 7 new stations.
- There are 2 weather observation stations at an elevation band of 201-300 m. These are: Cornești (232 m), Briceni (261m). The station density in this elevation band is 1/3108 km^2. It is proposed to add 4 new stations.
- There are no stations at the elevation band of 301-425 m. It is proposed that an optimal coverage can be reached by adding 2 new stations in this elevation band.

Figure 7-3: Distribution of weather stations proposed to cover the optimal density of the MMN.

In total it was assessed that the MMN can be expanded by adding 18 new stations to fill the gaps in the observation network. Although the exact locations of the stations must be determined by applying the site selection criteria in accordance with the WMO recommendations, the locations of the proposed stations are determined on a zonal basis. The distribution of the proposed stations is shown in Figure 7-3. The figure shows the MMN according to the proposals based on the Functional Analysis for improvement of the meteorological observation network and operational institutional capacities to provide user-oriented climate services, carried out by international experts in the framework of the National Climate Change Adaptation Planning Project.

2) *IT systems*

The SHS operates its own ICT system which comprises the following systems:

- Wide Area Network (WAN) for transmission of radar data and the WMO Regional Centre in Moscow by VPN with optic-fiber infrastructure;
- system for downloading, processing, viewing and distributing data on the server;
- web interfaces for processing the data from the AMS, stored in databases on a server;
- database management systems for the AMS.
- the central network monitoring and operation system with data visualization, remote reconfiguration and remote monitoring functions of the SMA;
- software application for product forecasting (Synergy & Meteofactory);
- satellite data and product software (EUMETSAT-MSGProc 2019 v. 4.3.1).

It should be noted that the following systems/equipment are not available:

- central data collection system. Data collection is done through the PTF connection.
- message switching system (MSS) for sending and receiving messages via WMO's GTS. SYNOP messages are sent via VPN to the regional data center;
- high performance system for running numerical weather prediction models;
- database management system for climatological data.

Besides the existing ICT systems, it is proposed to purchase and implement the optimal technical infrastructure, including servers, terminals and communication equipment in the central spaces for the operation of the systems. A central system shall be installed as a component of the observation network with the following main features and functions: open-source operating system, collection of all data from observation systems in operation on the observation network, automatic operation according to the defined schedule, running quality control algorithms, defining the running of a data collection software with data transmission protocols that will allow the server to collect data from different types of systems, having a defined format for archiving the data in the database, calculating the variables to be derived from the measured data (e.g. reduction of the pressure at medium sea level, vapor pressure, precipitation intensity), etc.

3) *Offered services*

- *Forecasting and warning services* using observational data from the observation network, international data exchange through GTS, altitude observations, application software for forecasting, satellite products and radar products;
- *Forecast* and *warning* products, as follows:
  - *immediate and very short-term weather forecasts (up to 6 hours);*
  - *short-distance weather forecasts (24 hours with 12 hours resolution);*
  - *medium-term weather forecasts (2-7 days);*
  - *long term weather forecasts (up to 1 month);*
  - *early warnings with several dangers:* flood, storm, hail, drought, thunder, frost and ice, heavy rain and snow, extreme temperatures, fire, etc.
- *Climate services* according to the following parameters: air temperature, humidity, atmospheric pressure, precipitation quantity, wind speed and direction, type of clouds, present and past weather, depth and water equivalent of snow, soil temperature and humidity, duration of sunny hours, solar radiation, visibility, evaporation.
- *Climate forecasts:* seasonal climate forecasts on climate projection models; summer and winter forecasts; results of numerical models and monthly forecasts.
- *Climate products and services for users:* long-term climate analysis, monthly statistical analysis of climate data; seasonal statistical analysis of climate data; annual statistical analysis of climate data; long-term statistical analysis of climate data; research studies on climate and climate change.

The main interested sectors requesting data, products and climate services are: agriculture and food security; disaster management; energy sector; water management; health; insurance, industry; transport; construction, rural development, etc.

The shortcomings identified include the following:

- The SHS does not have special application software for immediate prognosis. It is very important for immediate forecasting and early warning to have an application software for immediate forecasting to improve the quality of the service.
- Although the SHS has digitized climatological data, there is no database management system for climatological data for the processing, sampling, analysis, archiving, dissemination and recovery of climatic data. A special database management system is needed to improve the quality of SHS climate services.
- It has been stated that climatic predictions are available on a monthly and seasonal basis, but not for longer periods. The ability to forecast the climate needs to be improved for longer periods.
- The SHS does not do sectoral climate analysis and forecasts. It was also noted that no evaluation reports and climate change adaptation guidelines are available for different sectors.
- There is no specially developed web service for the provision of climate services and products.
- No other mechanisms are available, such as regular surveys between key stakeholders, interactive forums on the webpage and sectoral workshops and seminars.

7.3.3. Agroclimatic Monitoring System

The Agroclimatic Monitoring System (AMS) is developed by the central specialized subdivisions and agrometeorological monitoring network and is a system of observations of agrometeorological conditions, soil condition and moisture reserves in the soil, the agricultural crops development and productivity rate. The operational information received serves as basis for the estimation of the weather conditions and their effect on the state and productivity of agricultural crops, modeling of the production process and projection of agricultural crops growth, development and yields, as well as development of agrometeorological recommendations for making operational and optimal decision by agricultural producers.

Within the AMS, agrometeorological monitoring is carried out at 17 weather stations and 16 agrometeorological posts, according to the following parameters: temperature in the soil layer on agricultural fields; soil moisture up to 100 cm depth; soil and snow layer condition in the cold period: soil frost depth, soil thaw depth; observations on the thickness and density of the snow layer on agricultural fields during winter period; phases of agricultural crops development; determination of crops production inputs, etc.

In 2016, the AMS was modernized by equipping agrometeorological stations with new equipment for determining soil moisture (Delta-T).

Main activities:

- methodological management of agrometeorological stations and posts.
- receipt of agrometeorological observation data from agrometeorological stations and posts and quality control thereof;
- making agrometeorological forecasts regarding the determination of crops, soil moisture reserves and others;
- drought monitoring.

Services and Products:

- information on the influence of weather conditions on crops, field work;
- drafting agrometeorological forecasts regarding crop yields, moisture reserves;
- soil moisture forecast during vegetation and freezing;
- the estimation of the harvest time for farmers, according to their own methods;
- analysis of agrometeorological characteristics by week, month and season;
- data on the overwintering conditions and possible damage to agricultural crops;

Dataflow

The data flow takes place through the -up connection. Precipitation data is transmitted every 24 hours and other parameters are transmitted within 10 days.

It is recommended to design and install a central data collection system with the capacity to collect data from all observation systems, including agrometeorological stations, which are not connected to the international OSCAR system, and the data from these stations are not exchanged at international level.

Spatial coverage of agrometeorological stations

The analysis of the spatial coverage and density of agrometeorological stations, the distribution of stations at each 100 meters elevation band and horizontal coverage within 20 km radius show that new posts are needed at all elevation bands to achieve the required density recommended by the WMO.

The analysis of the 16 agrometeorological posts showed that the lowest station was operated at 24 meters high, and the highest at a height of 273 meters.

Overall, it was estimated that the AMS can be extended by adding 7 posts to fill the gaps in the observation network. The locations of the proposed agrometeorological posts are determined on a regional basis. The distribution of the proposed stations is shown in Figure 7-4.

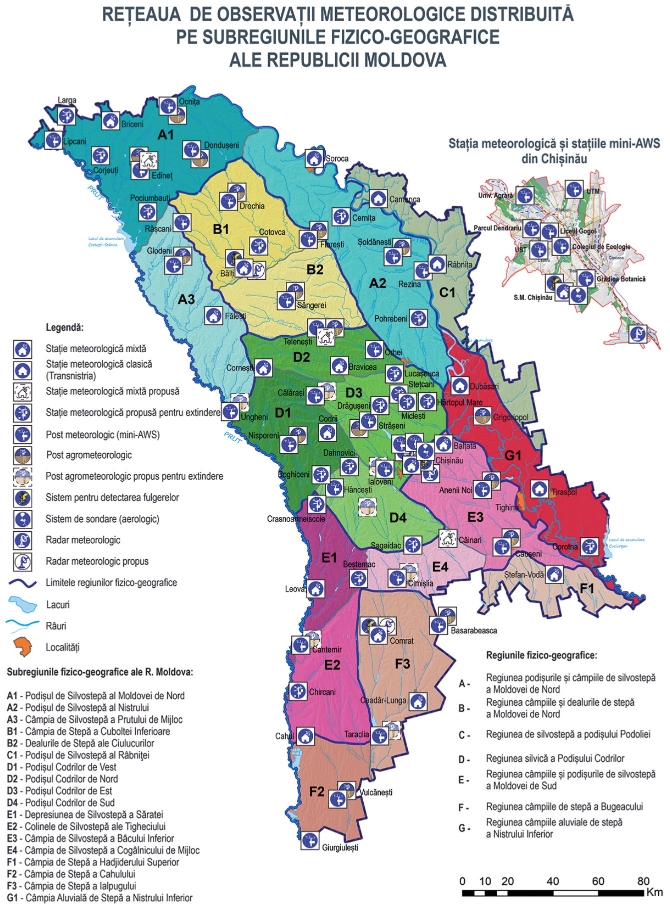


Figure 7-4: The AMS of the SHS.

Gaps, challenges and needs:

- lack of an operational computer system for drought monitoring;
- lack of specialized software for calculating and mapping the standardized precipitation index;
- the need to train staff in the using new techniques and methods, in particular the use of satellite data for agrometeorological applications;
- lack of communication and feedback from users.

7.3.4. Hydrological Monitoring System

The Hydrological Monitoring System (HMS) consists of the central hydrological structures and the hydrological monitoring network of the SHS.

HMS monitors the state and evolution of the hydrological regime of surface waters in the hydrographical network of the country, with the following functions:

a) monitoring the hydrological regime of surface waters on the territory of the RoM, through observations and measurements carried out through the network of hydrological stations;
b) making hydrological forecasts, issuing warnings regarding the triggers of dangerous hydrological phenomena, publication of annual and multiannual synthesis data;
c) organizing and conducting hydrographical research, data and information exchange with subsidiary institutions and academia;
d) supervision and control by monitoring current and operational activity of the hydrological monitoring network;
e) exchange of information within the global system of hydrological observations, by fulfilling the obligations resulting from the international conventions to which the RoM is a party.

The Hydrological Monitoring Network (HMN) represents the totality of information systems, stations and posts, organized for observations and measurements on the surface waters, weather conditions and data collection. The HMN provides the necessary information for making operational decisions on prevention of dangerous hydrological phenomena, water management and development of the river basin management plan.

In 2006-2008, five automatic hydrological stations were installed under the "Monitoring of surface waters and protection against floods in the Raut River basin" project supported by the Government of the Czech Republic. In 2010-2012, eleven automatic hydrological stations were installed on the Prut River with the support of the Government of the Czech Republic. In 2011, a Web server was installed within the SHS, which receives data from automatic hydrological stations using GPRS and satellite communication.

In 2013, within the Millennium Challenge Corporation Project "Irrigation Sector Reform", an automated system of water resources monitoring in the Dniester River was created and 8 automatic hydrological stations were installed. In 2014, eight automatic hydrological stations were installed on the Dniester River under the "Disaster and Climate Risk Management in Moldova" Project.

The systematic hydrometeorological observations, carried out on the territory of the RoM during 50-100 years, allowed to summarize the hydrological data, to publish it as hydrological guidance, monographs such as: "Hydrological Yearbook", "Multiannual data on resources and surface water regime", "State Waters Cadaster", the information of which is used to plan and carry out measures against the harmful influence of dangerous and hazardous phenomena, and to protect the environment.

Hydrological information is shared on a regional level between the Danube River basin (DANUBE-HYCOS) and Black Sea (BLACKSEA-HYCOS) states.

Long-term intergovernmental agreements and programs with the neighboring countries, Ukraine and Romania, are of particular importance. These agreements and programs provide for sharing hydrologic operational information and monitoring of the state of water resources in the Dniester and Prut Border Rivers.

Among the problems faced by the hydrological monitoring system are:

1) *Lack of data management system in the hydrological monitoring network.*

There is no single database for all hydrological data and there is no real automation of all hydrological data. This is currently the most pressing issue within the SHS and it imposes significant limitations on the development of climate services and functioning of the hydrological network.

The data is managed according to the manufacturer of the hydrological station and therefore the automated stations (OTT production) are available in the HYDRAS-3 database (OTT), while the system from other stations differs according to the manufacturer.

Manual station data is received daily and entered in Excel format. Currently it is not possible to have all data flows from automatic stations in one data management system. Data from 27 automatic hydrological stations automatically comes to the server where they are stored. The data from the Prut River basin are received every 4 hours, while the data from the Dniester River basin are received every 15 minutes.

However, while the data is received in real time, there is no automation and there is no software or procedures to extract the data in the SHS. This causes significant problems in terms of data operability and the possibility of producing associated services.

There are also inadequate procedures for hydrological data management in the SHS. The current data management situation indicates that the dedicated staff of HC have to involve significant effort on a daily basis to retrieve and analyze the collected data.

As a solution, it is proposed to implement a new database system, which would meet the following requirements:

- data collection from all automated stations, regardless of the manufacturer.
- facilitating the process of including data from manual stations.
- implementation of quality procedures.
- development of climate services associated products.
- data saving and management.
- providing direct data links between the database and the implementation of forecasting systems.

2) *Hydrological forecasts*

Hydrological forecasting is a key activity within the Hydrological Monitoring System. The main purpose of the forecasts is to prevent / warn the population and industries about the flashfloods, which may cause floods.

Two types of floods can be identified in the RoM: *river* and *flash floods*.

The river floods are mainly related to the two longest watercourses that pass through the RoM, the Dniester and the Prut. In view of the number of smaller rivers, all floods connected with these smaller streams could be characterized as flash floods.

Flash floods occur in most places, lasting less than 6 hours, usually associated with intense precipitation in small mountain basins with high gradient and/or dam damage. In case of our country, even if the topography is not very dramatic in terms of gradient, high intensity precipitation and, especially, the very high number of dams, result in a very high risk of flash floods.

All information presented above can be summarized as follows:

There are two main regulated rivers (Dniester and Prut), and the forecasts are based on calculations of discharges at two different stations (HPP 1 and 2 in Dnestrovsk and HPP Costești-Stanca), as well as on the data provided by Ukraine and Romania.

There are no forecasts for the small rivers flowing into the Dniester and the Prut, especially on the banks of the Danube, as well on the rivers flowing into the Black Sea. Thus, no studies, hydrological forecasts or assessments of the danger or risk of flooding for these rivers have been carried out.

Currently SHS has no hydrological models or flow patterns available (no numerical models or other high-performance methods), no experience in hydrological models has been identified.

The following solutions are proposed: to implement hydrological models in SHS, especially for forecasting purposes, but also for risk and disaster management purposes. The implementation of the hydrological forecasting models will increase the reliability of the forecasting results, will reduce the daily forecasting time and will increase the possibility of automatic publication of the hydrological forecasts.

The system to be implemented should meet the following requirements:

- real-time and automatic hydrological monitoring data.
- additional data resources from both remote sensing and NWP models.
- open-source, easy-to-operate software based on the implementation of previously calibrated models;
- providing daily hydrological forecasts with support for the climate services development.

The following implementation approach is recommended:

- design;
- collection of data;
- implementation of hydrological modelling;
- implementation of the forecasting platform;
- implementation of hydrological forecasts;
- data inputs and data flow procedures;
- testing of the platform
- results and warnings.

Figure 7-5: Hydrological monitoring network of the SHS of the RoM.

<u>*3) Improving the hydrological monitoring network of the SHS.*</u>

HMN of the SHS is organized in 2 hydrographical stations (HS), according to the hydrographical basins Prut and Dniester located on the territory of the country, having 53 hydrographical posts, of which: 33 are classical stations; 14 have classical and automatic functions and 16 are fully automatic.

Of the total number of listed hydrometric stations, 41 are managed by the SHS of the RoM, and 12 are subordinated to the Tiraspol Hydrometeorological Center (on left bank of Dniester River). However, there is a mutual cooperation between the hydrometeorological services on both sides of the Dniester River, based on partnership relations.

In line with the special programs within HMS, regional characteristics of the hydrological regime of the water flows, identification of the regional factors and economic activity impact, formation and spreading of the natural hydrological risk phenomena are being studied taking into account the insurance of the national economic organizations.

The main gaps and needs in hydrological monitoring are:

- there are still many manual stations in the HMS without telemetry procedures. It is recommended to automate all hydrological forecasting stations and data management purposes;
- the density of stations in some areas is not adequate, while in other areas it is considered that so many stations are not needed;

- network maintenance problems were identified, which resulted in a period with lack of data from some stations;
- lack of equipment needed to carry out flow measurements. The existing stationary equipment for flow measurements on Dniester and Prut rivers dates back to the 70-80 of the XX century. Currently, the flow measurements are partial, and the large flash floods are generally not measured because necessary equipment is lacking.

The analysis of the hydrometric observation stations location density ensures partial coverage of the hydrographical network of the RoM. However, for a number of stations, given the country's surface, the station density seems acceptable. The number of hydrological stations in the RoM is 52, which means that a station covers about 630 km^2.

While there are some stations serving a significant catchment area (Ungheni, Jeloboc, Leuseni or Tudora), other stations are very close to each other and therefore the downstream station does not register additional discharges from a hydrometrically significant basin (such as Camenca, Sanatauca, Costești or Braniște).

Another important feature to be analyzed, to determine whether all climatic and geophysical conditions are covered by the hydrological network, is the evaluation of hydrological posts distribution by altitude. Given that the altitude in the RoM varies from 0 to 450 m, most of the stations are located in the low area. Only 2 stations are located at 105 m, most of the stations being under 50 m.

Although it is understandable (and recommended), that stations are located at a lower elevation, where a more significant discharge is recorded and a significant catch area leaks to a certain monitoring location, it would also be advisable to achieve a higher elevation distribution. This is more relevant meteorology, but also recommended for upstream hydrometric posts, to characterize the discharge dynamics.

Therefore, as a summary and in the light of all the above information, the density of the existing network is not sufficient to cover all the required information and / or to provide observations in key areas for hydrological or climatic service purposes.

It is recommended to include 30 additional stations into the hydrological monitoring network of the RoM.

The WMO recommendations aim at 3 systems in organization and operation *of any hydrometeorological service: service provision; production and support.*

In order to ensure the interaction between the three systems, taking into account the physical and geographical conditions, it is recommended to organize the HMS by sectors - structures with administrative competences and logistical support.

The table below shows the hydrological observation network organized in 8 hydrometric sectors, according to the coverage area and the location of the existing/planned posts.

A no less important segment of the hydrological field is related to lack of monitoring of the aquatic regime of lakes and other artificial water bodies.

To ensure the monitoring of lakes water regime (15 lakes with a large area), proposals shall be submitted to ensure hydrological monitoring in line with the procedures established jointly with the "Apele Moldovei" Agency, and the observations data, once collected, shall serve as an additional source for the assessment of the hydrological regime of all water bodies in the RoM.

Figure 7-6: The HMS of the SHS proposed by experts under the National Climate Change Adaptation Planning Project.

In order to develop the hydrological monitoring capacity, the following actions are proposed:

- ensure the procedures for the reallocation or stopping the operation of redundant hydrometric stations;
- carry out hydro-morphological studies to determine the locations of the planned hydrometric stations;
- carry out necessary legal and technical procedures related to the establishment of new hydrometric sectors and posts;
- ensure legal and technical / operational procedures for organization and functioning of the new positions;
- carry out the administrative procedures regarding the allocation of resources and ensuring maintenance and sustainability of the HMS in an updated format.

7.3.5. Environmental Quality Monitoring System

The *Environmental Quality Monitoring System* is maintained by the Environmental Agency, through the environmental quality monitoring posts and the environmental reference laboratories, part of the Environmental Components Monitoring Network (ECMN).

The ECMN includes: 72 points on surface water quality, 19 monitoring stations for air pollution and environmental radioactivity, 37 soil monitoring sections (Figure 7-7).

The national environmental quality monitoring system was set up in the 1960s of the XX century, but systematic observations started in the 80s of the XX century. At present the system has the following priority objectives:

- monitor the quality of the environmental components and determine the level of pollution; detect cases of exceptional pollution of surface water, air and soil;
- prevent and reduce negative effects on the environment and population by means of alert systems in case of exceptional situations;
- urgently notify the decision-making structures on the degree of environmental pollution;
- systematic information of civil society about the quality of the environment.

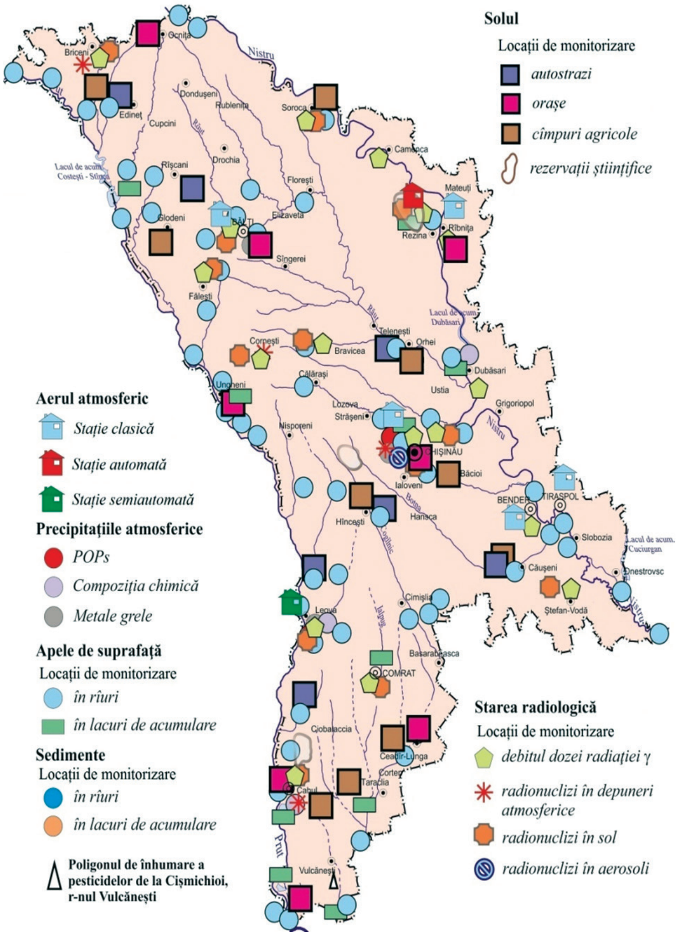


Figure 7-7: Environmental Components Monitoring Network.

The air quality is monitored on the basis of a surveillance network consisting of 17 stationary posts, where 3 times/24h (7 AM, 1 PM, 7 PM) air samples are taken according to the following basic indices: solid suspensions, sulphur dioxide, carbon monoxide, nitrogen dioxide and related: soluble sulphates, nitrogen oxide, phenol, formal aldehyde in 5 industrialized areas of the country (Chisinau-6 posts, Balti-2, Bender-4, Tiraspol-3, Ribnita-2).

In order to assess the radioactive state of the environment, starting with 1978, systematic observations are made on the equivalent *of the ambient gamma radiation dose rate*, now at a frequency of 2 times/24h (7 AM and 8 PM) at 7 weather stations.

Starting with 2015, observations of the equivalent of gamma radiation ambient dose in continuous mode were initiated following placement of 5 MIRA detectors on the territory of the country.

The quality of the waters of the transboundary rivers Dniester and Prut, from a hydrochemical and hydrobiological perspective, is monitored at 72 monitoring sections, located on 34 large and small rivers, 6 reservoirs and 2 natural lakes. The analysis is focused on hydrochemical parameters (physical-chemical indicators, oxygen regime indicators, biogenic elements, heavy metals, organic pollutants, pesticides and hydrocarbons) and 6 groups of hydrobiological elements, in accordance with European directives.

The soil quality is monitored within the monitoring network of agricultural lands, lands in recreational areas, near industrial objects, soils located near roads with different intensity of circulation, background lands that have not been subjected to anthropogenic pollution, soils in the vicinity of pesticide deposits, lands adjacent to power system substations, water alluvium in basins, and studies of pollutants migration. Monitoring is carried out at 4 to 5 years intervals in order to determine organic and inorganic pollutants and soil fertility.

The national environmental quality monitoring system is compliant and operates within the following international forums, to which the RoM is a party:

- Danube River Protection Convention;
- Stockholm Convention on Persistent Organic Pollutants;
- The Convention on the Transboundary Effects of Industrial Accidents (CTEIA) designed for protecting human beings and the environment against industrial accidents by preventing them as far as possible, by reducing their frequency and severity, and by mitigating their effects;
- Convention on Long-range Transboundary Air Pollution.

The monitoring results are used for equivalent exchange of information with the neighboring countries and the member countries of the Danube Convention on the Quality of Transboundary Watercourses and are periodically submitted to the secretariats of the Stockholm Convention on Persistent Organic Pollutants and the UN Convention on Long-Range Transboundary Air Pollution (CLRTAP), with a view to drawing up monthly reports on the quality of the environment, concerning high and extremely high pollution cases of environmental components and other types of information requested by the beneficiaries.

The creation and management of the database on the state of the environment in the RoM are needed in the decision-making process of the relevant bodies and for determination of the ecological management strategy at all management levels. In order to develop the environmental component monitoring system, two automated information systems were created and launched in 2018:

- "Waste management", created by the GD No. 682/2018[466], to implement the procedures for record-

[466] <https://www.legis.md/cautare/getResults?doc_id=108814&lang=ro>.

ing and reporting waste data and waste management information;

- "National register of emissions and transfer of pollutants", created by the GD No. 373/2018[467], in order to ensure the reporting and monitoring of data and indicators about the emissions of pollutants to water, air and soil, diffuse sources as well as the transfers of waste and pollutants from waste waters off-site.

7.3.6. Radar Monitoring System

The SHS provides meteorological monitoring through the C-band Doppler dual polarization radar system. This radar is not registered in the international OSCAR system, nor in the OMEN radar database (BRO).

Another 9 S/X weather radars are operated by the Special Service for Active Influences on Hydrometeorological Processes (Fig. 7-8).

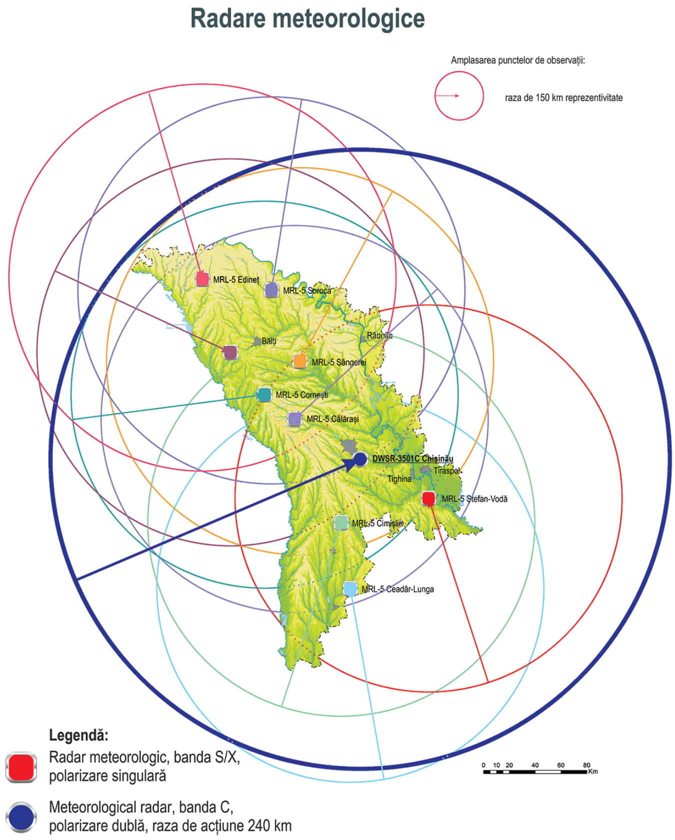


Figure 7-8: Radar coverage in the RoM.

Weather cameras as the most advanced active surface-based remote sensing systems, at least for the time being, are the only essential tools that can provide real-time (less than 15 minutes depending on the scan strategy and processing characteristics), accurate and high resolution (up to 150 m) weather information on a large scale (up to 500 km depending on the frequency used).

The weather radar owned by the SHS can provide data from a range of up to 480 km in intensity mode and up to 240 km in Doppler mode, depending on the operating cycle.

S-band radars can provide data of up to 500 km and X-band radars have a radius of up to 100 km due to their sensitivity to atmospheric attenuation.

[467] <https://www.legis.md/cautare/getResults?doc_id=103021&lang=ro>.

Radar products are the following: large-scale weather monitoring; immediate forecasts (0-4 hours); early warning of weather hazards; flood warning; tornado warning; aviation safety; wind warning; hail detection.

7.3.7. Other Monitoring Systems

1) *Automated meteorological observation network of national roads managed by the State Road Administration.*

During 2017-2019, in cooperation with the bilateral program of development and cooperation of the Czech Republic for the Republic of Moldova, the road meteorological system was launched in the Republic of Moldova, with the purpose of streamlining current maintenance of roads, streamlining road transport and increasing road safety, including in winter.

According to the Government's Action Plan for 2020 – 2023[468], by November 2022, 30 traffic weather stations will be installed to extend the system of traffic conditions forecasting and control. Automated road weather stations ensure the measurement of air temperature and humidity, precipitation quantity, soil surface temperature and others, the essential characteristics for the traffic control conditions.

2) *Microclimate monitoring network "Pessl Instruments GmbH".*

The Agricultural Competitiveness and Enterprise Development (ACED) project, funded by the USAID and MCC, in partnership with UNDP in the RoM, the Austrian Development Agency (ADA) has implemented a microclimate monitoring system through weather systems[469].

So far, the Austrian company has delivered 200 weather stations iMetos to farmers in the RoM. The iMetos station can be equipped with up to 80 sensors and can develop complex models of evolution of the state of the environment and plants, the data being updated every 15-60 minutes and transmitted to fruit producers, via the Internet, in the form of tables and diagrams. The iMetos weather network, installed on the territory of the RoM, includes air temperature sensors, relative humidity, leaf humidity, rain meter, solar radiation and wind speed and can provide service on field monitoring, disease forecasting, crop and insect monitoring, soil analysis, etc.

3) *Airport observations network built by the Ministry of Defense, the Moldavian Air Traffic Services Authority (MOLDATSA)* consists of weather monitoring services (synoptic) for its own needs (national security, aviation security, disaster response, etc.)
4) *The Institute of Geology and Seismology* implements research projects in the field of hydrogeology, and some of them include the groundwater monitoring component. The results of groundwater monitoring are published in annual scientific bulletins, in which the analysis of information on changing the level and quality of groundwater, as a result of human activity and natural processes, is presented. The results of groundwater quality monitoring are also transmitted to the state geological fund.
5) The *National Forest Monitoring Network of the Republic of Moldova* was created within the Moldsilva Agency.
6) The *Institute of Pedology, Agrochemistry and Soil Protection "N. Dimo"* deals with research into soil genesis, geographical distribution of soils, soil classification across

[468] <https://gov.md/sites/default/files/document/attachments/pag_2020-2023_en.pdf>.
[469] <https://meteo.agrobiznes.md/>.

the country, development of soil mapping and land valuation methods, development of soils monitoring and inventory database, as well as research of soil erosion processes, development of erosion control technologies to reduce the degree of soil degradation, and other environmental aspects.

7) The *National Scientific-Practical Centre of Preventive Medicine of the Ministry of Health* deals with the drinking water quality and atmospheric air monitoring in the sanitary areas of the localities of the Republic of Moldova.
8) The "*Apele Moldovei" Agency* collects and processes statistical information on water use.
9) The *Ministry of Health* monitors the air quality in urban areas. Measurements of the maximum permissible concentration are made monthly in urban residential areas according to six main air parameters.
10) The *Institute of Zoology, the Botanical Garden (Institute), the Institute of Genetics and Physiology of Plants, the State University of Moldova and the State Agrarian University of Moldova* study the wild flora and fauna of the country at species level.

7.4. Research Activity

Systematic hydrometeorological observations made in the RoM over the past 60-110 years, allowed to summarize the climate data, and to publish it as climate and agroclimatic guidebooks, monographs, such as "Climate of the Moldavian Soviet Socialist Republic", "Climate of Chisinau", "Agroclimatic Resources of the Moldavian Soviet Socialist Republic", "Agroclimatic Guidelines for the Moldavian Soviet Socialist Republic", "Natural Meteorological Phenomena in Ukraine and Moldova" and other which are used for planning and controlling harmful effects of dangerous natural phenomena, and environmental protection.

In climate research, special attention is paid to the study of complex adverse weather conditions. This is needed to successfully combat the negative effects of adverse weather conditions, identify solutions to environmental issues, and sustainable management of the environment

The features of the adverse weather conditions vary by the objects which are affected by climate conditions. For example, agriculture is affected by frosts, droughts, hot winds, dust storms, the transport sector – heavy rains, sleet, slush, the constructions sector – by extremes temperatures, strong wind, heavy snowfalls and ice, etc.

The results of hydrologic observations are published in: "Annual data on the regime and surface water resources", "State Waters Cadaster of the RoM", "Multiannual Characteristics Guide", etc.

Scientific research is also conducted under regional hydrometeorological programs. Based on regional climate monitoring the carried-out research is focused on the natural and anthropogenic influence on the climate of the RoM. Such research fosters climate change forecasts for the country; make it possible to calculate changes in the basic features of air temperature and precipitations. Risks and vulnerability for agricultural industries are assessed in the context of climate change, and adaptation measures for agriculture are identified.

It should be noted that the SHS conducts research in hydro-meteorology and environmental quality monitoring, including to ensure the methodological and scientific support to the SHS subdivisions. The staffs of the Centre process and interpret meteorological, hydrological and environment quality monitoring related information, inclusively by using geographic information systems

The SHS carries out:

- development of scientific materials and methodologies in the SHS activity domains;
- development of scientific publications in the SHS activity domains;
- keeping record of new scientific and practical achievements in the GIS domain;
- mapping materials for forecasts development, analysis of certain hydro-meteorological actions or factors;
- mapping materials for the SHS web page;
- digital land use maps, updated from satellite imagery;
- spatial maps and different thematic maps;
- thematically dedicated GIS databases;
- GIS info-plans derived products (basin and sub-basin areas, average altitude of sub-basins, wooded area, afforestation coefficient, etc.);
- altimetric digital model of land and derived products (slopes, expositions, altitudinal levels, topographic profiles etc.);
- floods, droughts hazard and risk maps, etc.;
- flood risk model in major large and small riverbeds;
- maps with delimitated areas affected by floods, droughts;
- estimates of water reserves in snow layers, volumetrically expressed as median water layer for basins of interest in terms of hydraulic energy and water supply;
- agrometeorological and biophysical parameters of vegetal coverage derived from satellite date (soil surface temperature, actual evaporation, foliar index, biomass, spatial structure, vegetation indices, etc.).

Climate change modelling relevant for the territory of the country was carried out by the Climate Change Office of the Public Institution "Environmental Project National Implementation Office".

Other institutions involved in climate research, including modelling of future climate events are the State Hydrometeorological Service and the Institute of Ecology and Geography of the ASM.

Research with reference to the influence of climate change on different sectors of the national economy are periodically carried out by other organizations: Institute of Plant Protection and Ecological Agriculture of the ASM, Institute of Plant Genetics and Physiology of the ASM, Research Institute for Field Crops "Selectia", Institute of Pedology, Agrochemistry and Soil Protection "Nicolae Dimo", "Moldsilva" Agency etc.

For example, in 2013, the Institute of Ecology and Geography of the ASM published the "Atlas of Climate Resources of the Republic of Moldova" based on Geographic Information Systems (GIS), and in 2021 - Atlas "Climate Change and the Current State of Landscapes"[470].

[470] <https://drive.google.com/file/d/19scpi5yL00NJvU1457vUSFCMXz8ZOy-S/view>.

7.5. Information on International Assistance to Support Surveillance Networks

International cooperation is essential for the development of meteorology, hydrology and environmental quality monitoring. Therefore, the activity in these fields is impossible without the international exchange of hydrometeorological information and data, as well as of data on environmental quality. In order to integrate the principles of sustainable development in the state policies and programs, the Republic of Moldova is paying more attention and is implementing the international conventions to which the State Hydrometeorological Service adhered.

In its turn, the SHS focuses its international activities on the following main directions:

- participation in the programs of specialized UN agencies: WMO, UN Convention to Combat Desertification;
- Partnership with the Commonwealth of Independent States (CIS);
- implementation of bilateral agreements with other national meteorological, hydrological and environmental quality monitoring services;
- participation in scientific programs within international conventions and projects.

Collaboration with the national hydrometeorological services takes place in the framework of bilateral agreements. The relations with the hydro-meteorological services of the neighboring states develop at a more intense pace. The intergovernmental long-term cooperation programs with Ukraine and Romania are of special importance for strengthening the cooperation. These agreements and programs include sharing of operational hydro-meteorological information, the monitoring of the Dniester and Prut border rivers water resources status.

In the period 2006-2021, SHS implemented, in collaboration with its partners, the following projects:

- “Disaster and Climate Risk Management in Moldova” (2010-2016) project (supported by the World Bank);
- “Surface water monitoring and flood protection in the Prut River basin” (2010-2012) project (supported by the Government of the Czech Republic);
- EUMETSAT Project “Access to Data in the Western Balkans and Eastern Europe (DAWBEE)” (2010);
- “Surface water monitoring and flood protection in the Raut River basin” (2006-2008) project (supported by the Government of the Czech Republic);
- UNDP/ADA Project “Supporting Moldova’s National Climate Change Adaptation Planning Process” (2014-2017);
- “Building national capacities for primary response in the event of nuclear accidents / incidents that can cause environmental pollution” project (2015) (supported by the Swedish Government);
- “Strengthening Meteorological and Climate Services in Moldova” Project supported by the World Bank (2017-2019);
- WMO Project “South-Eastern Europe Multi-Hazard Early Warning System” (SEE-MHEWS-A) (2016-2022);
- UNDP Project “NAP-2: Promoting the National Process of Planning for Adaptation to Climate Change in the Republic of Moldova” (2020-2025).

International cooperation in the hydrometeorological field is an important component of the SHS operation process. International cooperation in hydrometeorology is based on conventions and agreements to which the RoM is a party.

In accordance with the Parliament Decision No. 210-XIII of 29 July 1994[471], the RoM joined the World Meteorological Organization (WMO), and the SHS Director is the representative of the country within this organization. The specialists of the Service participate in the programs and projects of the CIS Interstate Council for Hydrometeorology under the Cooperation Agreement on Hydrometeorology, signed by the Republic of Moldova on 8 February 1992; as well as in other international programs (such as: the UNFCCC, the Convention on Cooperation for the Protection and Sustainable Use of the Danube River, the Convention on Long-Range Transboundary Air Pollution, the United Nations Convention on Combating Desertification).

The SHS is also actively involved in the implementation of the World Climate Program, the World Climate Applications and Services Program, the Hydrology and Water Resources Program, organized under the World Meteorological Organization (WMO), and the work of the Intergovernmental Panel on Climate Change (IPCC).

7.6. General Policy for Environmental Monitoring Systems Development

It has been estimated that there are needs on several issues to improve environmental monitoring systems. The value chain approach and service delivery strategy developed by the WMO are essential and form the basis of this process.

Observations, data processing and management, modelling, forecasting, research and service development are defined as the main components of the value chain production phase. The use of the services, the main results and the impact of these services on users’ applications were also considered an important component of this process. Most socio-economic sectors, such as agriculture, energy, transport, water management, forestry, health, tourism, insurance, national defense have a significant effect on weather, water and climate and are in dire need of high-quality meteorological, hydrological and climate services.

Furthermore, climate services are of vital importance for studies on disaster management and risk reduction. The WMO has stated on the basis of several research studies that a US $1 investment to improve forecasting and early warning capabilities will provide a benefit of at least US $7 just by contributing to the prevention of loss of life and property caused by disasters related to weather, climate and water.

There is no doubt that any investment to improve the SHS service delivery capacity will bring great benefits to the RoM. The well-being of the community, the development of socio-economic sectors and the assurance of sustainable development depend heavily on the provision of user-oriented products and services, including the necessary meteorological, hydrological and climate data and analyses, impact-based predictions and warnings against hazards.

[471] <https://contacts.wmo.int/all_members/details_all_members/?id=84afc9ce-816a-e811-a95b-000d3a38c0b3>.

Based on the above-mentioned conceptual framework and special conditions, it is recommended to plan and implement a set of activities to improve the capacity to provide climate services and the environmental monitoring network development, as follows:

Stage 1: Capacity Building

Well-defined and implemented capacity building activities will be crucial to improve service delivery capacity. The main areas for capacity building activities are defined as follows:

a) *Legal framework*

It was considered that the legislative framework is outdated and that it needs to be updated in order to ensure compliance with the current field-specific requirements. This process was seen as an essential step and basis for improving climate services and the environmental monitoring system.

The legislative framework must be updated to meet the national requirements for hydrometeorological and climate services, to clearly define all the field specific mandates and responsibilities, to solve possible conflicts and mandates of all the agencies with environmental monitoring competences, to monitor, supervise and coordinate the activities of the other public and private agencies in the field of hydrometeorology and climate, to vest the SHS with authority and responsibility to manage international cooperation activities, to carry out revenue raising activities, to ensure compliance with the regulations and recommendations of the international organizations.

b) *Institutional capacity and organizational structure*

The institutional capacity of the environmental monitoring system must be improved by carrying out activities in several important areas, by establishing the necessary new structures, by completing the decentralization process by strengthening the regional units, by increasing the number of personnel by allocating new and young generation personnel, by improving the skills of the personnel through the necessary training, by increasing the budget by finding new financial resources.

c) *International cooperation*

It is of the utmost importance that the environmental monitoring system shares its experience and exchanges data and information to improve its service delivery capabilities. It is clear that cooperation with international organizations and other countries will contribute greatly to capacity building. These cooperation activities can be cooperation with international organizations regulating and coordinating activities related to the environment, weather, water and climate, cooperation with international service providers, with other countries to share experiences and use good practice examples, participation in regional and global projects, use of services provided by international organizations and other countries, and international agencies donor funding for future projects.

Step 2: Improve Service Production Components

As stated in the WMO value chain approach, service output components are essential components of the user service delivery process. The following basic components need to be improved for accurate and reliable production and better service delivery.

a) *Extension and evolution of the observation network*

The observational data will be the main contribution of any process of production and delivery of products and services needed by users. It is important to establish and operate an observation network designed for fit-for-purpose observation. The following main activities are proposed for the redesign, expansion and development of the observation network:

- Evaluation of the existing observation network for spatial coverage;
- Evaluation of requirements with reference to observational data of internal and external users;
- Upgrading existing observation systems;
- Installation of new in situ observation and remote sensing systems to fill gaps and meet observational data requirements.

b) *Modernization and installation of ICT systems*

For data collection, processing, visualization, distribution and archiving, as well as for generating and delivering products to users, advanced ICT systems will be required containing all components from data collection systems, message switching, database management, product generation, weather forecasting and up to communication and distribution systems.

c) *Improvement of operation and maintenance capabilities*

The continuous, sustainable and efficient operation of the relevant observation network and ICT equipment will require regular maintenance activities. The systems cannot be supported and the required results cannot be achieved without proper systems operation and maintenance. Annual plans must be drawn up and implemented, specifying the financial, human, technological, logistical resources and preventive and corrective maintenance requirements for the systems.

Stage 3: Products, services and service provision

Existing products and services, as well as the need for the development of new products and services and their delivery to users, should be considered as an important component to improve the service delivery capacity of the SHS. The main components of this step which need to be improved are the following:

a) *Weather forecasts and warnings*

For most of the beneficiaries the weather forecast and warnings are the best-known products and services, although the services provided by the competent authorities are not limited to these.

Thus, it is very important to provide accurate, reliable and timely forecasts and warnings not only to meet the needs of the community and ensure the well-being of the community, but also to ensure sustainable reliability and increased visibility among the community and policy makers.

Improving forecasting and warning services requires the deployment and widespread use of remote sensing products, forecasts with higher temporal and spatial resolution, early warnings with more dangers, immediate forecasting, but also the provision of impact-based forecasts and sectoral forecasts.

b) *Climate services*

Climate services are becoming increasingly important for many economic sectors and applications, in particular due to the high impact of climate change.

So, climate services need to be improved to meet the users' growing demands. In this respect, it is necessary to plan and implement a set of actions, as follows:

- establish the Climate Prediction Centre;
- provision of long-term climate forecasts;
- provision of sectoral climate analyses and climate change predictions;
- use of remote sensing data for climate studies;
- set up the climate databases management system.

c) *Agri-meteorological services*
The agricultural sector is the most important economic sector in the RoM, extremely sensitive to climate events. The services offered by the current environmental monitoring system for the sector are of vital importance for agricultural applications and products, as well as for the economic development of the country. In order to develop this sector, it is necessary to extend and modernize the agrometeorological and soil quality observation network, high resolution agrometeorological frost forecasts, the establishment of the drought monitoring system, new methods of crop yield forecasting and crop condition assessment.

d) *Hydrological services*
There are three main recommendations: the hydrological database, the hydrological network and the hydrological forecasting, for which an implementation plan has to be defined, which will provide the necessary means for the production of climate services.

Based on the conceptual framework and special conditions, it is recommended to implement a set of the monitoring system capacity building activities:

- Extend and develop network, by installing new automatic and classical observation systems to close gaps and meet the observation data requirements.
- Upgrade and install the ICT systems for collection, processing, visualization, distribution, as well as for the generation and delivery of products to users.
- Improve the operation and maintenance capabilities for continuous, sustainable and efficient operation of the relevant observation network and ICT equipment;
- Develop early warning system; provide high resolution hydrological forecasts and warnings and strengthen all software systems for hydrological data analysis and reporting;
- Evaluate the effectiveness of existing mechanisms for improving and developing new mechanisms in consultation with users, develop and operate mobile applications.

7.7. Socio-Economic Benefit of Climate Services, Climate Change Adaptation and New Technologies Application

The socio-economic benefits provided by meteorological, climatic and hydrological products and services vary greatly between countries depending on the exposure and vulnerability of the main economic sectors to weather and climatic phenomena, involvement or non-involvement of users in the service delivery chain and in user-led services and products, and the level of using meteorological and climatic services in decision-making process.

7.7.1. Socio-Economic Benefit of Climate Services

Services provide extreme benefits and contributions to communities and economic development of countries. There is a growing contribution and socio-economic benefits of meteorological and climate services, in line with the increasing demand for these services from economic sectors, in particular for adapting to and mitigating the climate change impact.

The WMO report on the economic value of climate services states that the average ratio between benefits and costs derived from several studies on investment costs and socio-economic benefits appears to be approximately 10:1. The conclusion is that climate services provide significant benefits in relation to their costs and increase public investment.

On the basis of the FAO report, 20-80% of the interannual variability in crop yields is currently associated with meteorological phenomena and 5-10% of national agricultural production losses are associated with climate variability. In addition, agriculture suffers 26% of the damage and losses during climate-related disasters.

Although there are no comprehensive data and studies that include all sectors and the impact of climate services on their applications, there are some studies that show some of the socio-economic benefits of the services provided in the RoM, which show that the minimum cost-benefit ratio for Moldova is 1:6 with increasing potential depending on the improvement of climate services and user awareness.

On the other hand, a report prepared by the World Bank for the RoM clearly states that there is a high degree of uncertainty regarding the current impact on the climate (i.e., the way in which biophysical processes respond to the variation of climatic parameters) and regarding the price of non-market goods. Extrapolation of several decades into the future greatly exacerbates the uncertainty in the study, both in terms of future climate forecasts, but even more deeply in the uncertainty around future socio-economic conditions, i.e., demand and prices for goods and services, availability of alternative technologies, etc.

The same report states that the National Climate Change Adaptation Strategy has identified six sectors at particular risk of climate change. The climate problems expected in these sectors are summarized in the report as follows:

a) *Forestry*
Moldovan forests, the best-preserved ecosystems compared to other natural remains (wetlands, steppes), are already fragmented and stressed, and climate-related changes in species composition are observed. Climate change is expected to have substantial negative impacts on forests, especially in the southern and eastern parts of the RoM. It is expected that productivity of natural forests will reduce and change pathological patterns. Changes in forest vitality have a cross-sectoral impact on agriculture and land management.

b) *Agriculture*
Climate change could seriously undermine Moldova's food security, as shown by the severe drought of 2007, which worsened both the global quantity and the quality of food available to rural residents. It is expected to significantly

reduce the productivity of most of Moldova's current crops (although cereals are affected more severely than tree crops) before considering the impact of extreme events, which include hail storms and late frosts (icing), as well as major floods and droughts, or changes in disease patterns and pests. Climate change with changing rain patterns can also aggravate land management challenges and increase erosion events such as landslides, etc. Even if climate change can induce some positive changes, the overall balance of the climate change effects projected for the next 100 years is not favorable to RoM agriculture sector.

c) *Water Resources*

The use of water resources is already much lower in RoM than in the Soviet period, and the supply of drinking water is a problem in many rural areas due to the decrease in the level and quality of groundwater.

Despite current low levels of use, water availability is expected to fall below total demand in a few decades, and the country's south could experience a one to two-thirds reduction in resources by the 2080s. The most populated and economically important regions are the most vulnerable to the expected climate change. Some of these regions are already experiencing water scarcity. Tackling deficits in these regions will be essential to support a sustainable economic recovery. Due to climate change, RoM is expected to face an increasing frequency of short-term water supply surpluses, in particular in the form of rapid floods and seasonal droughts.

d) *Energy*

Climate change could affect energy distribution infrastructure, demand patterns and energy production capacities. Infrastructure may suffer as a result of more frequent and violent extreme weather events affecting supply networks, while increasing summer demand may cause transmission lines to weaken. Demand patterns will change, changing peak energy consumption from winter to summer. In addition, climate change could affect the country's ability to reduce energy imports by reducing the potential for renewable sources such as hydropower, solar, biomass and wind.

e) *Transport*

Climate change will have more effects on the transport sector. First, sustainable heat waves can worsen or even destroy the pavement of national roads. Second, high summer temperatures can cause deformation of railway lines, acceleration of wear and tear of metal parts in bridges, and even thermal deformation. Furthermore, higher temperatures may require the use of more heat-resistant motors. Even more critically, climate change will significantly constrain the development of river transport if water levels are low. In addition to higher temperatures, extreme weather events can also have a significant impact on transport, both in urban and rural areas.

f) *Health*

The climate change effects on health will include an increase in heat-related conditions (including cardiovascular diseases), transmission of gastrointestinal diseases, air pollution and allergies, as well as an increased number of victims of disasters.

7.7.2. Climate Change Adaptation and Application of New Technologies to Improve Climate Services

As shown in the above analysis and in the examples from several studies, the cost of investments to improve the capacity of the environmental monitoring system will remain much lower than the benefits of the climate services to be provided, given the impact of climate events, and the required services.

The following investment projects and capacity development activities are proposed to be developed and implemented to improve the capacity to provide climate services:

a) *Redesign, expansion and modernization of the monitoring network*

Observational data is the central and indispensable component of the value chain of hydrometeorological and climatic services.

It is important to ensure optimal spatial coverage of the observation network, to provide high-quality observation data with high temporal resolution in accordance with WMO standards and recommended practices.

Therefore, it is necessary to fill the gaps of the existing observation network in Moldova by installing observation systems with appropriate and cost-effective technology, as follows:

- modernization of existing stations with automatic systems;
- installation of automatic weather stations (18)
- installation of automatic hydrological stations (30)
- installation of X-Band weather radars (2)
- upper air observation station;
- lightning detection system;
- anemometric system.

b) *Provision and installation of information systems*

It was assessed that ICT systems do not have sufficient capacity to collect, process, generate products, view, archive and disseminate data. It is necessary to install the hardware and software component of the central system for the collection of data from the observation network, the weather forecasting system as a special tool to support the preparation of the weather/hydro forecasting and warning process and the communication and dissemination system in order to get the products and services to the users in a timely manner.

c) *Modernization of calibration laboratories*

Regular calibration and post-adjustment of sensors based on calibration results are necessary to ensure data quality. This is why existing calibration laboratories need upgrading in accordance with IEC/ISO 17025, General requirements for the competence of testing and calibration laboratories.

d) *Adaptation and implementation of the quality management system*

It is recommended to adapt and implement a quality management system within the environmental monitoring competences. It will support the improvement of the institutional capacity of the competent structures, the institutional management for sustainable and well-defined operations for a better and reliable delivery of services.

e) *Improved use of remote sensing*

The use of remote sensing sources should be improved, both for forecasting purposes. To be noted that there are several products, such as satellite precipitation estimates, weather radar, and other satellite estimates such as snow cover and soil moisture. The procedures for the acquisition and processing of this data should be carried out within the ICT system (as described in the second point), but the product definition should be done separately. The product quality assessment will also be required.

f) *Processing Multiple Forecast Data Sources*

There are a number of products for forecasting available. Some of them are currently used by the SHS, but other products are not. The Global Forecast System (GFS) by the National Oceanic and Atmospheric Administration (NOAA) is available free of charge, but procedures should be developed to ensure correct data processing and processing procedures. Also, the implementation of a new WMO - World Bank project in the South-Eastern Europe region involves the implementation of a new weather forecasting system throughout the region, with higher accuracy and resolution.

7.8. Information on International Data Exchange Issues

7.8.1. Climate Database

Within the SHS, the climate database is being continuously developed. Also, the National Hydrometeorological Data Fund stores the historical data of meteorological observations (starting with 1886). These data are used for the analysis of the climatic regime on the territory of the country and for the estimation of its evolution during the period of instrumental observations. The climate database generated by meteorological observations shall contain the following parameters:

- atmospheric pressure (station and sea);
- air temperature (ordinary, maximum, minimum);
- air humidity (partial pressure, relative humidity, dew point deficiency);
- wind (direction and speed);
- meteorological visibility;
- rainfall;
- cloudiness (cloud type and height);
- the soil surface temperature (ordinary, maximum, minimum);
- soil temperature on the plot without vegetal carpet (at 5, 10, 15 and 20 cm depth);
- soil temperature on the plot with vegetal carpet (at 20, 40, 80, 120, 160, 240 and 320 cm depth);
- snow cover (height, density, water reserves);
- atmospheric phenomena.

Meteorological data processing is carried out based on "PERSONA MIS" and "PERSONA MIP", programs which allow processing of information in accordance with the WMO recommendations and requirements. The climate database is established on the basis of the climate data computing system 'CLICOM'. Meteorological data from new automatic stations (ADASA, Spain) are automatically summarized in the form of TMS, TMP tables and also in the form of monthly weather reports.

The National Hydrometeorological Data Fund is systematized and permanently completed with the hydrometeorological observations data and relevant scientific researches materials.

The basic tasks of the National Hydrometeorological Data Fund are:

- collection, keeping, systematization and recording the observations and research materials on hydrometeorological regime on the territory of the RoM, including the information of administrative authorities in the country and abroad.
- carrying out state registration of departmental hydrometeorological stations;
- development, based on the data of the hydrometeorological observations made on the territory of the country, of the registers, catalogues, relevant guidelines for the activity of the service.

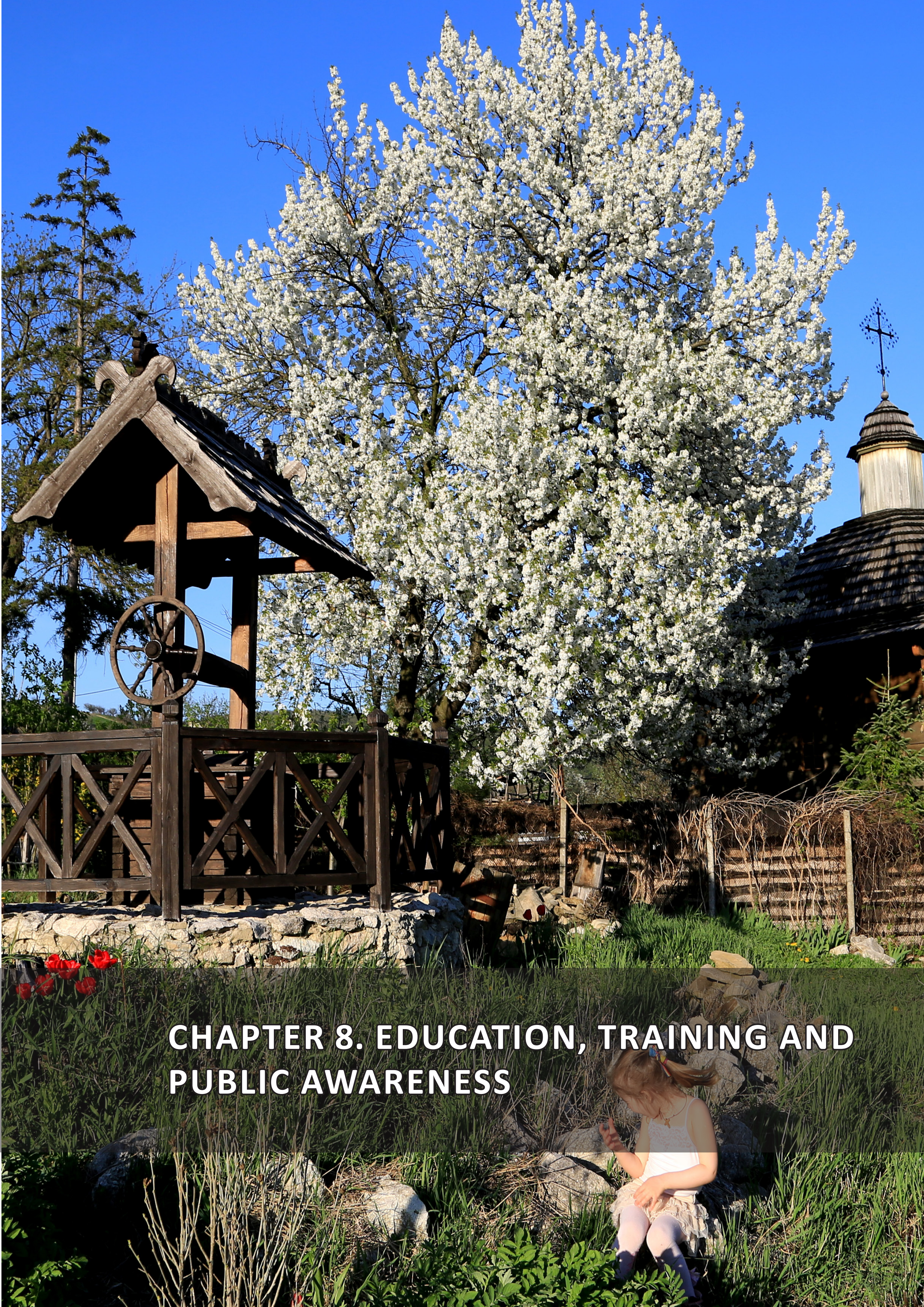
7.8.2. Data Collection System

The following types of communication are used to collect data from the observation network and to receive synoptic information:

- internet (data from weather stations); 14 out of 18 stations have 3G modems installed, which ensure a speed of 4.7 Mb/s;
- since 2016 the data from the new meteorological stations are transmitted directly (via GSM) to the server installed in SHS (Chisinau);
- telephone (in case of failure of other means of communication);
- a complex meteorological multi-satellite "MITRA", connected to a satellite communication channel that allows the reception of satellite images, maps, data, distributed in the form of weather-message, as well as service information;
- direct channel for transmission of information from the Dopler DWSR-3501C meteorological radar, located on the territory of the Chisinau International Airport;
- direct channel with the Regional Meteorological Centre of the World Meteorological Organization (Moscow), using the designed hardware and software complex "UniMas", intended to perform the function of switching messages; "UniMas" fulfils the reception-transmission of meteorological data on a direct link channel.

Also, the SHS specialists designed and developed the website <www.meteo.md>, which contains data on current weather, agro-, hydro- and metrological forecasts, various maps, satellite images and other meteorological and hydrological information, as well as information on the quality of the environment.

In 2017, through the UNDP/ADA Project "Supporting Moldova's National Climate Change Adaptation Planning Process" and the partnership with colleagues from ZAMG, the SHS website <http://www.meteo.md> was modernized.



CHAPTER 8. EDUCATION, TRAINING AND PUBLIC AWARENESS

CHAPTER 8. EDUCATION, TRAINING AND PUBLIC AWARENESS

The purpose of the study is to centralize, explain and analyze the information on activities carried out during 2018-2021 in the RoM, in education, training and public awareness on environment and climate change subject. The topics addressed are the state policies in this field, action plans implementation, integration of ecological aspects into the educational system, the initiatives and awareness campaigns carried out, NGOs and the media (especially the environmental ones) involvement in these actions, etc.

8.1. State Policies in Education, Training and Public Awareness

It should be mentioned that the right to a healthy environment and free access to information on the state of the environment are guaranteed by the Constitution of the RoM (Art. 37). At the same time, each citizen has the obligation to protect and preserve the environment (Art. 59). In recent years, discussions on environment and climate change have become very large scaled and increasingly vocal and visible on the world, regional and national stage. Thus, the presence of this topic in the public space of the RoM is ascending, and population, authorities, media institutions, civil society show increased interest in getting information from credible sources, and contribute to nature protection and combating climate change. The COVID-19 pandemic, although it has made it difficult to carry out certain activities, has also intensified the dialogue on these issues, making people think more about their future and the future of the planet. Consequently, the importance of environmental education and access to environmental information has become even more focused.

In the RoM, the "Environmental Strategy for 2014-2023", approved by the GD No. 301 of 24.04.2014, amended and supplemented by the GD No. 1143 as of 21.11.2018, together with the "Action Plan for the Implementation of the Environmental Strategy 2014-2023" represents the matrix for education, training and public awareness policies on environment and climate change. Chapter III, section 3 of the programmatic document – "Ecological Education and Access to Environmental Information"– provides the context for the need to form a new attitude towards ecological education and training, based on the principle that "People must understand, perceive ecological problems, make decisions and take actions to prevent pollution and rational use of resources, without causing damage to nature"[472]. In this respect, it presents both the current situation with reference to ecological education, and the arguments in favor of its introduction in the school curriculum as a separate discipline, not necessarily interdisciplinary. One of the main reasons cited is that "ecological training involves not only a simple accumulation of information, but also environmental protection activities, an appropriate attitude towards nature and awareness of the interrelationships between nature -people- nature". Another fundamental subject approached is facilitation and improving access to environmental information, the RoM being, in fact, the first state to ratify, by the Parliament Decision No. 346 of 07.04.1999, the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (Aarhus Convention).

Based on the described situation, Section 3 sets forward the following problems related to environmental education and access to environmental information:

1. low level of awareness and ecological education among students, employees and general population;
2. lack of programs, of a school curriculum on ecological education;
3. insufficiency of places where environmental information can be accessed;
4. lack of an integrated environmental information system.

In order to solve or, at least, mitigate the negative effects of the above, the Specific Objective 3 of the "Environmental Strategy 2014-2023" was formulated: "Increasing the level of environmental protection knowledge among students and employees by at least 50% by 2023 and ensuring access to environmental information". To achieve this specific objective, five strands of action have been set:

1. developing and incorporating environmental education into the formal education system (in all relevant disciplines), as well as into non-formal and informal education;
2. ensuring continuous training of teachers to acquire the necessary skills to include green education in teaching;
3. ensuring access to appropriate tools and materials for environmental and sustainable development education;
4. promoting research in sustainable development education;
5. informing and raising public awareness on environmental issues falls within the competence of environmental public authorities.

According to the Action Plan for the implementation of the Environmental Strategy 2014-2023, the activities, monitoring indicators, deadlines and estimated costs for the Specific Objective 3 implementation were organized as indicated below in Table 8-1.

The "Climate Change Adaptation Strategy of the Republic of Moldova until 2020", approved by the GD No. 1009 of 10.12.2014, amended and supplemented by the GD No. 1143 of 21.11.2018, together with the Action Plan for its implementation, also includes relevant environmental and, in particular, climate change education, training and public awareness measures. Strand 3 of the Specific Objective 2 – creation by 2020 of a climate change impact monitoring mechanism, the associated social and economic vulnerability and climate risks and disasters information management/ dissemination – are part of such measures. Specifically, it focuses on "raising the awareness of all actors involved, in particular general population, of the climate change risks and adaptation measures"[473]. Due to permanent appropriate information from truthful sources and awareness-raising, people will understand the urgent need to adopt a new approach and skills (rational use of natural resources, for example) that contribute to safeguarding and protecting the environment, including with a view to climate change mitigation effects.

[472] GD nr.301 of 24.04.2014 on the Approval of the Environmental Strategy for 2014-2023 and the Action Plan for its Implementation,

[473] GD no.1009 of 10.12.2014 on the Approval of the Climate Change Adaptation Strategy of the Republic of Moldova until 2020 and the Action Plan for its implementation.

Table 8-1: Details extracted from the Action Plan for the implementation of the Environmental Strategy 2014-2023 on activities, monitoring indicators, deadlines and estimated costs related to the Specific Objective 3

Action	Monitoring indicators	Deadline	Projected cost, MDL
Development of programs and modules on ecological education and integration of ecological education into the formal education system.	Programs and modules – developed; ecological education course – introduced in the formal education system.	2016	922 400
Capacity building of lifelong learning centers on environmental education.	Teaching, instructional materials – in place.	2023	2, 000, 000
Ensuring training of teachers to acquire necessary skills in teaching ecological education course.	Teacher training courses – organized; teachers – trained.	2023	2, 000, 000
Creating a mechanism to ensure public access to environmental information and to disseminate environmental information.	30 environmental information centers – created in districts; dissemination mechanisms – in place.	2020	45 000 000
Creating an integrated environmental information system, connected to the Government system and ensuring public access to this system.	The system is functional; free access – provided.	2017	100 000 000

According to the Action Plan for the implementation of the Climate Change Adaptation Strategy of the Republic of Moldova until 2020, the activities, monitoring indicators, deadlines and estimated costs for strand 3 of the Specific Objective 2, were organized as shown in Table 8-2.

Table 8-2: Details extracted from the Action Plan for the implementation of the Climate Change Adaptation Strategy of the RoM until 2020, with reference to the activities, monitoring indicators, deadlines and estimated costs related to strand 3 of the Specific Objective 2.

Activities	Monitoring indicators	Deadline	Projected Cost
Developing a mechanism to ensure awareness of the climate change risk and adaptation measures.	The information and awareness program developed and approved.	2020	1, 000, 000
Organizing climate change awareness-raising, information and education campaigns in media and by other information dissemination means.	Climate change information campaigns organized.	2018	4, 500, 000
Revision and supplementing the curriculum for primary, secondary and high school, to include «Climate Change» in the reference disciplines.	The curriculum is supplemented.	2016	700 ,000
Development and implementation of programs and accessible materials for e-training (books, brochures, etc.) on climate change adaptation to improve the abilities of farmers, health, civil protection and emergency situations professionals, energy, transport and construction engineers, other specialists.	E-training programs and materials (books, brochures, etc.) on climate change adaptation developed and published.	2018	1, 000, 000
Establishment of an early-warning system on natural hazards of climate origin, providing public access to data and information necessary for climate risks and impacts assessment.	The early warning system on natural hazards of climatic origin is in place; Regular monitoring reports on natural hazards of climatic origin published.	2019	2, 000, 000

The details about implementation of these strands of the specific objectives set forth in strategies and action plans will be provided further in this chapter.

The national policies of ecological profile are also included, or to a certain extent derived from the bilateral/regional/multilateral/international agreements in which the RoM participates. They intend to strengthen the process of environmental and climate change education, training and public awareness. In addition to the Aarhus Convention (1998), mentioned above, the UNFCCC (1992) was the one that in Art. 6, de facto enshrined the indispensability of public education, training and public awareness.

The Paris Agreement, ratified by the RoM by the Law no. 78 of 04.05.2017, a treaty conceived under the UNFCCC, serves as another example in this direction. The preamble itself emphasizes ' … the importance of education, training, awareness-raising and public participation and access to information and cooperation at all levels on the subjects referred to in the… Agreement '[474], a sentence reiterated in Articles 11 and 12, which highlight the need to act in strengthening the elements set out above.

The Association Agreement between the European Union and the European Atomic Energy Community and their Member States, on the one part, and the RoM, on the other part (ratified 2014-2016), contains provisions similar to those mentioned above. Art. 93 in Chapter 17 (Climate Action), expressly provides for the encouragement of public awareness, education and training activities, through cooperation, to combat climate change.

8.2. Education System

In order to achieve the Specific Objective 3 of the "Environmental Strategy 2014-2023" and the Specific Objective 2 (strand 3) of the "Climate Change Adaptation Strategy of the Republic of Moldova until 2020", systematic steps have been taken to gradually fill the potential gaps of the educational system in addressing environmental issues. In primary, secondary and high school education (depending on the situation, and technical staff), they continue to be addressed through compulsory school field related disciplines, the curricula for which are reviewed, supplemented, updated, generally, on a yearly basis. However, it can be deduced that even now, they are approached relatively sporadically, apparently, without an integrated, coordinated, cursive structure, in a sustainable spirit. Ecological education remains an optional discipline. Nevertheless, it can conclude that given the decreasing number of students attending educational institutions, the expressed interest in studying environmental and climate change issues, is quite high. So is the number of people who register and attend the specializations of the Ecological College of Chisinau. Unfortunately, the number of students and graduates in the field of environmental sciences has been decreasing since the academic year 2019/2020.

[474] Law nr. 78 of 04.05.2017 on Paris Agreement Ratification.

At the same time, the regular training of school and university teachers is a fundamental factor for the implementation of information and awareness actions, and according to the above-mentioned strategies monitoring and implementation reports (2018-2020), hundreds of teachers are trained to improve their teaching methods, make them more attractive and subsequently implement them in formal, non-formal and informal environments.

8.2.1. Pre-School Education

Besides the activities carried out at home, in the family, the early education institutions – crèches (0-2 years)/kindergartens (2-6/7) – considerably complement the parents' efforts, being essential in the multilateral training of the child, helping them to develop useful skills for the next stage of their life. The pre-school education fosters the process of adapting to the status of the member of society and, at the same time, of learning the environment, especially through various interactive learning games, books, drawings, photographs, sounds, visits, outdoor walks, direct observation of the natural world (plants, animals, phenomena, relief, etc.). The role of the educator is crucial – depending on the techniques applied, they can awaken the curiosity, creativity, enthusiasm, the child's responsibility and cultivate the love for nature, guiding them gradually, to understanding the need to protect it. Skills and knowledge acquired in childhood can accompany people throughout their lives. For this reason, it is very important, that the attitude inspired towards the environment from an early age is respectful, protecting and careful.

8.2.2. Primary and General Secondary Education (Secondary and High School)

In primary education (grades 1 to 4) and general secondary education (grades 5 to 9 and grades 10 to 12) the subject of environment and climate change is taught interdisciplinary, through modules incorporated in the curriculum of such disciplines as: "Sciences", "Biology", "Chemistry", "Geography", which are taught, depending on the year (class) and the profile, 1-3 hours of lessons per week. Additionally, in 2019, the "Geography" curriculum (grades V-XII) was supplemented with various informational/educational components targeting topics such as climate, climate factors, climate zones[475]. In 2020, as a result of the curriculum reforms, the subject of climate change and adaptation measures was more explicitly addressed through the disciplines "Science" (5th grade) and "Biology" (V-XII grades), the aim being to develop skills in environmental protection and to stimulate participation in sustainable development promoting activities/campaigns.

Cross-sectoral cooperation between the Ministry of Agriculture, Regional Development and Environment / after restructuring – the Ministry of Environment, and the Ministry of Education, Culture and Research, under the provisions of the Environmental Strategy 2014-2023 and the Action Plan, has resulted in the inclusion in 2015 of the "Green Education" in the list of optional school disciplines. Also, "every student, with the exception of students from specialized and bilingual classes/institutions, is required to study an optional subject, depending on the Framework Plan model selected for implementation. Once the option for a certain discipline has been expressed, its attendance and implementation of the curricular provisions become mandatory"[476]. According to the data of the "Report on the implementation of the Environmental Strategy 2014-2023" (2020), in the academic year 2019-2020, 18,784 students chose to study "Ecological education" (primary school – 3,896; secondary school – 11,714; high school cycle – 3,174).

8.2.3. Vocational Education and Training

There are 42 vocational schools, 36 colleges and 13 centers of excellence in the Republic of Moldova. Their mission is to train future professionals, qualified in a certain profession/trade, who can easily adapt to the requirements of the labor market and the demands of the economic sector. Admission takes place either on the basis of secondary or high school education (only in secondary and post-secondary technical training programs)[477].

There are also vocational education institutions which are directly or indirectly related to environment and climate change. One of the most renown in this regard is the Chisinau College of Ecology, which provides training in a range of specializations such as "Ecology and environmental protection", "Forestry and public gardens", "Water management and protection", "Meteorology", "Fisheries and aquaculture", etc., for about 1,000 students (annually). In 2021-2022, about 339 candidates were admitted to nine programs (in the academic year 2020-2021 – 296), covering almost all competed positions, the majority in "Ecology and environmental protection" specialization (63 out of 75 available). Its curriculum contains at least one module on the current state and trends of change in climate and environment, revised over the last few years[478]. The same specialization is also available at the "Iulia Hasdeu" College in Cahul (2021-2022 – 30 positions, all filled in).

8.2.4. Higher Education

There are 16 state higher education facilities and 8 private ones in the Republic of Moldova. Of these, at least five offer bachelor's programs (three years, in general) and/or master's programs (two years, in general) focused on environmental topics, which contribute to training of specialists in the field, who, after a substantial understanding of the subject, its problems and management methods, approaches, strategies and solutions in the short, medium and, above all, long term, developing the necessary skills, are able to participate, either as members of civil society or public institutions, in development of effective national policies, which ensure not only "theoretical" protection of the environment, but also practical protection. At the same time, students are trained to be able to transfer knowledge and experiences, to people at large, media, authorities, etc. in accessible language.

[475] Report on the implementation of the Climate Change Adaptation Strategy of the Republic of Moldova until 2020, Ministry of Agriculture, Regional Development and Environment.

[476] National Curriculum Framework Plan for Primary, Secondary and High School Education, Ministry of Education, Culture and Research, 2020, p. 12,

[477] Code no.152 of 17.07.2014 Education Code of the Republic of Moldova,

[478] Environmental Strategy Implementation Report for 2019, Ministry of Agriculture, Regional Development and Environment.

Table 8-3: Higher education institutions which include environmental aspects (ecology, nature protection, climate change, etc.) among the specializations and modules taught

Educational establishment	Specializations/modules related to environmental aspects
State University of Moldova	"Ecology and protection of the environment"; "Forestry and public gardens", "Geology", "Meteorology";
Technical University of Moldova	"Water engineering and protection", "Environmental engineering";
State Agrarian University of Moldova	"Plant protection", "Environmental engineering", "Ecology";
Free International University of Moldova	"Ecology"
Tiraspol State University (based in Chisinau)	"Biology", "Ecology".

The data of the last three academic years (2018/19; 2019/20; 2020/21), and made publicly available information of the National Bureau of Statistics show that in environmental sciences, but also in the related fields (biological sciences, chemical sciences, forestry), both the total number of students and the total number of graduates is unfortunately showing a downward trend, mainly since 2019/20 academic year. It is very likely that this decline can be correlated with the COVID-19 pandemic, which undoubtedly affected the quality of the act, the educational picture, but also with migration phenomenon.

Table 8-4: Total number of students in environmental sciences and related fields

	2018/19		2019-20		2020-21	
	License (Cycle I)	Master's Degree (Cycle II)	License (Cycle I)	Master's Degree (Cycle II)	License (Cycle I)	Master's Degree (Cycle II)
Environmental Sciences	520	119	385	96	347	65
Biological Sciences	113	62	98	58	78	44
Forestry	217	40	164	60	166	63
Chemical Sciences	191	64	166	56	173	48

Table 8-5: Total number of graduates in environmental sciences and related fields

	2018		2019		2020	
	License (Cycle I)	Master's Degree (Cycle II)	License (Cycle I)	Master's Degree (Cycle II)	License (Cycle I)	Master's Degree (Cycle II)
Environmental Sciences	136	61	126	53	92	38
Biological Sciences	37	23	26	24	24	29
Forestry	72	35	79	39	38	33
Chemical Sciences	43	24	57	26	39	25

8.2.5. Post-University Education

The most advanced stage of the educational system is the post-graduate studies, which focuses on thorough, meticulous, scientific examination of the subject of interest. The requirements for enrollment in these programs are at an extremely high level, and the intellectual activities carried out during the study should reach absolutely special standards, as well as the expected results. The aim is to build research that "splits" and explains various processes, phenomena, etc., in depth, to present discoveries, data, calculations, solutions, results, conclusions that, combined, will boost the progress of the respective field and, ultimately, of society.

The institutions in the RoM that carry out postdoctoral programs (addressing those who already holds the PhD title) that fall within the paradigm of ecological education are:

- State University of Moldova (Department of "Ecology and Environmental Protection");
- Technical University of Moldova;
- Institute of Ecology and Geography.

8.3. Public Information and Awareness Campaigns

In 2018 and 2019, events, initiatives, discussions, conferences, exhibitions, press campaigns and other actions were carried out, aimed at strengthening the public information and awareness-raising efforts in the field of environment and climate change. Some of these have become a tradition for decades – the cyclical sanitation and afforestation campaigns, but the scale at which they take place has changed. Over time, more and more people, especially teenagers, young adults, join such actions. Information and awareness-raising activities were launched, coordinated, carried out both by central state bodies, local administrations, as well as by non-governmental environmental organizations, media institutions and even individuals, including through collaborations between the respective actors.

Since 2020, the COVID-19 pandemic has made it difficult to carry out some of the information and awareness campaigns in face-to-face form, which were systematic up to that point. Activities continued, however, more intensively in cyberspace, with social networks such as the Facebook platform becoming the basic tool for raising the information provision profile, environmental protection promotion and dialogue on climate change.

The following general examples of activities that took place in 2018-2021 were:

- national sanitation campaigns;
- national afforestation campaigns;
- information campaigns through broadcasts, articles, thematic podcasts, especially in specialized media;
- conferences, public lessons, ecological classes;
- development of brochures, guides, reports and other information materials;
- thematic contests;
- thematic exhibitions;

- civil society organizations projects;
- marking thematic days (International Biodiversity Day, Environment Day, World Wetlands Day, Danube Day, International Forest Day, etc.).

More specific examples of activities (not an exhaustive list):

- "Earth Hour" campaign;
- "Hai, Moldova" campaign;
- "Plant your future" campaign (successor to "A tree for our sustenance");
- Velo Marathon "Eco Energy";
- "Straseni, mon amour";
- Climate box;
- IarmarEco;
- InnSpirECO;
- "Choose not to Disappear as a Species";
- "Clean River from Village to Village";
- "Clean City with Recycled e-Waste";
- "Disinfection and Cleaning of Wells";
- "REP Week in Moldova";
- European Week "Clean, Shared and Smart Mobility";
- European Green Week;
- "Skip to Green", "Kids' World" podcasts (eco stories);
- 107 ecological classes – 2,255 people (2018)[479];
- Ecological Education Hour entitled "Global Warming and Climate Change: Causes and Effects";
- Public lecture "Water on EARTH and in the Republic of Moldova: problems and solutions";
- Public lectures "Study of the World Meteorological Organization", "Climate Change";
- Conferences "Ecological issues in the context of sustainable development of the Republic of Moldova", "Dniester in danger";
- Round table "Efficiency of applying minimum soil cultivation technologies in the RoM";
- Contests "Local Environment and Sustainable Development", "School of the Green City";
- Exhibitions "Everywhere you look – everywhere is garbage", "Water - essence of life and well-being", "Water and its mysteries", etc.

Among the non-governmental environmental organizations actively involved in the public information and awareness campaigns on the environment protection and climate change phenomenon are below-mentioned.

8.3.1. Association of Environmental Journalists and Ecological Tourism

The Association of Environmental Journalists and Ecological Tourism (AJMTEM) was formed by a group of journalists who covered environmental issues in the early 90 's and is a non-governmental, non-profit, apolitical organization, created by journalists, and its activity covers the entire territory of the RoM. AJMTEM trains media specialists in the ecological field and promotes environmental journalism in the RoM.

The association builds and stimulates partnerships between media, the environmental community and general public for a protected environment and sustainable development. Professionalism, access to information and communication, active involvement, transparency and ethics are among the values adopted and shared by the association. The fundamental priorities of AJMTEM are environmental information and awareness, access to information and public participation, sustainable development, partnership with public authorities and environmental NGOs in the country and abroad, development of an environmental editorial program, support and diversification of the NATURE collection, development of rural and ecological tourism.

8.3.2. Ecological Movement of Moldova

The Ecological Movement of Moldova (EMM) is a non-governmental, non-profit, apolitical organization, founded in 1990, based on the principle of free association of Moldovan citizens and public organizations whose main objective is to restore the harmony of the Nature – People – Society triad.

The Ecological Movement of Moldova considers that environment protection is the main problem of the world. In this respect, the EMM's main concerns are: restoring natural balance, preserving and caring for our natural and cultural heritage and creating a pro-ecological state of mind in society.

The EMM's declared mission is to form an ecological vision and conscience of the citizens, to green the society and to change collective thinking the towards the environment for the better through ecological education and training. In order to achieve these objectives, the Movement carried out and carries out multiple projects with environmental content, including mobilization of public opinion to save many values of the natural heritage, including the natural monument "The Great Rock", the landscape reserve "Saharna", "The Park of Taul". Also, EMM participated as an expert in the drafting ecological laws and the National Strategic Action Program until 2010; Biodiversity Strategy in the Republic of Moldova; Climate Change Strategy; National Forestry Fund Development Strategy, etc.

8.3.3. Media-Group Meridian (EcoFM Radio)

Founded in 2013, the Public Association "MEDIA-GRUP MERIDIAN" aims to raise the awareness of the population on environmental issues. Among the main objectives of the organization are to focus the population's attention on environmental issues, to raise public awareness in identifying local environmental problems, to involve them and to solve them, to inform the public about the latest environmental news both from the RoM and from abroad, to promote a healthy way of life and to eradicate vices, to develop ecological culture, to encourage cooperation between the media and the representatives of the civil society.

In order to achieve the organization's objectives, the ecological radio station EcoFM was founded in 2015, which appeared on the media market of the RoM as a "tribune" of NGOs focused on environmental and social issues.

[479] *Environmental Strategy implementation Report for 2018*, Ministry of Agriculture, Regional Development and Environment, <https://mediu.gov.md/sites/default/files/Documente%20atasate%20Advance%20Pagines/Raport%202018%20Strategie%20mediu%20%20%28Anexa%29.pdf>.

8.3.4. EcoVisio

EcoVisio Association was founded in 1999 as “Ecological Association of Children and Youth from Moldova” (AECTM), changing to the new name in 2013. EcoVisio’s activities were focused on the organization of creative and non-formal actions to popularize ecology in schools, and at present the association is working to achieve the potential of the Republic of Moldova as a model region for sustainable development.

EcoVisio’s vision for the future of RoM and the entire region is active society, healthy environment and a prosperous and fair economy.

The mission of the association is to bring this future closer to present, through educational activities, theoretical and practical promotion of sustainable living, development and growth of communities, and supporting the initiatives that share this vision.

The association’s activities include educating young people about the environment, compensating CO_2 emissions by planting trees, creating and maintaining a training center in the village of Rascova, for practical education and exchange of innovative ideas, offering greening up services to enterprises and civil society organizations, exploring the long-term impact of climate change, interactively, through games (“Keep cool” – table game and online).

8.3.5. EcoContact

EcoContact Association exists since 2010 and aims to promote sustainable development processes, environmental protection and sustainable use of natural resources at regional level.

EcoContact’s mission is to support the environment improvement and partnerships for sustainable development of communities in the RoM, thus contributing to creation of a responsible society that builds an environment conducive to the life of current and future generations. The values that EcoContact shares and promotes are responsibility, involvement and action, dignity and respect, cooperation and partnership.

Since 2013, the EcoContact Association hosts the Aarhus Environmental Information and Consultancy Center, created with the support of the OSCE Mission to RoM, but also others, such as: Society for the Protection of Birds and Nature, Ecological Consulting Center Cahul, Eco-TIRAS – International Association of the Dniester River Keepers, BIOS, Ecological Society “BIOTICA”, Terra-1530, Ecotoxicologists Society of the Republic of Moldova ECOTOX, Women Association for Environmental Protection and Sustainable Development, Association for Waste Recovery, etc.

Among the media outlets actively involved in the information and public awareness campaigns are the below-mentioned.

8.3.6. Ecopressa

Created as a portal with the role of promoting, educating, informing and raising awareness of ecological values, Ecopresa.md, established in 2013, has as a central element the implementation of sustainable development and respect for the applicability of environmental protection strategies. Ecopressa, being a broad base of information, news, analysis, studies and reports, offers genuine tools for increasing the quality and coherent and correct interpretation of the natural, cultural and ecological heritage perception – at local, regional and national level. Once these notions are understood, practical directions are offered to concrete actions that emphasize the mission of the press portal.

Ecopressa has, by the end of February 2022, almost 1,300 articles published on the website, under the “environment” category and 164 under the “climate change” category.

8.3.7. “Nature” Periodical Publication

Since 1990, the monthly publication “Nature” transforms the efforts into results, by draws attention to the aspects of promoting ecology, the historical-cultural and natural heritage as essential elements of the healthy image of a state, as its mission.

In addition to promoting environmental education, eco-tourism and environmental protection in its articles and reports, the periodical “Nature” highlights the importance of traditional values that respect nature and proves how essential it is to keep these values alive. Therefore, the magazine “Nature”, which is read by over 30 thousand readers in the RoM and abroad, brings sound and applicable ways of action in its articles and reports, as well as examples of good practice in creation and continuous construction of the national heritage conservation system, where ecological education is the central pillar.

8.4. Climate Change Training Programs

According to the monitoring reports of the “Environmental Strategy 2014-2023” and “Climate Change Adaptation Strategy of the Republic of Moldova until 2020”, below is the list of some of the training activities that took place in 2018 and 2019:

- the scientific-didactic seminar for teachers from pre-university institutions “Training through research for a prosperous society”;
- thematic workshop for journalists and environmental NGOs where the National Pollutant Release on Transfer Register (PRTRs) was launched;
- scientific Circle of Meteorology and Climatology “Local, Regional, Global Climate Change” (Tiraspol State University);
- kick off workshop of the “Capacity building in the implementation of extended responsibility of producers in the Republic of Moldova” project;
- workshop for farmers with the participation of trainers from Great Britain and Austria;
- three training courses on extended manufacturer responsibility, attended by 56 environmental inspectors;
- training of customs officers on issuance of the Authorization for export/transit of waste in the workshop “Administration of customs and tax facilities. State Aid”.

At the same time, 16 centers for the continuous training of teachers in higher education institutions, the Institute of

Education Sciences and the Institute of Continuous Training were active in 2019. In that year, 354 teachers were trained in addressing ecological issues.

It should also be mentioned that certain NGOs from those mentioned organize/coordinate, by the nature of their declared mission, regular training in environment and climate change issues, for students, teachers, journalists, etc.

In this respect, the example of EcoVisio workshops (water management, solar energy, afforestation, thermal insulation) within the project "Preparing rural environment for climate change" (2021-2022) can be brought. The aim is "to raise awareness and cope with climate change among rural communities, to identify best practices and to stimulate policy makers to support rural communities in their activities"[480]. In 2018-2020 EcoVisio also started the project "ActiveCiuluc", intended for the inhabitants of the Ciuluc river basin, and organized ecological information classes about the ecological status of the region.

Another example is that of the green schools/teams, a project implemented by the Energy Efficiency and Renewable Alliance, in partnership with the Energy Efficiency Agency and the Association of Environmental Journalists and Ecological Tourism: "The main objective of the project, launched on October 12, 2021, is to create a sustainable planning model for improving the physical school environment, the purpose being to manage the school resources and facilities (energy, waste, water, spatial planning, green procurement, use of ecological materials, etc.) [...] 12 communicators from among the students will also be trained, so that they can reflect the problems faced by the educational institution"[481]. By the end of the project, it is expected that over 1,000 students, parents and teachers from 12 schools from different regions of the Republic of Moldova will benefit from tangible results, such as: the practical guide "Towards a green, sustainable and efficient school!" (7th-12th grade), distribution of kits equipped with specialized tools for assessing the indoor microclimate, thematic training.

In 2020, the Association of Independent Press together with the Association of Environmental Journalists and Ecological Tourism organized the program "School of Environmental Journalism", based on trainings, contests of journalistic materials and a study visit to one of the European Union countries. The online seminars of the "School of Environmental Journalism" are focused on: "Climate change and the consequences of the phenomenon", "Media campaigns on ecological topics", "Reflecting the subject of air pollution in cities in the media", "Waste management and sustainable consumption", "Fossil fuels, alternative energy".

Also in 2020, "Media-Grup Meridian" (EcoFM radio station), initiated, within the project "The voice of young people – a sustainable element for a green future", training sessions in the field of environmental journalism for groups of students from Falesti, Stefan Voda, Sangerei and Anenii Noi.

[480] Project 'Preparing the Rural Environment for Climate Change', EcoVisio,

[481] They're going to measure the quality of the water and the air. 12 schools in the country will receive sets to establish the level of comfort of the institutions, Ecopressa, <https://ecopresa.md/video-vor-measure-calitatea-apei-si-aerului-12-scoli-din-tara-vor-primi-seturi-pentru-a-stabili-nivelul-de-confort-al-institutiei/>.

8.5. Resource and Information Centers

8.5.1. Regional Environmental Center (REC Moldova)

REC Moldova was established by the GD No. 1071 as of 22 October 1998, on the basis of the agreement signed between the Government of the RoM and the European Commission. The organization was established with the purpose of assisting nongovernmental organizations in their effort to solve environmental problems in the RoM and its neighboring states.

In its activity, REC Moldova has implemented a number of projects, in areas such as increasing public involvement in the decision-making process, ensuring access to environmental information for all environmental stakeholders of the country, strengthening partnerships between all environmental stakeholders at local, national and regional level, solving environmental problems of local, national and cross-border priority, through concrete actions, harmonizing national environmental legislation with the EU environmental legislation, promoting the principles of sustainable development.

8.5.2. National Environmental Center

Founded in 2010, the National Environmental Center aims to increase the level of public awareness on environmental protection and climate change issues, to raise awareness and mobilize citizens, so that by a joint effort of all actors of society, to change the classical development paradigm into the sustainable development model, where decisions are made in a balanced way between the three pillars: environment, social and economic.

The vision of the National Environmental Center is a world where environmental protection is a value for society and where people and authorities act consciously and responsibly towards the natural resources of the planet, with care for future generations.

The aspiration of the National Environmental Center is to learn the best practices in the field of environment, their application at the level of the organization, its employees and their replication at community's level.

8.5.3. Aarhus Environmental Consulting and Information Center

Since 2013, the EcoContact Association hosts the Aarhus Environmental Information and Consultancy Center, created with the support of the OSCE Mission to Moldova. The mission of the Centre is to assist in Aarhus Convention implementation at national, regional and local level, and is the result of successful cooperation between the OSCE and the UNECE.

In order to achieve sustainable results in environmental protection, the Aarhus Centre by the EcoContact, tends to achieve the following strategic objectives: promoting the implementation of the Aarhus Convention through an active dialogue between the Government, NGOs and the general public, promoting access to environmental information and increasing public participation in the decision-making process.

Useful information sources from the RoM, in the field of environment and climate change:

- https://www.mediu.gov.md/
- https://www.ecocontact.md/
- https://www.ecovisio.org/
- https://www.eco-tiras.org/
- https://www.natura.md/
- http://www.clima.md/
- https://ecopresa.md/
- https://ecofm.md/
- https://sppn.md/
- http://mem.md/

8.6. International Training and Awareness-Raising Activities

The RoM, as a member of regional, global multilateral organizations and/or signatory to international agreements, including in the field of environment and climate change, inevitably, participates in joint training and awareness raising activities held by the authorities, NGOs, media, general public, through programs, mechanisms and financing instruments of the United Nations, Organization for Economic Cooperation and Development, Organization for Security and Cooperation in Europe, European Union, USAID, etc., which contribute significantly to implementation of the Paris Agreement, the European Ecological Pact, the 2030 Agenda for Sustainable Development, UNFCCC, the Aarhus Convention, the EU-RoM Association Agreement, etc.

For example, the Eastern Partnership (EaP; last Summit – December 2021) represents a platform for dialogue, often through working groups, both between the EaP and the EaP-EU States, on the challenges encountered, good practices and experiences exchange, especially since they receive support in the field of environment through joint programs such as EU4Environment, EU4Climate, financed by the EU, implemented by UNDP, an organization which is also the focal point for managing the plans for achieving the Sustainable Development Goals (SDG 13 – Action on climate). A concrete model of action towards the achievement of SDG 13 is that "30 communities from Nisporeni, Calarasi, Basarabeasca, Leova, ATU Gagauzia, the security area (Dubasari district) and the Transnistrian region have received grants of up to 16,000 USD for projects aimed to increase the resilience of communities to climate change, to reduce the risks of disasters and to contribute to the sustainable development of localities"[482]. At the same time, "Following the implementation of the selected projects, 110,000 people from 18 localities will benefit from access to a modern waste management system, over 30,000 people from four communities will benefit from territories rehabilitated by afforestation and arrangement, about 100,000 people from four localities will carry out projects for cleaning rivers and arrangement of adjacent territories, and 19,500 people from four other localities will get access to alternative energy systems, including in public institutions". The Republic of Moldova, through the UNDP Moldova, also joined the global campaign "Mission 1.5", a "game" that basically probes the participants and "educates people about climate action and connects them with their governments and political decision-makers"[483].

Another form of RoM's participation in international training and public awareness activities could be through its citizens, who, certainly, are among the almost 50,500 people enrolled on the digital platform "Conference on the Future of Europe" and, certainly, whose ideas are among the over 3,200 opinions/proposals for "Climate Change and the Environment" theme. The Conference on the Future of Europe is a means for European citizens to make their voice heard and involves forms of opinion, events, debate groups on certain topics, generally deriving from EU priorities. Subsequently, the opinions are discussed, analyzed, monitored and summarized in a report sent to the EU institutions, and contribute to the initiation, development or optimization of European policies (public participation in the decision-making process).

Art. 6

Information on the monitoring and evaluation of Art.6 of the UNFCCC implementation activities have been integrated throughout the study, in particular through the details of the official monitoring reports on implementation of the "Environmental Strategy for 2014-2023" and the "Climate Change Adaptation Strategy of the Republic of Moldova until 2020".

In this context, the content of Art. 6, with reference to "Education, training and awareness-raising" is the following:

'The Parties:

a) undertake to encourage and facilitate at national and, where appropriate, sub-regional and regional level, in accordance with their laws and regulations and according to their capabilities:
    i. development and implementation of climate change and its effects education and awareness programs;
    ii. public access to information on climate change and its effects;
    iii. public participation in the examination of climate change and its effects and the development of appropriate adaptation measures; and
    iv. training of scientific, technical and administrative staff;
b) support through their cooperation and encourage at international level, where appropriate, by involving the existing bodies:
    i. development and exchange of educational material and materials intended to raise public awareness on climate change and its effects; and
    ii. development and implementation of education and training programs, including through strengthening of national bodies and exchange or secondment of staff responsible for training experts in this field, particularly for developing countries ".

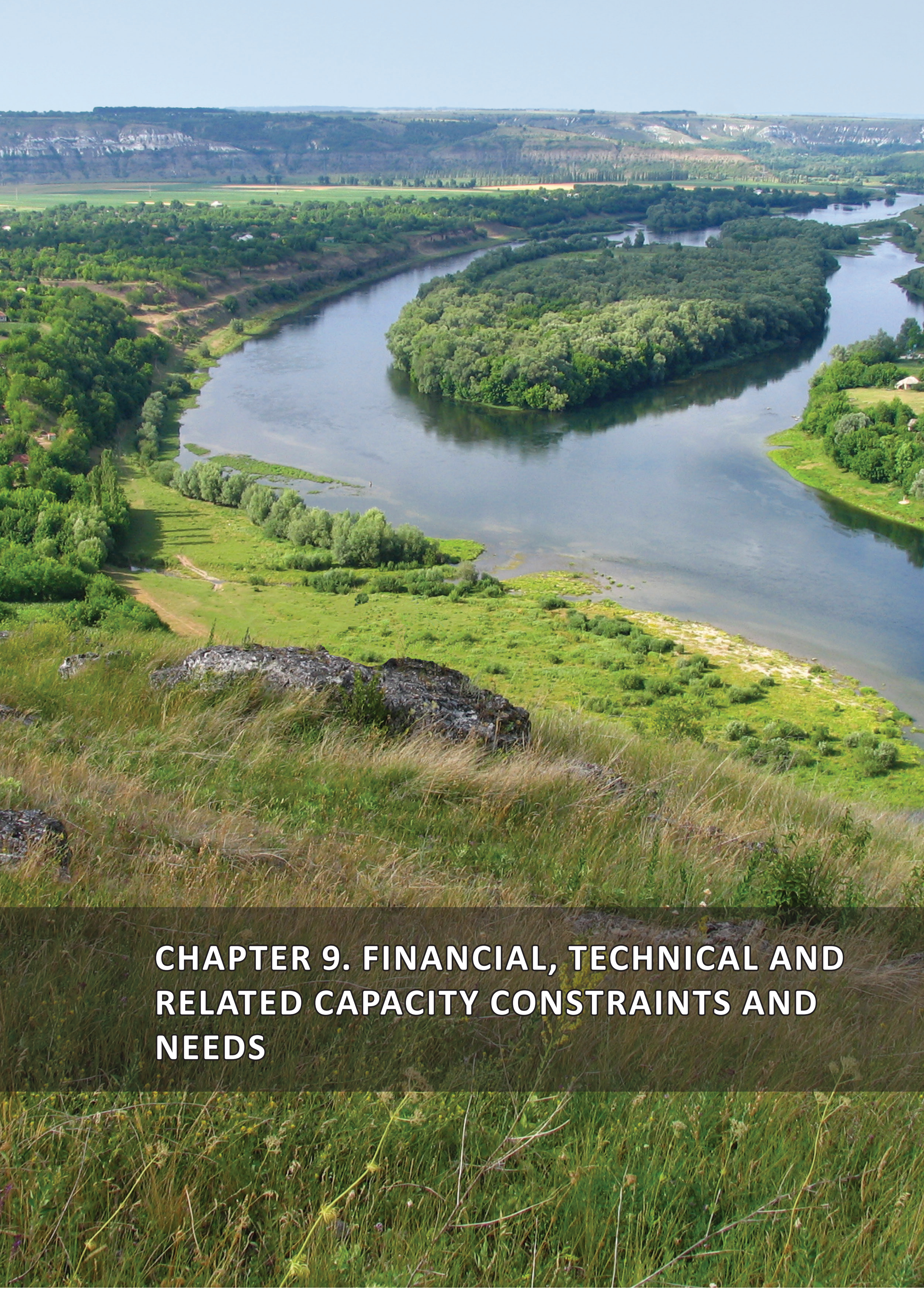
[482] *With the help of Sweden and UNDP, 30 communities will carry out projects to increase climate resilience and reduce environmental degradation,* UNDP Moldova.

[483] *Moldova joins Mission 1,5 - the largest global survey on climate change,* UNDP Moldova.

In conclusions, the overview of the activities started and carried out during the years 2018-2021 in the RoM in education, training and public awareness on environment and climate change, highlights, in particular, the campaigns carried out in this regard by state institutions, civil society organizations and media, especially the specialized one, but not only. These types of actions, should be mentioned due to their intensification and their visibility, especially in the online environment, but also because, in the context of the COVID-19 pandemic, many of the activities have "moved", at least temporarily, in the online space, except for the events carried out in the open air, such as sanitation, afforestation and festivals dedicated to the awareness of the need to protect the environment, which were carried out in compliance with the protection rules and applied restrictions. For this reason, the number of face-to-face participants could only be limited. Gradually, the institutions and people adapting to the pandemic circumstances, began to organize "hybrid" events, with more emphasis on online (through Zoom, live broadcasts on Facebook) and, as far as possible, with the physical presence of some guests, again, in limited numbers. Meetings with face-to-face participation took place as exceptions. In these circumstances, websites of the specialized press, relevant NGOs and social networks have substantially contributed to promoting access to environmental information, through "friendly" approaches with the users of the platforms (attractive video/graphic materials, professional, but understandable language, establishing a connection with the followers, etc.).

On the other hand, the educational act, at almost all stages of education, was severely affected by the consequences of the coronavirus pandemic, resulting into a decrease in the number of students enrolled and graduates of the higher cycle. Communication between teachers and students has changed due to virtual interaction, and the closure every few weeks/months and re-opening for a few weeks/months of educational institutions has created instability and, to a certain extent, lack of continuity in the educational process. For primary school students and first-year undergraduate students in particular, it is extremely difficult to "get attached" to this process. Consequently, it is quite difficult to assess the degree of perception and receptiveness of students to traditional disciplines ('Sciences', 'Biology', 'Geography', etc.) that include modules/elements on environment and climate change. This observation also applies to the optional subject 'Ecological education'. Therefore, "measuring" the true efficiency of the programs and teaching methods in conformity with a clearly defined algorithm becomes complicated.

In this context the implementation monitoring reports for the "Environmental Strategy 2014-2023" during 2018-2020 are quite difficult to be evaluated. The actual implementation of the first component of the Specific Objective 3 "Increasing the level of knowledge on environmental protection among students and employees by at least 50% by 2023", the results of which, in terms of knowledge and percentage, are difficult to "quantify" in a concrete and truthful way.



CHAPTER 9. FINANCIAL, TECHNICAL AND RELATED CAPACITY CONSTRAINTS AND NEEDS

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9.1. Constraints to Climate Change Mitigation

Putting into value the climate change mitigation potential of the RoM depends to a large extent on how barriers to the implementation of GHG emissions reduction and removal actions can be overcome. The financial, technological and capacity constraints, specific to each sector, are described in the Environmental Strategy for 2014-2023 and in the Low Emission Development Strategy until 2030 and in the Action Plan for its implementation. The most important constraints in the key sectors of the national economy are explained below.

9.1.1. Energy Sector

The RoM has made progress in creating the regulatory framework for the electricity and natural gas sectors[484], but not all approved normative acts are implemented so far.

The reduced payment capacity of consumers has been put to the test in the context of the energy crisis faced by the European Union and the Eastern Neighborhood countries since the last months of 2021. The significant increase in the purchase price of natural gas has placed a significant proportion of natural gas and heat consumers practically in default, and the central authorities have decreed a state of emergency in the energy sector. These circumstances have a number of negative consequences, including increasing internal political instability.

The relatively high cost of capital in the RoM continues to represent a significant barrier for the construction of new electricity generation and transmission capacities required to ensure energy security and performance efficiency of power plants. The interest rates charged by local banks on investment loans are generally very high, and the reluctance of foreign investors is caused by the high level of country risk. Thus, in January 2022 Moody's rating of the RoM was B3, and the capital risk premium rate amounted to 10.67%[485].

There is a lack of interest in the country's electricity market for the construction of new power plants on fossil fuels, given the availability of some sources to supply electricity at much lower prices (for example: suppliers from Ukraine; MTPP in Dnestrovsk), than the price of electricity produced by a new installation. The diversification of electricity supply sources has led in recent years to the start of the implementation of several large infrastructure projects in the energy sector. In November 2021, the winner of the tender for construction of high voltage line with a capacity of 400 kV on the Vulcanesti-Chisinau section, with an approximate length of 160 km and a *back-to-back* transformer station that would allow an interconnection with the electricity system in Romania[486], was announced. The prospect of implementing such projects diminishes the likelihood of attracting investment for construction of new fossil fuel production capacities.

[484] Energy Community Secretariat. Annual Implementation Report 2020. <https://www.energy-community.org/implementation/IR2020.html>

[485] Source: *'Government debt credit risk and risk premium rate'* (updated version: 05.01.2022). <https://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ctryprem.html>

[486] TVR Moldova: *"Construction of the Vulcanesti-Chisinau high voltage power line begins"* (15.11.2021). <http://tvrmoldova.md/economic/incepe-constructia-liniei-electrice-de-inalta-tensiune-vulcanesti-chisinau/>

RoM's investment risks are also determined by separatism in the Transnistrian region. The evolution of the Transnistrian settlement process is virtually blocked in the context of the armed conflict between Ukraine and the Russian Federation. The regional security-related instability has a series of direct repercussions for the RoM due to the increased risk of political and economic instability, which may have a negative impact on the parity of the national currency against the main foreign currencies. These circumstances do not favor access to foreign credit and discourage small and medium-sized enterprises from investing in the energy sector.

As a result of the political instability, the EBRD – MOSEFF III project was cancelled, the previous editions of which enjoyed great success among SMEs by transferring new technologies to reduce the energy resources consumption and promoting RES.

A favorable regulatory framework for the development and use of RES has been approved in recent years. By the beginning of 2022, the tender for providing the status of eligible producer to suppliers with an installed capacity greater than 1 MW has not yet been announced, although the ceiling prices for electricity to be produced from renewable sources have been approved[487]. The delay is partly explained by the slow pace of approval of some amendments to the Law on Renewable Energy Sources, necessary in the context of providing more guarantees to investors in this sector. On the other hand, the Register of eligible producers[488] shows that the capacity limits for photovoltaic and wind installations, established by the Government according to the provisions of the Law on the Promoting Use of Energy from Renewable Sources, for the support scheme based on the fixed tariff have already been exhausted by 2020. As a result, the accomplishment of objectives set out in the country's strategic documents related to promotion of RES, becomes problematic.

Production of electricity from renewable sources (solar and wind) dependent on weather conditions which have been subject to high variability over the last decades, as a result of climate disturbances. One of the adverse consequences of climate change is an increase in the frequency and duration of droughts leading to a reduction in biomass production used for energy purposes.

Global GHG mitigation policies will be based on market-based instruments and price capping. This approach is also implemented by the European Union, which has financial mechanisms in place to help limit GHG emissions across Member States and to determine the prices at which unused quotas are traded. The accession of the RoM to the EU carbon market will allow trading of the GHG emission reductions registered on its territory. In accordance with the RoM - EU AA, Directive 2003/87/EC on the establishment of a GHG emissions trading scheme within the European Community is to be implemented by 2022, which will contribute to

[487] ANRE Decision no. 54/2020 of 28.02.2020 on fixed tariffs and ceiling prices for electricity produced from renewable energy sources by producers who will obtain the status of eligible producer in 2020, Official Gazette no. 94-98/326 of 27.03.2020.

[488] ANRE Register of eligible producers. <http://www.anre.md/register of eligible producers-3-339>

the reduction of GHG emissions in a cost-effective and economically efficient manner. At the same time, in order to fully integrate the EU-SCE, the RoM must transpose at least seven other EU directives and regulations, including those regulating the MRV, GHG emissions registration, benchmarking, auctions, etc. In the context of this paradigm shift, the RoM will begin preparing complex legal and institutional changes, a process that will have an impact on the activity of all greenhouse gas emitting entities, including power plants. The speed of implementation of these changes and the high costs of maintaining and using new accounting and emissions trading systems are a real concern of the environmental authorities of the RoM, this issue being on the permanent agenda of the dialogue with the European institutions.

9.1.2. Transport Sector

The number of vehicles registered in the RoM has increased considerably in the last decade. Thus, this indicator increased by over 57%, from almost 611 thousand in the end of 2010 to over 961 thousand in the end of 2020[489]. The low purchasing power of individuals and economic agents is reflected in the considerable age of the purchased vehicles, more than 90% of them being second-hand vehicles. The ageing effect of the vehicle fleet has been deepened by the adoption in recent years of amendments to the legal framework allowing import and registration in the country of certain types of vehicles with a considerable age. In 2013, the MoE launched the idea of implementing the "Rabla" project similar to the one implemented in Romania, by which the state would stimulate the process of continuous renewal of the car fleet by direct financial contributions to consumers. Despite several attempts, the actual implementation of the project has not yet started and the feasibility study is at an early stage.

Another factor contributing to maintaining high GHG emissions in the transport sector is the quality of roads and road infrastructure. The lack of sufficient financial means for the regular and routine repairs and maintenance of road communication routes and for construction of new roads leads to the maintenance of the average vehicle speed at approximately 50 km/h. Given the characteristics of the operating cycle of thermal (internal combustion) engines, GHG emissions at such an average speed are approximately 20–30% higher than those generated at an average speed of 70 km/h. Financial and institutional impediments contribute to a very slow increase in the length of new and high-quality roads. The high degree of wear and tear on roads and road infrastructure and low performance of motor vehicles are the main barriers to GHG emission reductions in the transport sector.

Due to these two main causes, the effects generated by the following aspects, overlap:

- Pre-operational costs for electric vehicles remain high, given the still poorly developed charging infrastructure. This reduces the commercial attractiveness of this type of vehicles. Fiscal measures aimed at encouraging purchase of hybrid and electric motor vehicles – the 50% reduction in customs duties on imports of hybrid motor vehicles and VAT exemption on imports of electric motor vehicles – are not yet capable of contributing to an essential increase in the number of such vehicles. In general, lack of clear regulations in the form of vehicle efficiency standards increases the perceived commercial risk of investment in the development of efficient technologies in this sector.
- Use of biofuels as low GHG-intensity fuels is limited by the imperative of using arable land and water resources to achieve the higher priority objectives of domestic food security policy.
- Unsatisfactory urban planning as well as inadequate institutional mechanisms for managing transport demand in urban areas generate significant GHG emissions in major cities, in particular due to congestion and insufficient public transport. The insufficient development of cycling infrastructure is one of the causes of the very low use of cycling infrastructure in urban areas.
- Energy intensity in the transport sector can also be considerably reduced by the development of rail transport. However, it remains poorly developed and in little demand from individuals and businesses due to lack of necessary investments and outdated infrastructure. In the context of the COVID-19 pandemic and in the absence of investments in rolling stock modernization, railroad passenger traffic has decreased considerably in the last two years.

9.1.3. Buildings Sector

Despite provisions included in Article 7 of the Law on Energy Efficiency[490], the long-term sectorial strategy for renovation of the national housing fund (for residential and public buildings) has not been developed and approved so far. The legal and regulatory framework for the residential sector is being developed. This prevents the promotion of energy efficiency measures in the buildings sector and does not allow attraction of financial resources needed to use the national energy efficiency potential. Therefore, actions associated with GHG emissions reduction in this sector are carried out sporadically and are left almost entirely to the discretion of the residential sector tenants.

The allocation of financial resources to the public sector is insufficient, and local public authorities often lack the necessary human and administrative capacities to attract financial means in the form of preferential loans granted by development partners.

Most of the old-style residential buildings (built before 2000) with the district heating system are not equipped with individual thermal points, heat meters at each apartment and horizontal heat distribution system. The outdated heating systems with vertical distribution do not allow the regulation of heat consumption, and the Municipal Housing Fund Management Companies do not have sufficient financial and technical means to ensure proper maintenance of these systems. Some buildings are in advanced state of damage and require urgent major renovations and significant financial means.

Given the circumstances described above, the tenants in these buildings do not have specific interest for the insulation of the exterior walls, especially when these works are carried out on a small number of apartments in one building. In these cases, the

[489] National Bureau of Statistics, Table Vehicles registered in the Republic of Moldova, at the end of the year, by types of vehicles, 2004-2020.

[490] Law no. 139 of 19.07.2018 on energy efficiency, Official Gazette no. 309-320/476 of 17.08.2018.

thermal energy consumed is accounted for the entire building, and practically no essential financial savings are achieved for the thermal energy consumption in the apartments where the wall has been insulated. These circumstances motivate some tenants to make use of more advantageous possibilities to provide heating during the cold period of the year, and this causes effects of hydraulic disruption of the building heating system and reduce the building heating system efficiency.

The high level of endemic poverty and lack of state subsidies prevent a significant proportion of tenants from having the financial resources to improve energy efficiency of buildings. Growth of the heating tariffs since the end of 2021 makes it difficult for some households to pay the tariff and reduces practically to zero their capacity to allocate financial resources to improve energy efficiency of their home.

The merger of the Energy Efficiency Fund with the Energy Efficiency Agency in 2019 created a temporary legal vacuum situation as a result of the modification of the estimation methodologies and the establishment of the minimum performance requirements for buildings renovation. Shortage of qualified specialists in conditions of new standards has created impediments for new projects development and implementation. The increase in minimum performance requirements for major rehabilitation of buildings has led to a significant increase in the necessary investments. All these barriers have recently led to a considerable decrease in the number of buildings rehabilitation projects and use of RES in this field.

The negative effects of the above mentioned aspects on energy consumption and GHG emissions reduction in the building sector are also amplified by a number of specific factors, among which the most important being: the ageing and the advanced technical wear and tear of the heat production and distribution equipment, lack of interest shown by the young energy specialists in the sector of energy performance of buildings, massive emigration of the workforce (including technicians and skilled professionals), operation of the equipment under partial load regime, increase in the last years of the frequency and duration of the drought periods that cause reduced interest for the use of biomass for energy purposes.

9.1.4. Industrial Sector

Over the past decades the industrial sector of the RoM has been facing a number of structural, operational and financial macro-stability problems, resulting in several barriers to the introduction and widespread use of efficient modern technologies that contribute to the greenhouse gas emissions reduction.

The generally unfavorable business environment does not stimulate the transfer of the necessary technologies. Given the shortage of specialists prepared to work in modern economy and the continuous emigration of economy professionals, the enterprises are unable to identify the human, technical and financial resources necessary for the efficient implementation of new technologies and measures to increase energy efficiency of the industrial processes. Shortage of engineers and qualified technical staff is constantly increasing and the discrepancy between the training of technical staff and the needs of modern industry is also deepened by lack of interest for introduction of energy-efficient technologies. Industrial parks in the RoM are still at an early stage of development and energy efficiency in industrial sector is being promoted at an insufficient level due to the lack of technical expertise, resources and programs to increase the industrial potential following the improvement of energy efficiency. The widespread use of obsolete GOST-type standards does not allow diversification of industrial products range and contributes to maintaining the high level of GHG emissions. The instability of national legislation in the fiscal and budgetary policy is another barrier to low-carbon development in the industrial sector: in this context, it is necessary to amend the legislative framework in order to maximize implementation of new technologies in industrial enterprises in the RoM.

There are no Energy Service Companies (ESCO) in the RoM which would also take on the role of assisting small and medium-sized enterprises in identifying solutions to improve energy efficiency. The prices of some food products considered to be 'social products' are regulated by the State, which leads to the capping of the concerned producer's income and to limited possibilities to invest in processes modernization. To date, the RoM does not have a system to ensure the traceability of animal products, which makes it impossible to export animal products to the European Union.

Several large companies in the industrial sector have faced the problem of settling the "historic debts", which had been accumulated especially in the early years of the transition to market economy. Thus, several glass, brick, sugar, etc. factories are involved in long-lasting legal disputes, which have negative consequences on their industrial upgrading. In general, lack of available liquidity limits the possibilities of the industrial sector to carry out an audit of energy performance of industrial processes. Most of the industrial enterprises in the RoM have machinery and equipment with a high degree of moral and physical wear, and the state has limited possibilities to financially support the restructuring and retooling process. Lack of funds for the implementation of industrial energy efficiency projects, promotion of good practices to support, raise awareness and promote energy efficiency in industry is one of the chronic barriers of the sector. Access to loans granted by domestic and foreign banks for purchase of energy-efficient equipment is limited by high interest rates and in recent years the support provided in this area by external development partners has been considerably reduced. The chronic instability of the national currency against the euro or the US dollar and the financial shocks caused by the *"theft of the billion from the banking system"* since 2015 have contributed to the increase of the country's risk and increased the reluctance of foreign investors.

There is currently no specifically approved legislation in the RoM regulating the use of fluorinated greenhouse gases in industry. Given this state of affairs, in 2020, the EU4Climate project proposed a way that could help overcome this situation. During 2022, the Law on fluorinated greenhouse gases was developed and is to be approved and a number of normative acts are to be amended to effectively transpose the Regulation (EU) No 517/2014 of the European Parliament and of the Council of 16 April 2014 on fluorinated greenhouse gases and repealing the Regulation (EC) No842/2006[491].

[491] Energy Community. EU4Climate. Development of a Roadmap for EU4Climate support outlining priority actions for the Republic of Moldova. <https://eu4climate.eu/download/development-of-a-roadmap-for-eu4cli-

9.1.5. Agricultural Sector

Although it is an activity in which traditionally a significant proportion of population is involved, agriculture in the RoM is currently at a stage of underdevelopment, being subject to permanent vulnerabilities and risks especially related to climatic factors such as droughts, frosts, floods, hail, soil erosion, landslides, etc. In these conditions, productivity in the agricultural sector is at very low levels, which requires the use of larger areas to ensure the food security of the country. Reducing dependence on such natural phenomena is a major challenge for the sector.

Despite the fact that the agricultural sector is regulated by a multitude of strategies, programmes, activity plans, lack of coherence of these legal and normative acts is evident, which is reflected in the fragmentation of duties and responsibilities in the field of use of agricultural land and in the absence of an integrated agricultural management system in general. Lack of an integrated and comprehensive approach to resource efficiency also concerns the renewable energy potential in the agricultural sector (in particular agricultural waste and manure). The value chain of agricultural products with high added value is underused, and this aspect places the agriculture of the RoM in the category of underdeveloped, subsistence agriculture, characterized by a low presence and competitiveness on the world markets. In the last three decades, a number of agricultural sectors have faced continuous degradation, some (for example, the livestock sector) are now almost non-existent, or present in a significantly lower form and volume compared to the early 1990s. The inability to modernize the sectors concerned and to adapt them effectively to the market economy has turned into their *de facto* disappearance from the landscape of the national economy.

The main barriers to low-carbon development of the agricultural sector are related to the following:

- Budget allocations and direct investments, in particular for the renovation of assets and inventory base, are practically non-existent and this results in obsolete, energy inefficient infrastructure and agricultural machinery which generates significant GHG emissions;
- Excessive fragmentation of agricultural lands, which contributes to lower agricultural yields due to failure to comply with the soil tillage technologies and ensure anti-erosion protection of agricultural lands. Therefore, every year, advanced soil degradation causes significant financial damage and leads to the need to use larger areas to grow agricultural production;
- Insufficient and unbalanced fertilization of agricultural crops with chemical fertilizers (in the period 2015-2020 this indicator varied between 46-94 kg/ha active substance, of which 67-74% – chemical fertilizers with nitrogen), the gradual drying up of phosphorus and potassium reserves in the soil with a negative effect on the amount and quality of agricultural output;
- Insufficient use of organic fertilizers on arable land, which reduces the efficiency of chemical fertilizers and forms a deeply negative balance of humus and carbon in the soil, destructuring, strong compaction of the arable layer and increasing the risk of pedological drought with serious consequences for the quality and production capacity of agricultural soils;
- The widespread practice of subsistence agriculture in individual households where extensive production technologies predominate, without complying with environmental hygiene and protection rules, leading to soil and water pollution due to hazardous storage of manure and air with unaccounted emissions of GHGs;
- Insufficient development of the insurance market in agriculture, which make it impossible for the majority of farmers to recover losses and perpetuates an underdeveloped agricultural system, characterized by permanent shortage of investments for sector modernization;
- Insufficient development of conservative agriculture based on *'no-till'* and *'mini-till'* technologies with subsoil tillage and maintaining positive balance of humus, nitrogen and carbon in the soil through the systemic use of green fertilizers. During 2013-2020, new *'no-till* 'and *'mini-till'* technologies were used on only about 2.3-6.0% of the arable area[492];
- Inefficient statistical system for crops and livestock and poultry accounting, leading to erroneous estimates of real GHG emissions;
- Organic farming has not been sufficiently developed, so currently only 1.1% of agricultural land is occupied by the sector[493] with enormous potential for added economic value and GHG emission reductions;
- Lack of investments and reduced capacity to purchase breeding animals and state-of-the-art equipment essentially reduce the profitability of the animal breeding sector, which leads to the perpetuation of the vicious circle: "*underdevelopment – low incomes – inability to modernize*".

9.1.6. Forestry Sector

The main barriers and constraints with reference to the forestry sector in the RoM, which have a direct negative impact on its GHG removal capacities, can be classified into three categories: institutional (including legal aspects), financial and environmental.

The existing forest fund suffers as a result of its mismanagement at various levels, which is manifested in particular by the lack of coordination and collaboration between regulatory, research and management institutions in the forestry sector and institutions specific to related economic sectors. The development of the first National Forest Inventory was launched a late as in 2019 within the FAO project[494], and now this process is not yet completed and the collection of data on the amount, distribution, composition and general condition of forests does not meet the international standards. The related problem of excessive fragmentation of agricultural land into small properties hampers the consolidation and implementation

mate-support-outlining-priority-actions-for-the-republic-of-moldova/>

[492] Implementation Reports on the National Strategy for Agricultural and Rural Development for 2014-2020 of the Ministry of Agriculture, Regional Development and Environment (2020).

[493] UNDP Moldova, *"Closer to Consumers: Organic Agriculture Atlas of the Republic of Moldova"*, 15.09.2020. Available at: <https://www.md.undp.org/content/moldova/en/home/presscenter/pressreleases/2020/mai-a aproape-de-consumatori--a-fost-lansat-atlasul-agriculturii-e.html>

[494] Glasul.md The *Republic of Moldova is moving towards an improved system of planning and monitoring of forest resources*. Date: 11.06.2019. Available at: <https://glasul.info/2019/06/11/republica-moldova-se-orienteaza-spre-un-sistem-imbunatatit-de-planificare-si-monitorizare-a-resurselor-forestiere/?nonamp=1>

of measures to extend forest areas. The rhythms of extending the forest areas on account of degraded land withdrawn from agriculture are very slow, despite the existence of a relatively viable mechanism for allocation of land for these activities. The main difficulty persists in failure to monitor and sanction the non-fulfilment of this mechanism by the responsible actors.

Local public authorities, which manage forested areas, do not have specialized personnel in guarding these lands, and in many respects the forestry legislation is improperly applied at local level. Most of the forests owned by local authorities are in a state of continuous degradation, fragmentation, destruction and hazardous management, the planning required by the forestry regime is not implemented. Insufficient collaboration at institutional level, complexity of the legislative and regulatory framework and inadequate application of legislation are important barriers to the development of public policies and achieving synergy in the forestry sector.

State bodies responsible for the implementation of forest legislation, the control and protection of forested areas and sanctioning of illicit activities are in a situation of chronic shortage of specialized staff and periodically face problems of integrity of their own employees. Despite the adoption of several legislative and regulatory acts in the field of forestry, aimed specifically at preventing and combating illegal logging, recent studies show that the total volume of timber from unidentified sources is approximately equal to the legally harvested amount of timber. The situation is aggravated by the endemic state of poverty among population, which result, especially in rural areas, in illicit felling of trees for provision of firewood. Illegal logging of forests is also stimulated by possession by local companies of important wood processing capacities, and by the fact that the supply of legally harvested timber does not correspond to the quantity and quality parameters of demand on the domestic market. At the same time, public awareness on the mitigation and adaptation of the forestry sector to climate change is low, particularly at community and individual level.

On the financial level, the forestry sector faces the problem of insufficient allocations from the state budget, lack of investments from the private sector and practically non-existent financing at local level, which limits the ability to ensure efficient forest management and to expand the forested areas. The very low wages of forestry workers hinder the access of skilled and competent professionals and technical workers and encourage corruption. The practice of illegal logging is also motivated by the operation of an incorrectly applied and disproportionate payment system, which considerably reduces the attractiveness of legally harvested timber.

The insufficiently developed institutional framework for protected natural areas lack of financial resources to ensure their sustainable management lead to the stagnation of their total development (the natural areas protected by the state occupy only 5.5% of the country's territory). The same barriers prevent the expansion of areas covered with forests, which currently occupy only 11.1% of the country's territory. In general, the extent of ecological regeneration and reconstruction works, as well as the techniques used to improve the composition of stands and to restore fundamental phytocenoses, do not correspond to the existing needs. A large part of the natural forest stands is regenerated from sprouts, which have a low capacity for regeneration and adaptation to climate change. At the same time, the state of some rare and endangered ecosystems (beetles, fluffy oaks, petrophyte formations, etc.) is constantly degrading. The quality value of forest stands is gradually decreasing and forest biodiversity is continuously eroding. There are no substantiated studies on the genetic variability of the edifying species of valuable forest habitats and the endowment with modern technologies, equipment and techniques is insufficient.

The surface of the multiannual plantations participating in GHG emissions removals decreased by about 24% between 1990[495] and 2020, and the process of creating areas with new vineyards and orchards is unfolding al a slow pace, with little chance of recovering the quantitative indices certified in 1990. There is currently no clear picture of the state of grassland degradation at national, regional or local level. The share of abandoned, underloaded or overloaded grassland areas, the share of grasslands affected by scrubland, weeds or other restrictive factors is unknown. This makes it quite difficult to assess the need to undertake measures to improve and rebuild the environment and to use grassland in the context of sustainable development and the investment needed for this purpose. The practices of converting different categories of degraded lands into grassland, including as the main GHG removal factor, are decreasing, being practically overlooked by local and regional authorities.

9.1.7. Waste Sector

Despite the relatively recent improvement of the legal framework by adoption of the Law on Waste no. 209 of 29.07.2016 and the subsequent regulatory framework, the respective field is currently underdeveloped due to absence of comprehensive infrastructure for planning, organizing and implementing an integrated waste management system. The regulatory and technical regulations on disposal of different types of waste do not correspond to the non-existent framework and to the requirements of transposing the relevant EU legislation. In 2019-2020, the Environmental Agency became operational, providing the institutional framework for the implementation of the law and the regulation of waste management activities. However, the waste management system is inefficient, has a fragmented territorial coverage and does not use the GHG reduction potential that would have resulted from the widespread use of recycling and energy recovery processes.

Services specialized in waste collection and disposal exist in all municipalities and in district centers, but currently only 60–90% of municipal solid waste generators in urban areas are covered. In rural areas, the situation is really dramatic, only 10–20% of the waste generators being included in specialized systems of this kind. In most rural localities, waste collection, transportation and disposal infrastructure are totally lacking or operates with major deficiencies due to insufficient funding at the level of local public authorities. The amount and the methodology for calculating the waste collection and disposal

[495] NBS, *Multiannual plantations by crops, Years, Categories of households and Indicators*. <https://statbank.statistica.md/PxWeb/pxweb/en/40% %20e20Statisticaconomica/40%%20e 20Statistica conomica__16%20 AGR__AGR020/AGR020200.px/table/tableViewLayout1/?rxid=b2ff27d7-0b96-43c9-934b-42e1a2a9a774>

tariffs are not set by law, which prevents the operation of a cost-effective system. At the same time, most often the tariffs applied by operators are not differentiated according to the category of collected waste, which reduces the motivation of waste generators to separate waste at source. The awareness on the waste problem among population and businesses is at a very low level, which does not contribute to involvement of general public in solving it. Therefore, the vast majority of rural settlements and some cities use unauthorized and undeveloped dumpsites which cause considerable damage to the environment and lead to degradation of public health of the population.

The low implementation capacities of local waste management projects do not allow for attraction of available funding from development partners, in particular the EIB and the EBRD. Lack of alternative financial resources (offered by the state or in the form of investments from the private sector) does not allow construction of plants for mechanical and biological treatment of municipal solid waste. Institutional malfunctions at all stages of the waste disposal chain are a hindrance to private capital access: in recent years, a number of businesses have gone bankrupt and ceased their activity in this sector.

The implementation of integrated waste management infrastructure development projects is hampered by technical problems at local level, in particular regarding the identification and selection of land for construction of regional landfills and transfer stations. Consequently, the preparation of feasibility studies at the early stage of implementation is also delayed.

Existing barriers in the sector can also be classified by specific waste categories:

- Hazardous waste management is not progressing due to the lack of funding for the establishment of the Hazardous Waste Management Centre. Currently, they are stored in the same way as municipal waste, which represents a high risk for the environment, but also for public health and the safety of the population.
- The access of the population of the RoM to drinking water and sewerage services has not made any notable progress in the last 20 years. Despite the harmonization of relevant national legislation with the EU directives and regulations, there are a number of deficiencies at the implementation stage, caused in particular by clear failure to define the roles and responsibilities of each actor involved in waste and wastewater management. Due to the massive emigration of the population from rural areas and often exaggerated tariffs, the amount of consumed running water is lower than the technical norms and does not ensure an efficient functioning of the water supply and sewerage systems. Most water treatment plants are in an advanced state of technical wear, the modern treatment plants sludge formed after wastewater treatment are insufficient. At the same time, the problem of shortage of specialists in this sector, and a poorly developed technical and regulatory and standards framework, remains.
- Biodegradable waste management is particularly confronted with lack of funding which is particularly acute given the need to carry out advanced and costly technology transfer and to ensure specific operational capacities. Also, the poorly developed infrastructure for collecting and composting organic fractions of municipal solid waste discourages households from adopting waste separation practices at source.
- Infrastructure to manage other categories of waste, such as construction and demolition waste, manure, street waste, technical oils, tyres, etc. is almost completely absent.

9.2. Capacity Building Needs for Climate Change Mitigation

The ability to mitigate climate change should be understood as the ability of individuals, groups representing them, organizations and institutions to identify, plan and implement ways of mitigating and adapting to climate change, as part of a series of efforts to achieve sustainable development[496.]

The climate change mitigation capacity needs are relevant and required to be available in four dimensions:

- carrying out climate studies, research and evaluations;
- formulation of climate strategies and actions;
- implementation of climate strategies and actions;
- negotiating climate issues at international level, mainly in order to attract funds[497].

9.2.1. Capacity to Carry Out Climate Studies, Research and Assessments

The RoM has a wide network of research institutions in various fields, but no specialized structures for carrying out studies related to GHG emissions mitigation. This is justified by the fact that the country is currently not distinguished by sectors with high GHG emissions and the existing legal framework does not prioritize mitigation of emissions. At the same time, these institutions continue to have research structures as well as qualified personnel in areas related to climate change, which allows to carry out studies on climate change, including for development of NCs, BURs and NIRs to UNFCCC.

Regardless of the institution in which it is carried out, climate studies and research require complex modelling programmes. In addition to the programmes themselves, highly qualified specialists are required to carry out simulations and evaluations with these modelling programmes in different sectors. The ability to provide these programs and qualified personnel to operate them has been decreasing over the past few years. In 2000, the Institute of Power Engineering (IPE) received the right to use the ENPEP (Energy and Power Evaluation Program) model pack, mainly WASP and IMPACT modelling programs being used. Due to the very low salary level, the specialists who were trained and used these programs successfully left the institution, thus depriving the IPE of the ability to carry out simulation modelling and studies on the development of electricity sources in the country. The same happened with the MARCAL computer program. The use of other tools, such as MAED (Model for Analysis of Energy Demand), LEAP, TIMES, etc., faces impediments of a different order: the required input data

[496] OECD: *Donor assistance to capacity development in environment*, OECD, Paris, 1995.
[497] Sagar, A. Capacity development for the environment: A view from the south, a view from the north, in: Annual Review of Energy and Environment 25, 2000, pages 377–439.

from sufficiently credible sources is not available, and the independent preparation of information by experts requires important time and financial resources. At present, the national statistical system cannot meet the requirements for studies to assess energy efficiency reserves and to develop energy demands following a bottom-up approach.

Restructuring the statistical system of the country to comply with the one in the EU is in progress, so in the future official statistics will meet the requirements for carrying out studies and qualitative research on GHG emissions mitigation.

9.2.2. Capacity to Formulate Climate Strategies and Actions

The national climate change governance framework is based on a series of strategies and public policy documents that refer to GHG emissions mitigation and climate change adaptation measures. Apart from those documents, there is also a series of sector strategies that tangentially refer to combating climate change effects.

The basic document formulating public policies in GHG emissions mitigation is the Low Emission Development Strategy until 2030 and the Action Plan for its implementation, approved by the GD 1470/2016[498]. This document was developed by a group of international consultants who worked with the financial support provided by the Regional Bureau for Europe and the Community of Independent States of the UNDP and UNDP Moldova. Subsequently, numerous national consultants were involved in this process, who contributed with important changes to the document and also improved their capacities to develop such normative acts.

After the update of the NDC in 2020, the need for updating the LEDS arise. The updating of the LEDS, based on which the draft Low Emission Development Program until 2030 (LEDP 2030) and the Action Plan for its implementation were subsequently developed, was carried out by a group of national consultants and experts. The activity was carried out within the EU4Climate project implemented by UNDP Moldova. The draft version of the 2030 LEDP was presented to the Ministry of Environment (before August 2021: Ministry of Agriculture, Regional Development and Environment), which launched public consultations with stakeholders in April 2021. In 2022 it was carried out the strategic environmental assessment of the LEDP 2030, and starting with the 4th quarter of the 2022, it is planned to start promoting the document to the Government. Adoption by a GD will suffice for its implementation from 2023.

Most of the public policy and strategy documents in the areas related to climate were developed with the donors financial and logistical support. The most relevant of the documents in this category are the Energy Strategies of the RoM: the one adopted in 2000 with the timeline until 2010[499], the one from 2007 with the timeline until 2020[500], the one from 2013 with the timeline until 2030[501]; the latter being largely developed by a group of external consultants, with the financial support of the EU. The objectives outlined in these strategies for 2020, with few exceptions, have not been met, and this is primarily explained by the inability of the RoM to absorb in a relatively short time investments of approximately 2 billion US dollars, disproportionate to the internal socio-economic realities of the country.

Such a state of affairs can also be ascertained for other sectoral strategies. Most of the times, the actions included in the most important public policy documents are not fulfilled and they look like declarations of good intentions, they are not actually implemented. This is particularly true in absence of adequate substantiation of the objectives enshrined in strategies and action plans. Preliminary studies on how to achieve the objectives, the realistic sources of funding and the social, technical, legal and economic conditions for achieving them are almost completely missing. Moreover, the effects of accomplished objectives are often not stated explicitly, neither is a risk assessment carried out, nor are the means of overcoming potential impediments formulated.

An important barrier to the formulation of climate strategies and policies is the difficult provision of substantiation studies with viable simulations results, carried out using modern software. The shortage of specialists trained to use these programmes effectively is aggravated by the chronic lack of state funding to maintain the developed skills. Under these circumstances, external assistance is practically the only source of providing initial training to specialists. A conclusive example in this regard is the implementation of the TIMES calculation program, which was carried out within the STARS Project (Support for the Modernization of the Energy Sector in the RoM), funded by the EU and welcomed by energy specialists. Despite the fact that during 2019-2020 five training workshops were organized, where several specialists were trained, the license to use the TIMES program was not issued, nor was the funding of the trained teams ensured. This example illustrates a way in which resources allocated by development partners are not used in a sustainable way and do not serve to development of public policies and climate policy documents.

9.2.3. Capacity to Implement Climate Strategies and Policies

As mentioned above, in 2021 the LEDP 2030 was developed and proposed for public consultation. At mid-2022 this document was at the stage of Strategic Environmental Assessment (SEA), which will was carried out by the 3rd quarter of 2022 year. The approval of the LEDP 2030 by GD is planned earlier in 2023 year. The document outlines the policies and actions for achieving the new GHG reduction targets set out in the updated NDC (2020). The 2030 LEDP contains sectoral policies and actions to mitigate direct GHG emissions, the vast majority of which are contained in other policy documents. Many of those objectives are aimed at achieving objectives considered to be priorities for the key sectors of the national economy. Most of the actions mentioned correspond to those developed in the BUR2 of the

[498] GD no. 1470 of December 30, 2016 "On the Approval of Low Emission Development Strategy until 2030 and the Action Plan for its implementation". Official Gazette no. 85-91/1470 of 24.03.2017.
[499] Government Decision no. 360 of April 11, 2000 "On the Approval of the Energy Strategy of the Republic of Moldova until 2010". Official Gazette no. 42-44.
[500] Government Decision no. 958 of 21.08.2007 on the Energy Strategy of the Republic of Moldova until 2020. Official Gazette no. 141-145/1012 of 07.09.2007.
[501] Energy Strategy of the Republic of Moldova until 2030. Government Decision no. 102 of 05.02.2013. Official Gazette no. 27-30/146 of 08.02.2013.

RoM to UNFCCC (2019), which was the basis for identifying the emission mitigation targets set out in the updated NDC.

The RoM aims to achieve the objectives included in the 2030 LEDP through the development and implementation of nationally appropriate mitigation actions (NAMAs). Implementation of these actions requires the involvement of the strongest national institutions, their effective management, as well as adequate assistance from the international community. The institutional arrangements for the implementation of the Programme shall meet the objectives set out in three main areas:

1) national planning and mainstreaming of low-emission development priorities into the national regulatory framework and strategic development priorities;
2) attracting investments, as well as the efficient management of public and donor finances, of the environmentally friendly technologies transferred in support of LEDP 2030 implementation;
3) monitoring and controlling the implementation of the planned low-emission economic development actions of the Strategy.

The country's capacity to cope with the tasks relevant these areas is already seen in the following actions:

For Area 1:

- The LEDP 2030 complies with the objectives of the draft NDS "Moldova 2030"[502], which is currently being debated and approved by the Parliament. The document pays particular attention to climate change issues (pp. 19, 117). According to this, a higher quality of life requires sustainable and broad social progress in 10 dimensions, including the quality of the environment. The NDS "Moldova 2030" emphasizes that: *Climate change affects all areas of development of a state. Most sectors are vulnerable to climate change and are affected by extreme phenomena present in the country. In this context, climate change adaptation and GHG emissions reduction measures should be promoted*;
- GD no. 444/2020 of 01.07.2020 regarding the establishment of the mechanism for coordinating activities in the field of climate change, the National Committee on Climate Change[503] was established, which provides the institutional framework for monitoring, reporting and verification coordination, and facilitating the streamlining climate change aspects in national and sectoral programs and plans. Annex no. 4 to the GD no. 444/2020 establishes the mechanism for coordinating the NAMAs. This mechanism was developed to establish the normative and institutional framework for the development, evaluation, approval, monitoring, reporting and verification of nationally appropriate mitigation actions. It aims to establish the responsibilities and framework for preparation, evaluation and approval of projects for the implementation of such actions.
- Several pieces of legislation are currently being developed and implemented to support GHG emissions mitigation actions, as outlined for each sector in Chapter 3.

For Area 2:

- The RoM relies heavily on attracting investments to mitigate GHG emissions through NAMA registered on the UNFCCC NAMA Registry platform. In order to be more attractive to potential financiers, five out of twelve NAMAs registered on the UNFCCC platform (Tab. 9-1) were developed in a pre-feasibility study format. Also, with the support of the GCF, during the years 2018-2019 the RoM's Country Program for engaging with the Green Climate Fund 2019-2024, was developed[504]. However, the mechanism for getting investments from the GCF proved to be quite difficult, the experience demonstrating that the financing approval phase lasts at least 2 years, which discourages potential beneficiaries. In addition, the GCF does not finance mitigation projects related to agriculture and waste sectors. At the same time, there have been initiatives aimed at accrediting companies by GCF, including, for example, Mobiasbanca – OTP Group. Regarding the promotion of concrete GHG emissions mitigation projects, to which the Republic of Moldova is a part: Green Cities Program [505] and the GCF-BERD Sustainable Energy Financing Facility[11], both projects receiving co-financing from the GCF and EBRD.
- There are several internal funds in the RoM that have appropriate management experience and allow financing of climate change actions:
  - *National Ecological Fund (NEF)[506]:* In the RoM, access to financing from national funds is possible through a two-tier system of ecological funds, which includes the *NEF* and *36 local ecological funds*. FEN reports directly to the MoE. The general mandate of the FEN provides for offering grants to support environmental protection and research projects, and to support operation of environmental NGOs;
  - *National Fund for Regional Development (NFRD)[507]:* FNDR became operational in 2011 and has a budget of 150-200 million lei annually (equivalent to 9-12 million USD). Currently, FNDR is the largest internal source of funding for regional development projects. The fund is managed by the Ministry of Infrastructure and Regional Development, and since 2013 it is also involved in the implementation of energy efficiency projects. In December 2021, the Government approved the creation of *the National Fund for Regional and Local Development (NFRLD)*[508], which will operate under the FNDR. For 2022, this fund will allocate 800

[502] Government Decision no. 377 of 10.06.2020 on approval of the draft law for the approval of the National Development Strategy "Moldova 2030". Official Gazette no. 153-158/508 of 26.06.2020.
[503] Government Decision no. 444 of 01.07.2020 on establishing the mechanism for coordinating climate change related activities. Official Gazette no. 188-192/635 of July 24, 2020.

[504] Clima.md, *Country Programme of Engagement of the Republic of Moldova with the Green Climate Fund*. M., available at: <http://portal.clima.md/libview.php?l=en&idc=45&id=569&t=/Media/News/Program-de-ara-de-employare-a-Republicii-Moldova-cu-Fondul-Verde-pentru-Clima/>
[505] Green Climate Fund, *Republic of Moldova*. Available at: <https://www.greenclimate.fund/countries/moldova>
[506] Ministry of Environment of the Republic of Moldova, *National Ecological Fund*. Available at: <https://www.mediu.gov.md/ro/content/fondul-ecologic-na%C8%9Bional>
[507] Serviciilocale.md, *National Fund for Regional Development*. Available at: <http://www.serviciilocale.md/pageview.php?l=en&idc=94&id=150&t =/Cadrul-legal-si-institutional/Dezvoltare-regionalala/Fondul-National-pentru-Dezvoltare-Regional/>
[508] Ministry of Infrastructure and Regional Development, *Regional and local development projects will be financed from the National Fund for Regional and Local Development*. Available at: <https://midr.gov.md/noutati/proiectele-de-dezvoltare-regionala-si-locala-vor-fi-finantate-din-fondul-national-pentru-dezvoltare-regionala-si-locala>

million lei, of which about 300 million lei will be designated for implementation of regional development projects, for the following activities: creating jobs in the development regions, urban development, especially in the district centers and improving the water supply infrastructure, sewage systems, etc.; and 500 million lei will be designated for local development projects, for the following types of projects: construction and renovation of social infrastructure – schools, kindergartens, culture houses, playgrounds for children, etc., improvement of the water supply infrastructure, sewerage, wastewater treatment plants, etc., and co-financing of projects implemented with external financing. At the beginning of 2022, the Government will draft the implementation regulation at FNDRL, then the calls for projects will be announced to the Local Public Administrations.

– *The Energy Efficiency Agency*[509], which in 2019 was merged with the Energy Efficiency Fund[510]. The EEA is subordinated to the Ministry of Infrastructure and Regional Development (MoIRD), which has the mission to implement the state policy in the field of energy efficiency, the energy performance of buildings, as well as renewable energy sources, including by attracting and managing funds to finance projects in those areas in a sustainable manner from the point of view of the environment and climate change. In recent years, the financial resources available through the Investment Inter-Fund have been severely limited.

For Area 3:

- The national system for monitoring, reporting and verifying the implementation progress of the LEDS 2030 and NAMA-type actions in the RoM is regulated by the GD no. 1277/2018 on the establishment and functioning of the national system for monitoring and reporting GHG emissions and other climate change relevant information,[511] as well as by the GD no. 444/2020 on the establishment of the climate change activities coordinating mechanism[512];
- The technical aspects regarding the implementation of potential donor supported and creditable actions in energy, industrial, buildings and transport sectors are attributed to EEA; the mitigation aspects in the agricultural sector – to the MoE; the mitigation aspects in the forestry sector – to “Moldsilva” Agency of the MoE; and those related to waste and industrial sectors (including the refrigeration and conditioning sector) – to the PI “EPIU” of the MoE;
- National GHG emissions, as well as their evolution trends are periodically reported in the national communications and biennial update reports of the RoM to the UNFCCC, respectively in the national inventory reports. The NBS also publishes the level of GHG emissions actually recorded by the RoM.

[509] Energy Efficiency Agency website. Available at: <https://www.aee.md/ro/page/misiunea>
[510] Government Decision no. 45 of 30.01.2019 on the organization and functioning of the Energy Efficiency Agency. Official Gazette no. 38-47/71 of 08.02.2019.
[511] Government Decision no. 1277 of 26-12-2018 on the establishment and operation of the National system for monitoring and reporting greenhouse gas emissions and other information relevant to climate change Official Gazette no. 38-47/67 of 08.02.2019.
[512] Government Decision no. 444 of 01.07.2020, regarding the establishment of the mechanism for coordinating activities in the field of climate change. Official Gazette no. 188-192/635 of July 24, 2020.

Table 9-1: Characteristics of NAMA-type actions of the RoM registered in the NAMA Register of the UNFCCC

No.	NAMA	Emission reduction, kt CO_2/year by 2030	Needed investment, US $ mil.	Specific investment, $US/t CO_2
1	Promotion of wind sources in the RM	609	640	53
2	Promotion of low-capacity TECs in the RM	41	23	23
3	Promotion of heat pumps in the RM	148	180	108
4	Use of solar energy for production of domestic hot water in the RM	116	606.3	758
5	Use of energy willow for production of thermal energy in the RM	250	89	15
6	Waste to energy promotion in the RM	109	15	4
7	Hybrid and electric buses and minibuses in Chisinau municipality	17	344.3	2006
8	Promotion of energy efficient lighting in the RM	327	236.3	52
9	Substitution of clinker in cement production	301	100	92
10	Implementation of cattle feeding technologies through the use of dried grape marc in beef rations	69	4	4
11	Implementation of soil conservation tillage system	323	184	38
12	Afforestation of degraded lands, riparian areas and protective curtains in the RM	284	144	10
	TOTAL	**2595**	**2567**	

9.2.4. Capacity to Negotiate Climate Issues at International Level

According to the updated NDC (2020), the RoM contributes only 0.026% of global greenhouse gas emissions[513]. GHG emissions per capita in our country are about 50% lower than those recorded worldwide. Also, the RoM is responsible for a tiny proportion of historical emissions since 1990: 0.05% without LULUCF sector, or 0.04% with LULUCF sector.

The capacity of a country to contribute to the fight against climate change depends on the possibilities to invest means in the GHG mitigation actions implementation. Therefore, real GDP growth and the GDP value per capita are two basic indicators for the assessment of such capacity. However, in the period 1990 – 2016 the real GDP in relation to the reference USD (2010) decreased by 27.7% from 10.13 to 7.33 billion USD, and in the same period the GDP per capita decreased by 17.9% in relation to the reference USD (2010), from 2,323 USD to 1,906 USD. In this context, the possibilities to invest in the implementation of GHG emissions mitigation measures have been considerably reduced, the RoM being almost exclusively dependent on support from development partners. Thus, being a source country of a small proportion of GHG emissions from global emissions and relying mostly on external support to implement mitigation measures, our country has extremely limited negotiating capabilities in the context of international climate negotiations.

At the same time, the RoM is among the “exemplary students” in terms of GHG intensity decrease in the last three decades. This indicator, which is measured in the amount of GHG emissions relative to GDP, decreased from 4.43 to 1.99 kg of CO_2 per reference US dollar, or a decrease of 55.1% (excluding

[513] Updated NDC, 2020. <https://www4.unfcc.int/sites/ndcstaging/PublishedDocuments/Republic%20of%20Moldova%20First/MD_Updated_NDC_final_version_EN.pdf>

LULUCF), and from 4.28 to 1.86 kg of CO_2 per reference US dollar, or a decrease of 55.1% (with LULUCF). These values are among the best among the transition economies in the Central and Eastern Europe region and provide a realistic perspective on achieving the GHG reduction targets included in the updated NDC (2020).

9.3. Support Received and Financial Needs

9.3.1. Level of Support Received

Official Development Assistance

Official Development Assistance (ODA) consists of grants and credits for developing countries, granted for the purpose of macroeconomic consolidation (by the International Monetary Fund - IMF), concessional credits granted to the Government (especially by the International Development Agencies), grants for direct budgetary support and poverty reduction (granted by the European Union, the World Bank, etc.), technical assistance from a number of multinational organizations and bilateral donors, etc.

In order to formalize development assistance, the RoM has acceded to the Paris Declaration (2005), the Accra Agenda for Actions (2008), the Bussan Commitments (2011) and the Mexico Communiqué (2014).

In accordance with the GD no. 377 of 25 April 2018, the external financial assistance granted to the RoM includes financial support in the form of loans, grants, including supplies of goods and/or works for the implementation of external assistance projects and programs[514]. According to the same normative act, the Ministry of Finance was designated as the national authority for external assistance coordination. The institution is responsible for implementation of the external assistance coordination and management mechanism and acts as a single point of contact and control in relation to external development partners and public authorities on proposals for external assistance projects and programmes.

Detailed information about the official development assistance provided to the RoM can be accessed online from the for the Foreign Assistance Management Platform (AMP)[515], where, as of 31.01.2022, data for 2222 ongoing and completed projects was available. According to the data published on this Platform, the total value of official development assistance commitments for the RoM is 5142.35 million euro, of which the total value of disbursed funds is 3425.33 million euro[516].

According to data provided by foreign development partners, the value of foreign assistance disbursements to RoM amounted to about 692.6 million euro in 2020[517]. The total amount of external financial assistance disbursed in 2020 to the National Public Budget (NPB) is about 519.9 million euro according to the NPB implementation reports[518].

According to the Report "External Assistance to the RoM in 2019", the difference between the data provided by the AMP platform and by the donors is explained by the fact that some of the beneficiaries do not report and some of the implementers and/or donors do not share the information about the capitalized amounts. Some information is missing due to the fact that several projects are implemented directly and indirectly by donors, or due to technical deficiencies of the AMP platform[519].

According to the updated definition of the Organization for Economic Cooperation and Development (OECD), the Official Development Assistance (ODA) is defined as the total amount of financial assistance received to promote economic development and well-being by the governments of developing countries. Starting with 2018, the net value of ODA, accounting only for grants and the grant component of loans, is used for statistical comparison purposes[520]. The value indicated above, of EUR 312 million for the RoM in 2019, corresponds to the total volume of net ODA, reported by the OECD[521].

In order to better classify the role of external financial assistance in the national economy, it was compared with remittances[522] and foreign direct investments, respectively[523], which are also regarded as financial flows transferred from outside for real economic growth. The information regarding these indicators for 2020 is incomplete or missing, this aspect being explainable also due to the impact of the COVID-19 pandemic on the flow of remittances and capitalization of support provided by external donors.

It should be noted that in remittances indicated above, include only money transfers from abroad to individuals made "officially" via banks of the RoM. Transfers from outside the country made by other methods, including informal (unaccounted) means, are not covered by those calculations. Also, for the conversion of the numerical values from USD into EUR, one single coefficient was used for the entire period 2015 – 2019: 1.10 USD = 1 €.

As seen from Fig. 9-1, remittances continue to be about 2-3 times higher compared to external assistance during the period under review. It should also be noted that in 2012-2016 foreign direct investments were 2-4 times lower than foreign assistance disbursements during the year.

The official development assistance registered a relative decrease between 2016 and 2018 which was characterized by a series of economic, political and social involutions. Domestic political instability has had a number of adverse consequences, including a significant deterioration of the investment climate and a considerable decrease in external development partners and foreign investors' confidence. Thus, the volume of foreign direct investments decreased sharply, by 2.5 times, in 2016 compared to the previous year, and in 2017 remained by 30% lower than in 2015.

[514] Government Decision no. 377 of 25.04.2018, On regulation of the institutional framework and external assistance coordination and management mechanism. Official Gazette no. 133-141/419 of 27.04.2018. Amended by Government Decision no. 458 of 25.09.2019, published in the Official Gazette of the Republic of Moldova no. 296-301/657 of 27.09.2019.

[515] The External Assistance Management Platform (AMP) is a public portal managed by the External Assistance Directorate of the Ministry of Finance of the Republic of Moldova. The website of the Platform is available at: http://amp.gov.md/portal/

[516] Source: http://amp.gov.md/portal/ The indicated dates are valid on: 31.01.2022

[517] "External Assistance to the Republic of Moldova in 2020" report developed with the financial support of the European Union (beneficiary: Ministry of Finance of the Republic of Moldova). Available at: https://www.mf.gov.md/sites/default/files/Raport %20Asisten%C8%9B%C4%83%20Extern%C4%83%202020%20MD.pdf

[518] *Idem.*

[519] Report "External Assistance to the Republic of Moldova in 2019", prepared with the financial support provided by the European Union (beneficiary: Ministry of Finance of the Republic of Moldova). Available at: https://drive.gov.md/index.php/s/TFv9FBjrgEKdgys#pdfviewer

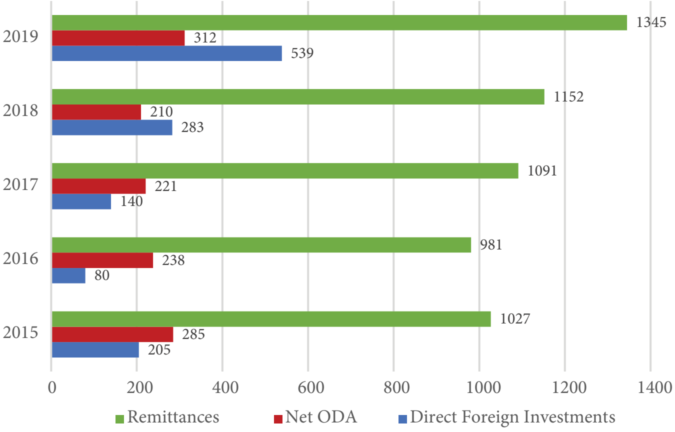
[520] The "OECD Data" portal, the "Net ODA" article. Available at: https://data.oecd.org/oda/net-oda.htm

[521] The 'OECD Data' portal, the 'Development finance data' article. Available at: https://www.oecd.org/dac/financing-sustainable-development/development-finance-data/

[522] National Bank of Moldova, Article "Evolution of money transfers from abroad to individuals through banks of the Republic of Moldova in 2020 (net settlements)" Available at: https://www.bnm.md/ro/content/evolutia-transferurilor-de-mijloace-banesti-din-strainatate-efectuate-favoarea-33

[523] A. Balan, "Investment climate and trends in the dynamics of foreign direct investments in the Republic of Moldova", *ECONOMICS*, no. 4 (114) 2020 pp. 45-64. The author of the article used the World Bank methodology for calculation of total Foreign Direct Investment. Article available at: https://irek.ase.md/xmlui/bitstream/handle/1234567890/1077/Balan_A_%20Economica% 20Nr.%204%202020.pdf?sequence=1&isAllowed=y

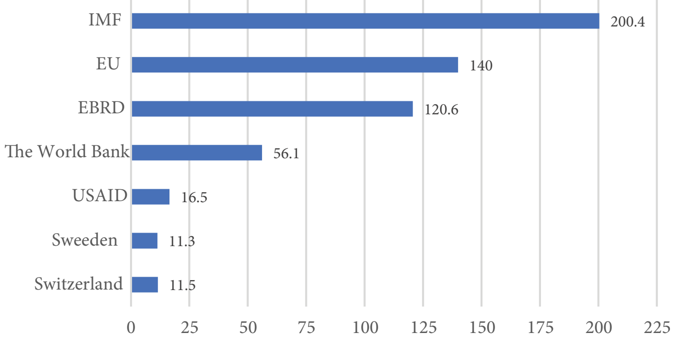
Between 2015 and 2019, the amount of "official" remittances (transferred through the banks of the RoM) was relatively stable (2015 – 2017) and showed a relatively significant increase in the next two years, 2018 and 2019. It is worth noting that the International Organization for Migration (IOM) and the World Bank forecast a significant decrease of remittances, by over 20%, in the next few years, following the massive return of migrants originating from the RoM to the country of origin during the COVID-19 pandemic[524].



Sources: *OECD, National Bank of Moldova and World Bank (via A. Balan, ECONOMIC no. 4 (114) 2020 pp. 45-64.*

Figure 9-1: Major financial flows for the Republic of Moldova, 2015-2019, million euro.

The most important donors (more than 10 million euro) by the amount of disbursements made in 2020 are: the International Monetary Fund (IMF), the European Union, the European Bank for Reconstruction and Development (EBRD), the World Bank, USAID, the Swiss Confederation Government and the Swedish Government[525]. The ODA disbursed in the RoM by these donors in 2020 is shown in Figure 9-2.



Source: *Ministry of Finance of the Republic of Moldova (Report "External Assistance to the Republic of Moldova in 2020", p. 12)*

Figure 9-2: Ranking of development partners by ODA disbursements in the RoM for 2020, million euro (donors who disbursed more than 10 million euros in 2020).

ODA disbursements in 2020 were distributed among the following sectors of the national economy: multi-sectoral - 34.3%, Sustainable Infrastructure - 31.9% and Good Governance - 12.7%[526].

According to the GD no. 377 as of 19 August 2015,[527] the Government gave priority to non-reimbursable technical and financial assistance. Thus, in case of loans, priority was given to the option with a grant component of at least 25% of the loan amount. The share of grants in the amount of disbursements, compared to the share of repayable loans for 2016 – 2020 is presented in Table 9-2[528].

Table 9-2: Share of grants and loans in ODA

	2016	2017	2018	2019	2020
Loan	77%	79%	84%	62%	94%
Grant	23%	21%	16 %	38%	6%

Source: *Ministry of Finance of the Republic of Moldova (Report "External Assistance to the Republic of Moldova in 2020", Table 1, p. 17).*

The average weight of credits during 2016-2020 was 79.2%, and of grants, respectively 20.8%. In general, there is an important fluctuation of the grant component in external assistance provided, which is also explained by the consequences of internal political instability[529].

Global Environment Facility

The Global Environment Facility (GEF), the operating entity of the UNFCCC financial mechanism, is a multilateral institution that plays a key role in the transfer of environmental technologies. GEF funds are made available to developing countries and countries with economies in transition to meet the objectives of international environmental agreements and conventions. The support provided by GEF can be accessed by government agencies and institutions, civil society organizations, private companies, research institutions and other potential partners, with the purpose of implementing projects and programs in the beneficiary countries. The GEF also aims to promote actions to reduce greenhouse gas emissions by reducing transfer barriers and new technologies implementation costs in the long term. An important objective of these programmes is to catalyze sustainable markets and create an enabling environment for technology transfer.

GEF projects are geared towards testing and demonstrating the variety of funding and institutional models to promote technology fusion, with several GEF projects being designed to mobilize private sector funding. Capacity building is a central element of most GEF projects, having a direct impact on the capacities of beneficiary countries to understand, absorb and disseminate environmental technologies.

Since 1992, that is over about three decades of activity, GEF has provided developing countries and those with economies in transition with about 21.1 billion US dollars in the form of grants and has mobilized over 114 billion US dollars in the form of co-financing for implementation of over 5,000 projects in 170 countries[530]. Through the Small Grants Programme (SGP), GEF has supported more than 25,000 initiatives implemented by civil society and community organizations in 130 countries.

GEF agencies active in the RoM are: Food and Agriculture Organization (FAO), International Agricultural Development Fund (IFAD), World Bank, United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP) and United Nations Industrial Development Organization (UNIDO).

[524] Source: Radio Free Europe, article "How affected will the Republic of Moldova be by the reduction of remittances?", published on April 23, 2020. Available at: https://moldova.europalibera.org/a/c%C3%A2t-de-afectat%C4%83-va-fi-r-moldova-de-reducerea-remiten%C8%9Belor-/30572659.html

[525] Report "External Assistance to the Republic of Moldova in 2020", developed with the financial support provided by the European Union (beneficiary: Ministry of Finance of the Republic of Moldova). Available at: https://www.mf.gov.md/sites/default/files/Raport%20Asisten%C8%9B%C4%83%20Extern%C4%83%202020%20MD.pdf

[526] *Idem.*

[527] GD nr. 377 of 25.04.2018, On regulation of the institutional framework and the coordination and management mechanism for external assistance. Official Gazette no. 133-141/419 of 27.04.2018. Amended by Government Decision no. 458 of 25.09.2019, published in the Official Gazette of the Republic of Moldova no. 296-301/657 of 27.09.2019.

[528] *Idem.*

[529] *Idem.*

[530] Source: Global Environment Facility website, 'About Us' heading. Available at: <https://www.thegef.org/about-us>

So far (31.01.2022) GEF Trust Fund provided the total amount of 35.8 million USD for implementation of 28 national projects in the RoM. Of these, 16 have been completed, 11 are under implementation (projects accepted), and one is at the stage of the concept note approval. The total amount of 142.3 million USD was mobilized in the form of co-financing within these 30 national projects. The GEF Special Fund for Climate Change has provided funding for 2 national projects totaling US $8.76 million.

At the same time, the RoM participates as a partner in other 26 regional and global projects where GEF financing amounts to 196.5 million US dollars, and co-financing amounts to 854.9 million US dollars. Fifteen of the 56 projects co-financed by the GEF in which the RoM participates are related to "combating climate change"[531]. This category includes the project dedicated to the preparation of the BUR3 of the RoM to the UNFCCC (2020-2021), with a grant component of 352 thousand US dollars (granted by UNEP) and with co-financing of 38 thousand US dollars, the project dedicated to the preparation of the NC5 of the RoM to the UNFCCC (2019-2022), with a grant component of 500 thousand US dollars (granted by UNEP) and with a co-financing of 50 thousand US dollars.

In the operational phase of filling in the financing applications to GEF (GEF-7) currently in progress (July 2018 – June 2022), the RoM submitted 5 applications for projects financing, of which four were approved and one is at the concept note approval stage. The total amount granted by GEF for these 5 projects is 6.2 million US dollars, and the amount mobilized in the form of co-financing is 50.9 million US dollars. These projects are carried out in the following areas: protection of biodiversity, management of chemicals and waste, combating climate change and combating soil degradation[532].

In 2012 the RoM joined the Small Grants Programme promoted by the GEF. Currently, the SGP is implemented through UNDP Moldova. For 2012-2024, covering the operational phases 5, 6 and 7, GEF has provided funding in the total amount of US $2.57 million for the implementation of projects promoted by NGOs and community organizations. For operational Phase 7, which is ongoing during the years 2020-2024, GEF provided 500 thousand US dollars funding; it is also planned to additionally mobilize 500 thousand US dollars in the form of co-financing. The main objectives of funding under the SGP programme are to promote and support innovative, inclusive and impactful initiatives and to encourage partnerships involving local actors to address priority environmental issues, develop community-level strategies and implement technologies that will reduce environmental threats by replicating them over time, build knowledge and share experience at community level between NGOs and with other organizations (including governments), build partnerships and stakeholder networks to build capacity at local and national level, to address global environmental issues and promote sustainable development[533].

The main expected results of the projects implemented under the SGP include: preserving the community environment, promoting climate smart innovative agro-ecology, promoting the advantages of co-benefits of access to low-carbon energy, promoting coalitions for chemicals management at local and global level, developing Government – civil society policies and platforms for dialogue for planning, promoting social inclusion, etc. [534].

By 31.01.2022, the following results were achieved under the SGP:

- 45 projects are successfully completed and 13 projects are ongoing;
- 7830 hectares of biodiversity areas of global importance have been protected or sustainably managed in the implemented projects;
- CO_2 emissions decreased by 665.2 tons by implementing energy efficient and renewable energy technologies in SGP projects;
- 600 farmers and over 1000 students have improved their knowledge and skills in the field of biological agriculture and sustainable management of agricultural land;
- 75 tons of e-waste was collected;
- 68 hectares of land were afforested, forest strips were planted on 28 hectares;
- 319742 people benefited from the implementation of the projects;
- 41010 women participated / got involved in SGP projects[535].

It is also important to point out that, in recent years, several already completed projects have created the basis for the implementation of new projects, supported by the GEF SGP in the RoM. Following a series of consultations with the potential beneficiaries of the SGP funds in the operational phase 7, which took place at the end of 2019, it was agreed that 70% of the financial resources offered provided under the SGP should be used for specific actions in several priority directions, including: improvement of degraded and/or eroded land by afforestation, improvement of the protected natural areas and wetlands management, local application of energy efficiency and alternative energy solutions, reducing the quantity of municipal solid waste, plastics, chemicals, etc. [536].

Green Climate Fund

Currently, the RoM is receiving funding for implementation of several projects supported by the Green Climate Fund. Detailed information on those projects is provided below. The amounts for financing the FP 025 and FP 086 projects (lines 3 and 4 in Table 9-3) are total amounts, respectively, for all beneficiary countries (10 and 9 beneficiary countries). In line with the GCF practice, funding provided under regional projects is distributed equally among the beneficiary countries.

[531] Source: Global Environment Facility website, 'Moldova' heading. Available at: <https://www.thegef.org/country/moldova>
[532] Source: Global Environment Facility website, under the heading 'Projects'. <https://www.thegef.org/projects-faceted?f%5B0%5D=field_country%3A109&f%5B1%5D=field_gef_period%3A881>
[533] Source: UNDP Moldova website, under the heading 'The Small Grants Programme of the Global Environment Facility'. <https://www.md.undp.org/content/moldova/en/home/projects/the-gef-small-grants-programme.html>

[534] *Idem.*
[535] *Idem.*
[536] GEF, UNDP Moldova, "Strategy of the GEF SG Programme for the Operational Phase 7, 2020-2024, in the Republic of Moldova". Chisinau, March 2021. Available at: <https://www.md.undp.org/content/moldova/en/home/projects/the-gef-small-grants-programme.html>.

Table 9-3: GCF Projects in the Republic of Moldova[537]

No	Project name	Financial resources allocated by GCF (US $million)		Financing Status/ Comments
		Grant	loan	
1.	Promoting the national process of planning the adaptation of the Republic of Moldova to climate change (Stage 2)	2.1	-	Approved
2.	Integration of adaptation into the planning processes for reducing vulnerability to climate change at local and central level in the agricultural sector of the Republic of Moldova	0.685	-	Approved
3.	Co-financing program GCF -EBRD Sustainable Energy Funding Program (EBRD SEFF) (FP 025)	34	378	Approved (Oct. 2016) / Regional project, 10 countries
4.	Green Cities Facility (FP 086)	26.8	79.3%	Approved (Oct. 2018) / Regional project, 9 countries
TOTAL		63,585	457.3	

Source: Green Climate Fund, Republic of Moldova heading.

[537] Source: Green Climate Fund website, Republic of Moldova. Available at: <https://www.greenclimate.fund/countries/moldova>.

Multilateral Development Banks

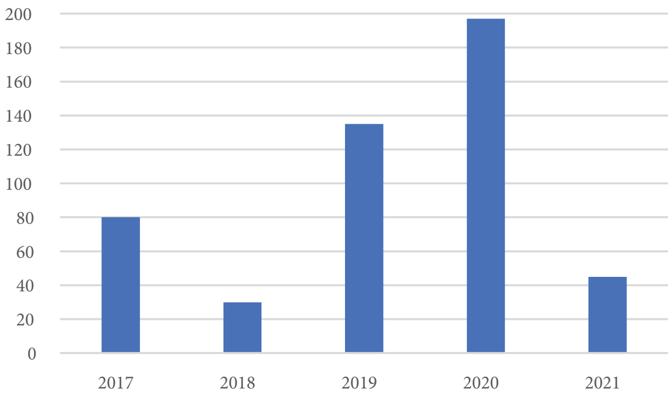
Multilateral Development Banks (MDBs) consider technology transfer as part of their mission to encourage development, including for a cleaner environment. These institutions have become aware of the role they can play in raising capital to meet sustainable development and environmental needs, and of the possibility of using financial innovation to encourage environmental projects and initiatives. Among the multilateral development banks, in the RoM the World Bank (WB) and the European Bank for Construction and Development (EBRD) have been particularly active in promoting sustainable and environmental development projects.

World Bank Group - WB (IBRD, AID, CFI, MIGA, ICSID)

The RoM joined the IBRD on 12 August 1992, a day considered the official date on which it became a member of the World Bank. The International Development Association (IDA) provides loans at a low or no interest rate – called "loans" – and grants to poorer countries. The RoM became a member of the IDA on 14 June 1994. The International Finance Corporation (IFC) provides loans, capital and technical assistance to encourage private sector investment in developing countries. The RoM became a member of the IAC on March 10, 1995. The Multilateral Investment Guarantee Agency (MIGA) provides safeguards against losses caused by non-commercial risks incurred by investors in developing countries. The RoM became a member of MIGA on June 9, 1993. The International Centre for Settlement of Investment Disputes (ICSID) offers international facilities for reconciliation and arbitration of investment disputes. The RoM became a member of ICSID on 4 June 2011[538].

From 1992 to 2021, the World Bank granted about 1.9 billion US dollars to the RoM for the development of 116 projects, being disbursed over 1.3 billion US dollars[539]. Currently (31.05.2021) in the RoM there are 18 projects financed by the World Bank, the total value of commitments under these projects is USD 636.58 million. Areas of support include regulatory reform and business development, education, social assistance, energy, health care, agriculture, local roads, environment, emergency funding to combat the COVID-19 pandemic, etc. [540].

The current Country Partnership Framework (CPF 18-21) of the WB Group includes financial commitments totaling US $407 million for the fiscal years 2018-2021. The mid-term review of the document recommends "... extending the implementation of the CPF with adjustments dictated by the developments in the country, the priorities of the country and the operational environment, including: [...] the *integration of the climate change theme in the entire program supported by the WB*"[541]. The distribution of loan commitments for the years 2017 – 2021 is reflected in Fig. 9.4.



Source: World Bank website, Moldova Overview.

Figure 9-3: The World Bank annual lending commitments, millions of US dollars.

The list of the World Bank projects in the RoM that have an impact on mitigating greenhouse gas emissions over the last ten years is presented in Table 9-4.

Table 9-4: World Bank projects with an impact on GHG mitigation in the RoM, 2011–2021[542]

No.	Project name	Financial commitment, million US dollars	Date of approval
1	Agricultural Competitiveness Project (WB), third additional funding *	15.0	30.07.2020
2	The Second Project for the district heating system efficiency	100.0	18.06.2020
3	Electricity Production System Development project in the Republic of Moldova	70.0	08.05.2019
4	Climate Change Adaptation Project	27.2	09.06.2017
5	Agricultural Competitiveness Project (WB), Second Additional Financing	10.0	07.07.2016

[538] Source: External Assistance Management Platform website, under the heading 'World Bank'. Available at: <http://amp.gov.md/portal/node/31>.
[539] Source: World Bank website, under the heading 'The World Bank in Moldova'. Available at: <https://www.worldbank.org/en/country/moldova/>.
[540] Source: World Bank website, Projects section, Applied filters: Country: Moldova, Status: Active. Available at: <https://projects.worldbank.org/en/projects-operations/projects-list?lang=en&countrycode_exact=MD&os=0&status_exact=Active>.
[541] Source: World Bank website, under the heading 'The World Bank in Moldova'. Available at: <https://www.worldbank.org/ro/country/moldova/overview#2>.
[542] World Bank website, Projects section, Filter applied: Country: Moldova. Available at: <https://projects.worldbank.org/en/projects-operations/projects-list?lang=en&countrycode_exact=MD>.

No.	Project name	Financial commitment, million US dollars	Date of approval
6	Rehabilitation of local roads	80.0	30.10.2015
7	Agricultural Competitiveness Project (WB), additional funding	12.0	19.05.2015
8	Streamlining the district heating system	40.5	21.11.2014
9	Urgent support in agriculture	10.0	14.05.2013
10	Agricultural Competitiveness Project (WB)	18.0	01.05.2012
11	Agricultural Competitiveness Project (GEF)	4.4	01.05.2012
12	Biogas Production from Manure Pilot Project	1.0	24.06.2011
13	Moldova: SIDA Trust Fund to Finance Energy Reforms and Increase Energy Efficiency	2.9	17.02.2011
TOTAL		391	

Note: * In November 2021, an additional tranche for the Agricultural Competitiveness Project was approved.

The biggest environmental problems of the RoM are: soil degradation, surface water pollution, lack of sustainable waste management (both solid and liquid), as well as increased groundwater pollution, caused by inefficient manure management in rural communities. In recent years, the RoM has made significant progress in the field of environmental protection. At the same time, projects have been successfully implemented aimed at stopping and reversing soil degradation, increasing energy efficiency, renewable energy production, etc. The implementation of these projects will generate a number of global benefits, including a planned reduction of CO_2 emissions in the years to come.

The largest project with an impact in the field of climate change mitigation, supported by the World Bank in the RoM, is the second project to streamline the heating system (IBRD commitment in the amount of USD 100 million for the years 2020-2025), which aims to increase the efficiency of the heating system in Chisinau municipality. This project is a continuation of the first district heating efficiency project, approved in November 2014 and financed by the World Bank with the amount of USD 40.5 million (implementation period: 2014 – 2020). The project will provide a total energy saving of about 3.44 billion kWh and a net annual reduction of CO_2 emissions by 603 kt as of 31.12.2025[543].

European Bank for Reconstruction and Development

The European Bank for Reconstruction and Development (EBRD) was founded in 1991 with the aim of facilitating, after the end of the Cold War, the transition to the market economy of the Central and Eastern Europe countries. Currently, the EBRD is owned by 71 shareholders: 69 countries and two international organizations: the European Union and the European Investment Bank (EIB).

The assistance provided to the RoM by the EBRD in the period 1991-2021 includes a total of 146 projects with a total value of EUR 1,487 billion, of which EUR 929 million have been already disbursed, the current investment portfolio being EUR 597 million for 51 ongoing projects[544].

As of 31.01.2022, the distribution of the current EBRD project portfolio for the RoM by fields is as follows[545]:

- sustainable infrastructure – 75%;
- financial sector – 13%;
- industry, trade and agribusiness – 12%.

The EBRD projects in the RoM, over the last ten years, with direct impacts on the direct GHG emissions mitigation are presented in Table 9-5.

By the end of 2021, two other projects were in the pre-approval phase for financing: the Municipal Solid Waste Project in Moldova (approved concept: October 4, 2021, EBRD component: $25 million) and the Balti Heating System – Phase 2 (pending approval: December 9, 2021, EBRD component: $14 million).

Among the above-mentioned projects/credits, the most important impact on reduction of direct GHG emissions is expected after the implementation of the MoSEFF II[546], MoREEFF[547] and "Energy efficiency of buildings in the RoM" projects. As a rule, the reduction in energy consumption in projects funded by these credit lines exceeds 30%, which directly leads to a significant GHG emissions reduction.

Table 9-5: The EBRD projects/credits with impacts on GHG emissions reductions in the RoM[548]

No.	Title of the loan / project	EBRD loan committed, million US dollars	Date of approval
1	Energy efficiency of buildings in the Republic of Moldova	30.0	15.10.2020
2	Green cities: trolleybuses in Balti	2.5	19.03.2019
3	Green cities: municipal solid waste in Chisinau	9.0	10.08.2017
4	The glass factory in Chisinau	5.3	06.12.2016
5	Chisinau Buildings within the Green City	10.0	30.11.2016
6	Heating system in Balti	7.0	15.10.2014
7	Rehabilitation of roads in Moldova IV	150.0	11.06.2013
8	Rehabilitation of the railway moving stock in Moldova	76.5	17.10.2012
9	Rehabilitation of the trolleybus park in Balti	3.0	18.09.2012
10	Moldova Sustainable Energy Financing Facility (MoSEFF and MoSEFF II)	22.0	09.05.2012
11	Sustainable Energy Financing Facility in Moldova's Rural Sector (MoREEFF)	35.0	09.05.2012
12	Rehabilitation of Moldelectrica transport networks	21.5	09.05.2012
13	Rehabilitation of the roads sector in Chisinau	14.4	22.11.2011
TOTAL		386.2	

In order to make investments in energy efficiency projects more attractive, the MoSEFF II offered a grant component for eligible projects. Depending on the energy savings and the reduction of direct GHG emissions achieved, the grant component varied between 5 and 20% of the loan amount.

Among the well-known companies in the RoM, which implemented projects with the help of the credit line offered through MoSEFF II are: Orhei-Vit, Macon, Ungheni carpets, etc. Also, a number of small companies have implemented projects with loans from 10,000 euro to 2 million euro. To

[543] World Bank website, 'Second District Heating Efficiency Improvement Project'. Available at: <https://projects.worldbank.org/en/projects-operations/project-detail/P172668>.
[544] EBRD website, 'Moldova data' heading. Available at: <https://www.ebrd.com/where-we-are/moldova/data.html>.
[545] *Idem.*

[546] EBRD website, 'MoSEFF II – Moldovan Sustainable Energy FF Extension'. <https://www.ebrd.com/work-with-us/projects/psd/moseff-ii---moldovan-sustainable-energy-ff-extension.html>.
[547] EBRD website, 'MoREEFF – Moldovan Residential EE Financing Facility'. <https://www.ebrd.com/work-with-us/projects/psd/moreeff---moldovan-residential-ee-financing-facility.html>.
[548] EBRD website, Project Summary Documents. <https://www.ebrd.com/work-with-us/project-finance/project-summary-documents.html?1=1&filterCountry=Moldova>.

facilitate and accelerate investments in energy efficiency, the MoSEFF II team provided technical assistance and recommendations for optimizing energy consumption. MoSEFF II technical assistance was financed by the EU and was free of charge for eligible projects.

The MoREEFF programme provides credits for the implementation of energy-efficient technologies in housing sector. This financing facility provides for credit lines to the banks in the RoM to facilitate loans for energy efficiency projects in residential sector. The loans beneficiaries may be the owners and tenants of the housing spaces, associations of apartments owners, housing fund management companies, energy services companies and other eligible companies that provide maintenance, operation, construction and renovation services, operate on the basis of a contract signed with the owners/tenants and intend to implement eligible projects. Eligible projects include the following types of works: installation of energy-efficient windows; insulation of walls, floors and roofs; installation of efficient biomass-based boilers, solar water heating systems, efficient gas boilers; installation of heat pump systems, photovoltaic systems, including those that are architecturally integrated, heat exchanger stations and engineering systems. Implementation of this project is expected to produce three types of impact: (i) demonstration effect and market expansion; (ii) skills transfer; and (iii) technology transfer.

The Project "Energy Efficiency of Buildings in the RoM" will finance energy efficiency measures, including those aimed at improving the insulation of buildings, heating, ventilation, air conditioning and lighting systems, and introduction of renewable energy sources. The deployment of new and high-quality energy efficiency technologies in buildings will have a strong demonstration effect in public and private institutions. It is estimated that energy savings of 40% to 50% will be achieved as a result of project implementation. The MoIRD has been appointed as the implementer of the project. The Energy Efficiency Agency has been appointed as promoter of the project[549].

Clean Development Mechanism of Kyoto Protocol

In order to promote eligible projects within the *Clean Development Mechanism* (CDM), the RoM has established the *Designated National Authority* (DNA) for the Clean Development Mechanism of the Kyoto Protocol: National Commission for Implementation and Accomplishment of Provisions of the UNFCCC. The activity of this Commission was regulated until 2020 by the GD no. 1574 of 26.12.2003[550].

It should be noted that the validity of the Kyoto Protocol expired in 2012, but by Decisions of COP 18 (Doha, 2012), it was extended for another eight years until 2020[551]. In order to ensure continuity in the implementation of the CDM in the RoM, in 2020 the GD no. 444 of 01.07.2020 which established a new mechanism for coordinating climate change activities - the National Committee on Climate Change[552]. The same normative act repealed the GD no. 1574 of 26.12.2003.

Under the CDM, the countries listed in Annex I to the Kyoto Protocol (43 countries and EU) invest financial resources to implement GHG emission reduction projects in non-Annex I countries. The GHG emission reduction is quantified in the form of *Certified Emission Reductions* (CERs), which serve the countries listed in Annex I to achieve the GHG emission reduction and limitation targets. Projects carried out within the framework of the CDM may generate CERs over a period of time, called the crediting period.

CDM projects initiated in the RoM until 31.01.2022 are presented in Table 9-6.

The total quantity of CERs certificates issued by the Executive Council of CDM until 31.01.2022 within the CDM projects registered in the RoM is 3,942,974 tons CO_2 equivalent[553].

In order to facilitate implementation of CDM projects aimed at reducing consumption of electricity produced from fossil fuels, in 2011 the WB financially supported development of the calculation tool to determine the Grid Emission Factor (GEF) in the national power system, and the GEF concrete value for the credit periods that started in 2010 were determined[554]. In 2017, GEF values were updated[555].

The implementation of the CDM projects in RoM allowed the technology transfer that would normally not have been introduced in the country at that time.

[549] EBRD website, under the heading 'Moldova Buildings Energy Efficiency'. <https://www.ebrd.com/work-with-us/projects/psd/50601.html>.

[550] GD no. 1574 of 26.12.2003, on the establishment of the National Commission for the Implementation and Accomplishment of the Provisions of the UNFCCC, as well as of the Kyoto Protocol Mechanisms and Provisions. Official Gazette no. 6-12/50 of 01.01.2004. Repealed by GD no. 444 of July 1, 2020, published in the Official Gazette no. 188-192/635 of July 24, 2020.

[551] Source: United Nations Framework Convention on Climate Change website, under the heading 'What is the Kyoto protocol?'. Available at: <https://unfccc.int/kyoto_protocol>.

[552] Government Decision no. 444 of 01.07.2020, On establishment of the mechanism for coordinating climate change activities. Official Gazette no. 188-192/635 of July 24, 2020.

[553] *Idem.*

[554] Moldova Grid Emission Factor Assessment (2011). Available at: <http://clima.md/lib.php?l=en&id-c=243&year=2012>.

[555] Moldova Grid Emission Factor Assessment (2017). Available at: <http://clima.md/lib.php?l=en&id-c=243&year=2017>.

Table 9-6: CDM projects implemented in the Republic of Moldova[556]

Credit Period	Project name	Projected annual emission reduction, t CO_2 eq	CERs issued until 31.01.2022, t CO_2 eq	Project Status
01.01.2014 – 31.12.2023	Reduction of fugitive gas leaks from the distribution network «Tiraspol-transgaz-Pridnestrovie» Srl, Republic of Moldova	164 043	0	Registered
01.01.2013 – 31.12.2022	Reduction of fugitive gas leaks from the Moldovagaz distribution network, Republic of Moldova	748 903	0	Registered
01.11.2006 – 31.10.2036	Forestation/ Reforestation Project of the Republic of Moldova	39 056	1 023 906	Ongoing
01.01.2013 – 31.12.2022	Production of biogas from pressed sugar beet pulp at the sugar factory in Drochia, Südzucker Moldova	27 347	0	Registered
01.01.2012 – 22.07.2019	Construction of the Combined Production of Electricity and Thermal Power Plant at Î.S. "Tirotex", Tiraspol city, Republic of Moldova	41 162	0	Finished Loan Period
01.01.2010 – 01.01.2020	Change of fossil fuel sources to local heating systems in the Republic of Moldova	11 312	0	Finished Loan Period
01.10.2008 – 01.10.2018	Recovery of biogas from the SWD site in Tintareni, Anenii Noi district, Republic of Moldova	79 733	0	Finished Loan Period

[556] Source: CDM website, Project Search section, click Host Country: Republic of Moldova. Available at: <https://cdm.unfcc.int/Projects/projsearch.html>.

Credit Period	Project name	Projected annual emission reduction, t CO_2 eq	CERs issued until 31.01.2022, t CO_2 eq	Project Status
01.06.2007 – 31.05.2017	Recovery of biogas from the SWD site in Tintareni, Anenii Noi district, Republic of Moldova	132 943	0	Finished Loan Period
01.01.2008 – 31.12.2017	Biomass based heating in rural communities of the Republic of Moldova no. 2	17 888	36 658	Finished Loan Period
20.01.2006 – 19.01.2016	Biomass based heating in rural communities of the Republic of Moldova no. 1	17 888	43 062	Finished Loan Period
29.01.2006 – 28.01.2016	Energy conservation and reduction of GHG emissions in the Republic of Moldova	11 567	44 339	Finished Loan Period
01.10.2002 – 30.09.2022	Soil Conservation in the Republic of Moldova	179 242	2 795 009	Ongoing
TOTAL			**3 942 974**	

9.3.2. Financial Needs

Two categories of funding are needed in order to meet the objectives of GHG emissions reduction in the context of low-emission development. The first should ensure achieving an adequate level of capacity in the field of greenhouse GHG mitigation. The second is investment needed to implement measures and technologies that contribute to the proposed GHG reductions.

The respective financial needs are reflected in Table 9-7, where the investments needed to implement NAMA-type actions correspond to those aimed at achieving the country's conditional objective. The table shows that technical needs and climate change capacities development are currently evaluated at 1530 thousand US dollars, technological transfer needs are evaluated at 675 thousand US dollars, and for the implementation of NAMA aimed at achieving the conditional nationally determined contribution – 4.9 billion US dollars, according to the LEDP 2030. The investments needed to implement unconditional measures and technologies that result in GHG emissions reduction and, at the same time, will ensure the sustainability of the national economy development, are evaluated at about USD 8.3 billion for 2021 – 2030, according to the LEDP 2030. The cost of implementing conditional actions (supported) for the same period is 2.6 billion US dollars. The total cost of unconditional and conditional actions included in the LEDP for 2021–2030 is US $10.9 billion.

Table 9-7: Financing needs in the context of ensuring low-emission development of the RoM

No.	Shares	Required support
Technical and Capacity Development Needs, thousand $US		
	Total inclusive	**1530**
1	Supporting the country's capability for capacity development and strengthening the national inventory system	50
2	Strengthening the national capacity to develop the GHG inventory for the LULUCF sector, including developing the land use matrix and completing the transition to the 2006 IPCC Guidelines for the LULUCF sector	30
3	Strengthening the capacity of the national network of research institutions to conduct studies, research and assessments to identify additional mitigation opportunities including financial and organizational justifications in terms of social, technical and economic impact	170
4	Enhance national capacity to prepare viable NAMA project proposals in transport, industry and agriculture sectors to attract investment	100
5	Strengthening the policies, legal framework and management of the forestry sector of the Republic of Moldova	50
6	Strengthening the capacity of stakeholders in the waste sector to implement EU directives and regulations	40
7	Facilitating the dialogue for the transfer of experience and lessons learned, as well as training of stakeholders and relevant experts within the administrative structure of the Republic of Moldova for the successful implementation of the MRV national system, with a special focus on the MRV of the LEDS and NAMA	40
8	Involvement and mobilization of the private sector in low-carbon and climate resilient action	300
9	Mobilization of investments for the implementation of the NDC of Moldova	300
10	Integration of mitigation and adaptation measures and objectives into business development plans, national and sectoral plans of the energy sector.	200
11	Stakeholder training and promotion of workshops devoted to afforestation, land restoration practices, creation of silvopastoral systems and sustainable grassland management	50
12	Stakeholder training, including through workshops on renewable energy sources and energy efficiency, and development of respective technical and financial demonstration tools (in the context of NAMAs on renewable energy sources and energy efficiency)	200
Financial needs to implement NAMA actions, US $million		
	Total inclusive	**4838.**
1	Promotion of low-capacity CHPs in the Republic of Moldova	23
2	Promotion of heat pumps in the Republic of Moldova	180
3	Promotion of wind power in the Republic of Moldova	640
4	Use of solar energy for domestic hot water production in the Republic of Moldova	606
5	Promoting efficient lighting in the Republic of Moldova	236
6	Hybrid and electric buses and minibuses in Chisinau municipality	344
7	Substitution of clinker in cement production	100
8	Reduction of GHG emissions in enteric fermentation by including dried grape marc in rations	228
9	Implementation of the soil conservation tillage system in the Republic of Moldova	5
10	Afforestation of degraded lands, riparian areas and protective curtains in the Republic of Moldova	144
11	Use of energy willow for thermal energy production in the Republic of Moldova	89
12	Promoting energy from waste in the Republic of Moldova	15
13	Other unconditional NAMAs	2271
Needs for the implementation of technology transfer, thousand $US		
	Total inclusive	**675**
1	Institutional assistance in promoting advanced technologies	250
2	Traineeships for knowledge of advanced technologies in operation	125
3	Identifying the most relevant and effective financial instruments to be applied by financial institutions in Moldova in promoting and implementing climate investments	300

9.4. National Arrangements for LEDP 2030 and NAMAs Implementation

The national monitoring, reporting and verification system for the 2030 LEDP and NAMAs implementation is regulated by the GD no. 1277/2018[557] on the establishment and functioning of the NSMR, as well as GD no. 444/2020[558] on the establishment of the mechanism for coordinating climate change activities.

The functioning of the national system for measuring, reporting and verification of GHG emissions is ensured through the implementation of the mechanisms established by the UNFCCC on the reporting of actual emissions produced in the country and prospects for the future, but also through several activities related to sectors (e.g., energy efficiency or the promotion of renewable energy sources), as well as through CDM type projects of the Kyoto Protocol.

National GHG emissions, as well as their evolution trends are periodically reported in the NCs of the RoM to UNFCCC[559] (starting with 2000), and in NIRs[560] (starting with 2010). These documents are developed on the basis of studies, research, reports made by national consultants of the highest qualification, including with international relevant experience, selected to make estimation and analysis of retrospective information, as well as develop short- and medium-term GHG emissions evolution scenarios for each sector, based on macroeconomic development scenarios of the RoM.

In addition, in order to improve transparency, stability, comparability, completeness and accuracy of the national inventory of anthropogenic greenhouse gas emissions from sources or carbon dioxide removal sinks, not regulated by the Montreal Protocol, the RoM has developed (in the end of 2015) the "*National Inventory System Report of the Republic of Moldova*", using as a starting point six templates developed by the Environmental Protection Agency of the United States of America[561] (US EPA) (institutional arrangements; evaluation methodologies and data documentation process; description of quality assurance and quality control procedures; description of the archiving system; key categories analysis; and national inventory improvement plan).

The institutional coordination framework for monitoring, reporting and verification, as well as for facilitating the integration streamlining climate change in national and sectoral programs and plans is provided by the National Commission on Climate Change, created by GD no. 444/2020[562]. Annex no. 4 to this GD establishes the mechanism for coordinating the appropriate mitigation actions at national level. This mechanism is developed in order to establish the normative and institutional framework for the development, evaluation, approval, monitoring, reporting and verification of nationally appropriate mitigation actions (NAMAs). It aims to establish set the responsibilities and framework preparation, evaluation and approval of NAMA projects implementation.

In this respect, the National Climate Change Commission (hereinafter – National Commission) has the following responsibilities and tasks:

1. coordinate the project development process;
2. examine the drafts in meetings and decides upon acceptance for approval or rejection;
3. calls on the central public administration authorities and recommendations on to local public authorities to take necessary measures to promote appropriate mitigation actions at national and local level;
4. request half-annual and annual reports on project implementation.

In order to implement the nationally appropriate mitigation actions, NAMA projects are developed by sectors of national economy. Implementation is ensured through technology transfer, financing and capacity building, involving use of the monitoring, reporting and verification mechanism.

NAMA projects fall into two categories:

1) *unconditional (unilateral)* – projects managed and financed from the state budget and/or other financial resources, which are provided in the national and sectoral planning documents and in the related financing plans established by the Government. They are not subject to registration in the NAMA Registry of the UNFCCC Secretariat;
2) *conditional (supported by external funds)* – projects financially supported by developed countries, included in Annex 1 to the UNFCCC, which aims to provide technical assistance, technology transfer and best practices in the field. They are subject to registration in the NAMA Registry of the UNFCCC Secretariat.

Unconditional NAMA projects are subject to the simplified monitoring, reporting and verification procedure set out in point 36 of the GD no. 444/2020[563].

NAMA projects supported by external funds go through the development, evaluation, approval and monitoring, reporting and verification cycle set out in Chapter IV of the same GD. The documentation of NAMA projects supported by external funding shall include a description of at least the following components: legal and administrative, relevant policies and strategies, financial, technical, direct and collateral benefits, risks and constraints, as well as monitoring, reporting and verification. The procedures, deadlines, elements of monitoring, reporting and verification, as well as the standard documents for the development, evaluation and approval of NAMA projects supported by external funding are set out in the Operational Manual on the NAMA Coordination Mechanism, prepared by the Central Environmental and Natural Resources Management Authority, and approved by Order of the Minister.

NAMAs Monitoring, Reporting and Verification

1. The monitoring, reporting and verification procedure

[557] GD no. 1277 of 26-12-2018 on establishment and operation of the national system for monitoring and reporting GHG emissions and other climate change relevant information. Official Gazette no. 38-47/67 of 08.02.2019.
[558] GD no. 444 of 01.07.2020, regarding the establishment of the mechanism for coordinating climate change activities. Official Gazette no. 188-192/635 of July 24, 2020.
[559] <http://clima.md/lib.php?l=en&idc=81&>
[560] <http://clima.md/lib.php?l=en&idc=82&>
[561] US Environmental Protection Agency <www.epa.gov/climatechange/emissions/ghginventorycapacitybuilding>
[562] Government Decision no. 444 of 01.07.2020, On establishment of the mechanism to coordinate climate change activities. Official Gazette no. 188-192/635 of July 24, 2020.
[563] *Idem.*

aims at tracking the overall performance of NAMA projects and includes the following activities: (1) measuring the reduction of greenhouse gas emissions; (2) reporting information; (3) verifying reported information.

2. The monitoring, reporting and verification procedure applies both to implementation and post-implementation stage.
3. Monitoring and reporting are ensured by the NAMA project beneficiary, while the verification – by the verifier.
4. Project monitoring is carried out during the project implementation phase. During the project monitoring phase, the beneficiary measures and estimates the GHG emissions reduction resulting from the NAMA project implementation according to the standardized measurement and calculation methodologies and instruments set out in the project document.
5. Reporting takes place during the project implementation phase by submitting the half-yearly reports, and by the end of the project the beneficiary shall submit the final report.
6. For reporting purposes, the beneficiary shall use the reporting forms as set forth in the procedure laid down in the Operational Manual on the NAMAs Coordination Mechanism. The reports shall contain data on GHG emission reductions monitoring results. The monitoring results shall be based on monitoring indicators set out in the reporting form attached to the Operational Manual on NAMAs Coordination Mechanism.
7. The drawn-up report is subject to the verification procedure, to ensure the truthfulness and reliability of the information reported by the project beneficiary.
8. The verifier shall draw up the verification report and submit it to the beneficiary, and the beneficiary shall use it as basis for drawing up the GHG emissions reduction report and submit to the national Commission.
9. The project beneficiary shall hire and pay for the verifier' services.
10. Authorities and institutions implementing unconditional NAMA projects not registered in the NAMA Register of the UNFCCC shall apply the simplified monitoring, reporting and verification procedure. They shall submit annual reports to the national Commission on the actions undertaken and the results achieved by the projects. The reporting format and the deadline for submission of the reports shall be set out in the Operational Manual on NAMA Coordination Mechanism.
11. The Secretariat of the National Commission shall process the data submitted by the beneficiaries and calculate the total amount of reduced GHG emissions as a result of unconditional and externally-supported NAMA projects implementation.
12. The primary information on the amount of reduced GHG emissions as a result of NAMA projects implementation is used for the preparation of the national GHG emission inventory, the biennial update report and the national communication under the UNFCCC.

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ANNEXES

ANNEXES

Annex 1: Summary Reports on GHG Emissions in the Republic of Moldova within 1990-2020

Annex 1-1: Inventory Year - 1990

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**35,191.3877**	**216.0563**	**10.0609**	**NO**	**NO**	**NO**	**NO**	**NO**	**95.6471**	**282.3156**	**141.5732**	**150.1134**
1. Energy	**35,401.1029**	**49.8489**	**1.1597**						**91.6413**	**270.6568**	**31.9022**	**148.7237**
A. Fuel combustion Reference approach	35,187.6578											
Sectoral approach	35,400.4397	13.4191	1.1597						91.6413	270.6568	31.2464	148.7237
1. Energy industries	21,300.2929	0.4913	0.1734						39.4664	7.2099	0.6297	102.3606
2. Manufacturing industries and construction	1,915.6706	0.0698	0.0146						8.9397	3.4622	0.8735	2.6760
3. Transport	4,698.2416	1.3467	0.3582						20.8774	70.8644	9.0718	0.7843
4. Other sectors	7,372.2624	11.5005	0.6092						21.5980	188.2917	20.5488	42.5973
5. Other	113.9722	0.0109	0.0044						0.7597	0.8286	0.1226	0.3055
B. Fugitive emissions from fuels	0.6632	36.4298	0.0000						NO	NO	0.6558	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	0.6632	36.4298	0.0000						NO	NO	0.6558	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**1,605.2224**	**NO**	**0.0001**	**NO**	**NO**	**NO**	**NO**	**NO**	**3.7596**	**5.4932**	**106.5516**	**1.3845**
A. Mineral industry	1,338.9600								3.6040	3.4372	0.0340	1.3202
B. Chemical industry	NO	NO	NO						NO	NO	0.0650	NO
C. Metal industry	28.5023	NO	NO	NO	NO	NO	NO	NO	0.0925	1.2102	0.0370	0.0427
D. Non-energy products from fuels and solvent use	234.3591	NO	NO						0.0434	0.2441	92.7937	0.0216
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				NO	NO	NO	NO	NO				
G. Other product manufacture and use	3.4010	NO	0.0001	NO	NO	NO	NO	NO	0.0197	0.6017	1.5459	NO
H. Other									NO	NO	12.0760	NO
3. Agriculture	**0.5820**	**107.3809**	**8.0256**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		87.5771										
B. Manure management		19.8038	3.0192								NO	
C. Rice cultivation		NO										
D. Agricultural soils			5.0064									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	0.5820											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						**NO**	**NO**	**NO**	
4. Land use, land-use change and forestry	**-1,830.4863**	**0.1061**	**0.5717**						**0.0959**	**3.5227**	**NO, NE**	
A. Forest land	-2,563.4328	0.0083	0.0005						0.0053	0.1887	NO, NE	

B. Cropland	2,379.0886	0.0978	0.0025						0.0906	3.3340	NO	
C. Grassland	-1,205.6938	NE	NE						NE	NE	NE	
D. Wetlands	-555.3798	NE	NE						NE	NE	NE	
E. Settlements	84.7480	NO, NE	0.5687						NO, NE	NO, NE	NO, NE	
F. Other land	152.3638	NE	NE						NE	NE	NE	
G. Harvested wood products	-122.1804											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**14.9667**	**58.7204**	**0.3038**						**0.1503**	**2.6430**	**3.1194**	**0.0052**
A. Solid waste disposal	NA, NO	44.2399							NA, NO	NA, NO	3.0203	
B. Biological treatment of solid waste		0.0544	0.0033						NO, NE	0.0076	NO, NE	
C. Incineration and open burning of waste	14.9667	0.3075	0.0054						0.1503	2.6354	0.0581	0.0052
D. Wastewater treatment and discharge		14.1186	0.2951						NA, IE	NA, IE	0.0410	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**193.4599**	**0.0153**	**0.0063**						**0.7651**	**0.5859**	**0.2298**	**0.0613**
Aviation	193.4599	0.0153	0.0063						0.7651	0.5859	0.2298	0.0613
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	232.8093											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**2.5613**									
Indirect CO_2	**207.5471**											

Annex 1-2: Inventory Year - 1991

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**28,417.2047**	**202.2024**	**9.3152**	**NO**	**NO**	**NO**	**NO**	**NO**	**78.5102**	**206.9674**	**114.3401**	**124.4509**
1. Energy	**29,898.2495**	**44.1221**	**0.8637**						**74.8304**	**196.1625**	**23.1980**	**123.1468**
A. Fuel combustion Reference approach	29,735.5050											
Sectoral approach	29,897.6098	9.6597	0.8637						74.8304	196.1625	22.5794	123.1468
1. Energy industries	18,927.0336	0.4230	0.1562						35.0660	6.4107	0.5515	90.5225
2. Manufacturing industries and construction	1,283.0799	0.0487	0.0095						6.4952	1.7418	0.5459	1.2222
3. Transport	3,656.1040	1.0343	0.2931						16.6517	53.9238	6.9484	0.6152
4. Other sectors	5,925.0237	8.1465	0.4014						15.9595	133.4692	14.4481	30.5092
5. Other	106.3685	0.0072	0.0034						0.6579	0.6170	0.0855	0.2778
B. Fugitive emissions from fuels	0.6397	34.4624	0.0000						NO	NO	0.6186	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	0.6397	34.4624	0.0000						NO	NO	0.6186	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**1,411.2739**	**NO**	**0.0001**	**NO**	**NO**	**NO**	**NO**	**NO**	**3.4408**	**4.9046**	**87.8865**	**1.2988**
A. Mineral industry	1,190.1632								3.3045	3.0431	0.0316	1.2438

B. Chemical industry	NO	NO	NO						NO	NO	0.0544	NO
C. Metal industry	24.7297	NO	NO	NO	NO	NO	NO	NO	0.0803	1.0502	0.0323	0.0371
D. Non-energy products from fuels and solvent use	193.3185	NO	NO						0.0361	0.2030	76.2635	0.0180
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				NO	NO	NO	NO	NO				
G. Other product manufacture and use	3.0625	NO	0.0001	NO	NO	NO	NO	NO	0.0199	0.6083	1.3920	NO
H. Other									NO	NO	10.1126	NO
3. Agriculture	**0.5226**	**97.7579**	**7.5533**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		81.1547										
B. Manure management		16.6032	2.7389									
C. Rice cultivation		NO										
D. Agricultural soils			4.8144									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	0.5226											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-2,907.8407**	**0.0960**	**0.6171**						**0.0885**	**3.2552**	**NO, NE**	
A. Forest land	-2,343.3131	0.0014	0.0001						0.0009	0.0316	NO, NE	
B. Cropland	1,248.7850	0.0946	0.0025						0.0876	3.2236	NO	
C. Grassland	-1,414.3167	NE	NE						NE	NE	NE	
D. Wetlands	-526.4627	NE	NE						NE	NE	NE	
E. Settlements	88.7139	NO, NE	0.6145						NO, NE	NO, NE	NO, NE	
F. Other land	152.3638	NE	NE						NE	NE	NE	
G. Harvested wood products	-113.6108											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**14.9994**	**60.2264**	**0.2811**						**0.1506**	**2.6451**	**3.2557**	**0.0053**
A. Solid waste disposal	NA, NO	46.1999							NA, NO	NA, NO	3.1602	
B. Biological treatment of solid waste		0.0551	0.0033						NO, NE	0.0077	NO, NE	
C. Incineration and open burning of waste	14.9994	0.3080	0.0054						0.1506	2.6374	0.0582	0.0053
D. Wastewater treatment and discharge		13.6633	0.2724						NA, IE	NA, IE	0.0373	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**147.3846**	**0.0117**	**0.0048**						**0.5829**	**0.4464**	**0.2298**	**0.0467**
Aviation	147.3846	0.0117	0.0048						0.5829	0.4464	0.2298	0.0467
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	201.2009											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**2.3400**									
Indirect CO_2	**170.8422**											

Annex 1-3: Inventory Year - 1992

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**21,825.6502**	**192.5536**	**7.9980**	**NO**	**NO**	**NO**	**NO**	**NO**	**58.5843**	**133.6331**	**90.3583**	**91.8546**
1. Energy	**23,310.7327**	**37.1762**	**0.6030**						**56.4998**	**124.6003**	**15.0948**	**91.1666**
A. Fuel combustion Reference approach	23,190.8152											
Sectoral approach	23,310.1924	6.0510	0.6030						56.4998	124.6003	14.5354	91.1666
1. Energy industries	15,660.9863	0.3579	0.1219						28.7536	5.5760	0.4762	71.2477
2. Manufacturing industries and construction	932.0767	0.0351	0.0069						4.5687	1.3199	0.4056	0.9295
3. Transport	2,615.2237	0.7228	0.2234						12.5061	37.2521	4.8651	0.4462
4. Other sectors	4,024.1583	4.9306	0.2486						10.1939	80.1095	8.7371	18.3826
5. Other	77.7474	0.0046	0.0023						0.4776	0.3429	0.0514	0.1606
B. Fugitive emissions from fuels	0.5403	31.1252	0.0000						NO	NO	0.5594	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	0.5403	31.1252	0.0000						NO	NO	0.5594	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**822.4617**	**NO**	**0.0001**	**NO**	**NO**	**NO**	**NO**	**NO**	**1.8526**	**3.4045**	**72.1808**	**0.6827**
A. Mineral industry	641.7935								1.7257	1.6459	0.0166	0.6316
B. Chemical industry	NO	NO	NO						NO	NO	0.0238	NO
C. Metal industry	23.9922	NO	NO	NO	NO	NO	NO	NO	0.0780	1.0194	0.0314	0.0360
D. Non-energy products from fuels and solvent use	154.2628	NO	NO						0.0304	0.1706	62.9651	0.0151
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				NO	NO	NO	NO	NO				
G. Other product manufacture and use	2.4132	NO	0.0001	NO	NO	NO	NO	NO	0.0186	0.5686	1.0969	NO
H. Other									NO	NO	8.0471	NO
3. Agriculture	**0.3905**	**94.7961**	**6.4497**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		79.8715										
B. Manure management		14.9247	2.4263								NO	
C. Rice cultivation		NO										
D. Agricultural soils			4.0234									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	0.3905											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-2,322.9822**	**0.0879**	**0.6868**						**0.0809**	**2.9777**	**NO, NE**	
A. Forest land	-2,184.2404	0.0015	0.0001						0.0010	0.0346	NO, NE	
B. Cropland	1,174.1876	0.0864	0.0022						0.0800	2.9431	NO	
C. Grassland	-1,428.4835	NE	NE						NE	NE	NE	
D. Wetlands	-595.5455	NE	NE						NE	NE	NE	
E. Settlements	386.6196	NO, NE	0.6844						NO, NE	NO, NE	NO, NE	
F. Other land	418.7786	NE	NE						NE	NE	NE	

G. Harvested wood products	-94.2986											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**15.0476**	**60.4934**	**0.2585**						**0.1510**	**2.6506**	**3.0827**	**0.0053**
A. Solid waste disposal	NA, NE	47.8234							NA, NO	NA, NO	2.9908	
B. Biological treatment of solid waste		0.0575	0.0035						NO, NE	0.0081	NO, NE	
C. Incineration and open burning of waste	15.0476	0.3089	0.0054						0.1510	2.6425	0.0584	0.0053
D. Wastewater treatment and discharge		12.3036	0.2496						NA, IE	NA, IE	0.0335	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**108.5369**	**0.0086**	**0.0036**						**0.4293**	**0.3287**	**0.2298**	**0.0344**
Aviation	108.5369	0.0086	0.0036						0.4293	0.3287	0.2298	0.0344
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	169.5924											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**2.0019**									
Indirect CO_2	**140.9363**											

Annex 1-4: Inventory Year - 1993

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**15,729.0875**	**179.5984**	**6.8796**	**NO**	**NO**	**NO**	**NO**	**NO**	**46.6890**	**70.9477**	**71.4281**	**72.3744**
1. Energy	**17,340.7506**	**30.5682**	**0.5000**						**44.6713**	**61.0487**	**8.2416**	**71.7032**
A. Fuel combustion Reference approach	17,279.5411											
Sectoral approach	17,340.2918	2.5952	0.5000						44.6713	61.0487	7.7383	71.7032
1. Energy industries	12,640.6006	0.2823	0.1058						23.6435	4.2355	0.3687	62.2743
2. Manufacturing industries and construction	617.5604	0.0229	0.0045						2.8651	0.9464	0.2784	0.6753
3. Transport	1,854.7578	0.4928	0.1808						9.9160	24.6271	3.3175	0.3241
4. Other sectors	2,133.9212	1.7913	0.2065						7.7876	30.6143	3.6883	8.0858
5. Other	93.4518	0.0058	0.0024						0.4591	0.6253	0.0853	0.3437
B. Fugitive emissions from fuels	0.4587	27.9730	0.0000						NO	NO	0.5033	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	0.4587	27.9730	0.0000						NO	NO	0.5033	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**737.8604**	**NO**	**0.0001**	**NO**	**NO**	**NO**	**NO**	**NO**	**1.7577**	**3.2411**	**60.2824**	**0.6658**
A. Mineral industry	587.5786								1.6352	1.4853	0.0144	0.6172
B. Chemical industry	NO	NO	NO						NO	NO	0.0199	NO
C. Metal industry	24.4250	NO	NO	NO	NO	NO	NO	NO	0.0794	1.0383	0.0315	0.0366
D. Non-energy products from fuels and solvent use	123.8759	NO	NO						0.0241	0.1356	50.1008	0.0120
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				NO	NO	NO	NO	NO				
G. Other product manufacture and use	1.9809	NO	0.0001	NO	NO	NO	NO	NO	0.0190	0.5819	0.9004	NO

H. Other									NO	NO	9.2154	NO
3. Agriculture	**0.1276**	**85.9140**	**5.3914**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		74.9162										
B. Manure management		10.9978	2.0341								NO	
C. Rice cultivation		NO										
D. Agricultural soils			3.3572									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	0.1276											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-2,364.6959**	**0.1179**	**0.7469**						**0.1091**	**4.0151**	**NO, NE**	
A. Forest land	-2,193.5115	0.0001	0.0000						0.0001	0.0024	NO, NE	
B. Cropland	1,442.9960	0.1178	0.0031						0.1090	4.0127	NO	
C. Grassland	-1,303.5202	NE	NE						NE	NE	NE	
D. Wetlands	-525.8447	NE	NE						NE	NE	NE	
E. Settlements	114.6181	NO, NE	0.7438						NO, NE	NO, NE	NO, NE	
F. Other land	164.0168	NE	NE						NE	NE	NE	
G. Harvested wood products	-63.4504											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**15.0447**	**62.9983**	**0.2413**						**0.1508**	**2.6428**	**2.9041**	**0.0053**
A. Solid waste disposal	NA, NO	50.2619							NA, NO	NA, NO	2.8159	
B. Biological treatment of solid waste		0.0288	0.0017						NO, NE	0.0040	NO, NE	
C. Incineration and open burning of waste	15.0447	0.3087	0.0054						0.1508	2.6388	0.0583	0.0053
D. Wastewater treatment and discharge		12.3989	0.2341						NA, IE	NA, IE	0.0299	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**55.2342**	**0.0044**	**0.0018**						**0.2184**	**0.1673**	**0.2298**	**0.0175**
Aviation	55.2342	0.0044	0.0018						0.2184	0.1673	0.2298	0.0175
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	143.2360											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**1.6120**									
Indirect CO_2	**112.2027**											

Annex 1-5: Inventory Year - 1994

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**12,752.1034**	**175.9101**	**6.1638**	**NO**	**NO**	**NO**	**NO**	**NO**	**36.6632**	**76.2586**	**52.6015**	**57.4117**
1. Energy	**14,491.6621**	**30.0466**	**0.4536**						**35.0613**	**68.5397**	**8.8760**	**56.8740**
A. Fuel combustion Reference approach	14,457.3119											

Sectoral approach	14,491.2336	3.0879	0.4536						35.0613	68.5397	8.3910	56.8740
1. Energy industries	9,961.8515	0.1888	0.0872						18.8108	3.5570	0.2847	47.1207
2. Manufacturing industries and construction	737.3282	0.0147	0.0023						1.2545	0.7747	0.3253	0.4083
3. Transport	1,612.9419	0.4373	0.1096						6.0604	22.3481	2.8670	0.2180
4. Other sectors	2,090.7472	2.4402	0.2529						8.6031	41.2528	4.8276	8.8679
5. Other	88.3648	0.0069	0.0016						0.3325	0.6071	0.0863	0.2592
B. Fugitive emissions from fuels	0.4285	26.9587	0.0000						NO	NO	0.4850	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	0.4285	26.9587	0.0000						NO	NO	0.4850	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**556.5852**	**NO**	**0.0001**	**NO**	**NO**	**NO**	**NO**	**NO**	**1.3900**	**2.8404**	**40.9265**	**0.5323**
A. Mineral industry	445.3398								1.2757	1.1521	0.0116	0.4870
B. Chemical industry	NO	NO	NO						NO	NO	0.0074	NO
C. Metal industry	25.3289	NO	NO	NO	NO	NO	NO	NO	0.0824	1.0774	0.0322	0.0380
D. Non-energy products from fuels and solvent use	84.4738	NO	NO						0.0146	0.0820	32.7972	0.0073
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				NO	NO	NO	NO	NO				
G. Other product manufacture and use	1.4426	NO	0.0001	NO	NO	NO	NO	NO	0.0173	0.5290	0.6557	NO
H. Other									NO	NO	7.4223	NO
3. Agriculture	**0.0537**	**83.5225**	**4.6821**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		72.9133										
B. Manure management		10.6093	1.9658								NO	
C. Rice cultivation		NO										
D. Agricultural soils			2.7164									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	0.0537											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-2,311.2923**	**0.0662**	**0.7938**						**0.0606**	**2.2302**	**NO, NE**	
A. Forest land	-2,108.0022	0.0023	0.0001						0.0015	0.0526	NO, NE	
B. Cropland	1,206.3850	0.0639	0.0017						0.0592	2.1776	NO	
C. Grassland	-1,577.3332	NE	NE						NE	NE	NE	
D. Wetlands	-497.6418	NE	NE						NE	NE	NE	
E. Settlements	130.4883	NO, NE	0.7920						NO, NE	NO, NE	NO, NE	
F. Other land	549.4579	NE	NE						NE	NE	NE	
G. Harvested wood products	-14.6464											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**15.0947**	**62.2747**	**0.2343**						**0.1512**	**2.6482**	**2.7991**	**0.0054**
A. Solid waste disposal	NA, NO	50.3641							NA, NO	NA, NO	2.7135	
B. Biological treatment of solid waste		0.0268	0.0016						NO, NE	0.0038	NO, NE	
C. Incineration and open burning of waste	15.0947	0.3096	0.0054						0.1512	2.6445	0.0584	0.0054
D. Wastewater treatment and discharge		11.5741	0.2272						NA, IE	NA, IE	0.0272	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												

International bunkers	**30.8414**	**0.0024**	**0.0010**						**0.1220**	**0.0934**	**0.2298**	**0.0098**
Aviation	30.8414	0.0024	0.0010						0.1220	0.0934	0.2298	0.0098
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	157.4600											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**1.4426**									
Indirect CO_2	**73.5965**											

Annex 1-6: Inventory Year - 1995

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**9,662.2364**	**166.5976**	**6.0382**	**1.0298**	**NO**	**NO**	**NO**	**NO**	**30.9295**	**66.5108**	**48.1949**	**31.8008**
1. Energy	**11,476.3176**	**31.4701**	**0.4305**						**29.4895**	**58.2503**	**7.3134**	**31.3056**
A. Fuel combustion Reference approach	11,441.9565											
Sectoral approach	11,475.8783	1.9344	0.4305						29.4895	58.2503	6.7793	31.3056
1. Energy industries	7,174.0286	0.1370	0.0502						12.9854	3.1484	0.2369	25.5949
2. Manufacturing industries and construction	386.3466	0.0080	0.0015						0.6898	0.5732	0.1809	0.3808
3. Transport	1,617.6947	0.4447	0.1058						6.1549	23.3801	2.9715	0.2340
4. Other sectors	2,172.1646	1.3343	0.2708						9.1456	30.5187	3.2884	4.8320
5. Other	125.6438	0.0104	0.0022						0.5138	0.6299	0.1015	0.2639
B. Fugitive emissions from fuels	0.4393	29.5357	0.0000						NO	NO	0.5341	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	0.4393	29.5357	0.0000						NO	NO	0.5341	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**455.6262**	**NO**	**0.0000**	**1.0298**	**NO**	**NO**	**NO**	**NO**	**1.2059**	**2.5644**	**39.1321**	**0.4898**
A. Mineral industry	351.6610								1.0921	0.9044	0.0090	0.4438
B. Chemical industry	NO	NO	NO						NO	NO	0.0060	NO
C. Metal industry	26.2369	NO	NO	NO	NO	NO	NO	NO	0.0854	1.1166	0.0327	0.0394
D. Non-energy products from fuels and solvent use	76.5607	NO	NO						0.0132	0.0740	29.2180	0.0065
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				1.0298	NO	NO	NO	NO				
G. Other product manufacture and use	1.1676	NO	0.0000	NO	NO	NO	NO	NO	0.0153	0.4695	0.5307	NO
H. Other									NO	NO	9.3357	NO
3. Agriculture	**0.0607**	**72.9745**	**4.5267**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		64.7235										
B. Manure management		8.2510	1.8043								NO	
C. Rice cultivation		NO										
D. Agricultural soils			2.7223									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	0.0607											

I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-2,284.8659**	**0.0896**	**0.8440**						**0.0829**	**3.0510**	**NO, NE**	
A. Forest land	-2,045.0670	0.0001	0.0000						0.0001	0.0030	NO, NE	
B. Cropland	1,316.7230	0.0895	0.0023						0.0828	3.0480	NO	
C. Grassland	-1,601.1004	NE	NE						NE	NE	NE	
D. Wetlands	-469.4389	NE	NE						NE	NE	NE	
E. Settlements	106.9167	NO, NE	0.8417						NO, NE	NO, NE	NO, NE	
F. Other land	401.1281	NE	NE						NE	NE	NE	
G. Harvested wood products	5.9727											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**15.0979**	**62.0635**	**0.2370**						**0.1512**	**2.6451**	**1.7494**	**0.0054**
A. Solid waste disposal	NA, NO	50.2429							NA, NO	NA, NO	1.6703	
B. Biological treatment of solid waste		0.0253	0.0015						NO, NE	0.0035	NO, NE	
C. Incineration and open burning of waste	15.0979	0.3096	0.0054						0.1512	2.6416	0.0584	0.0054
D. Wastewater treatment and discharge		11.4857	0.2301						NA, IE	NA, IE	0.0207	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**41.9508**	**0.0066**	**0.0014**						**0.1676**	**0.1539**	**0.2298**	**0.0133**
Aviation	41.9508	0.0066	0.0014						0.1676	0.1539	0.2298	0.0133
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	230.0480											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**1.3586**									
Indirect CO_2	**65.4471**											

Annex 1-7: Inventory Year - 1996

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**9,069.7634**	**164.6708**	**5.9658**	**1.6593**	**NO**	**NO**	**NO**	**NO**	**28.9453**	**78.7361**	**46.5154**	**31.9788**
1. Energy	**11,379.8429**	**35.3011**	**0.3745**						**27.6843**	**71.3532**	**8.7724**	**31.5576**
A. Fuel combustion Reference approach	11,323.8388											
Sectoral approach	11,379.3471	2.9694	0.3745						27.6843	71.3532	8.1891	31.5576
1. Energy industries	7,107.0544	0.1353	0.0469						12.7474	3.2595	0.2422	23.4411
2. Manufacturing industries and construction	326.3785	0.0070	0.0016						0.6523	0.6498	0.1616	0.4916
3. Transport	1,578.3769	0.4312	0.1009						5.9472	22.3021	2.8506	0.2207
4. Other sectors	2,285.6997	2.3850	0.2228						7.8951	44.6759	4.8360	7.2025
5. Other	81.8376	0.0109	0.0023						0.4423	0.4659	0.0987	0.2016
B. Fugitive emissions from fuels	0.4958	32.3317	0.0000						NO	NO	0.5834	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	0.4958	32.3317	0.0000						NO	NO	0.5834	NO

C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**415.2620**	**NO**	**0.0000**	**1.6593**	**NO**	**NO**	**NO**	**NO**	**1.0530**	**2.6496**	**36.1550**	**0.4158**
A. Mineral industry	316.3598								0.9331	0.8037	0.0070	0.3697
B. Chemical industry	NO	NO	NO						NO	NO	0.0085	NO
C. Metal industry	26.7261	NO	NO	NO	NO	NO	NO	NO	0.0870	1.1375	0.0332	0.0401
D. Non-energy products from fuels and solvent use	71.0712	NO	NO						0.0119	0.0671	27.0276	0.0059
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				1.6593	NO	NO	NO	NO				
G. Other product manufacture and use	1.1050	NO	0.0000	NO	NO	NO	NO	NO	0.0210	0.6414	0.5023	NO
H. Other									NO	NO	8.5764	NO
3. Agriculture	**0.0911**	**67.1693**	**4.4776**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		59.6750										
B. Manure management		7.4943	1.8962								NO	
C. Rice cultivation		NO										
D. Agricultural soils			2.5815									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	0.0911											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-2,740.5286**	**0.0616**	**0.8801**						**0.0569**	**2.0916**	**NO, NE**	
A. Forest land	-2,190.4337	0.0008	0.0000						0.0005	0.0176	NO, NE	
B. Cropland	1,118.5241	0.0609	0.0016						0.0564	2.0740	NO	
C. Grassland	-1,548.0826	NE	NE						NE	NE	NE	
D. Wetlands	-441.2360	NE	NE						NE	NE	NE	
E. Settlements	101.5910	NO, NE	0.8784						NO, NE	NO, NE	NO, NE	
F. Other land	217.3293	NE	NE						NE	NE	NE	
G. Harvested wood products	1.7792											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**15.0960**	**62.1388**	**0.2336**						**0.1511**	**2.6417**	**1.5880**	**0.0054**
A. Solid waste disposal	NA, NO	50.4732							NA, NO	NA, NO	1.5088	
B. Biological treatment of solid waste		0.0261	0.0016						NO, NE	0.0036	NO, NE	
C. Incineration and open burning of waste	15.0960	0.3094	0.0054						0.1511	2.6380	0.0584	0.0054
D. Wastewater treatment and discharge		11.3300	0.2266						NA, IE	NA, IE	0.0208	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**56.7300**	**0.0048**	**0.0018**						**0.2197**	**0.1539**	**0.0822**	**0.0180**
Aviation	56.7300	0.0048	0.0018						0.2197	0.1539	0.0822	0.0180
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	294.0280											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**1.3705**									
Indirect CO_2	**60.5658**											

Annex 1-8: Inventory Year - 1997

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**8,353.2467**	**149.0115**	**5.4829**	**2.3137**	**NO**	**NO**	**NO**	**NO**	**26.0436**	**73.9422**	**31.7581**	**16.7550**
1. Energy	**10,275.2096**	**29.7284**	**0.3430**						**24.5339**	**64.6496**	**7.9555**	**16.2511**
A. Fuel combustion Reference approach	10,209.9604											
Sectoral approach	10,274.7201	2.3177	0.3429						24.5339	64.6496	7.4670	16.2511
1. Energy industries	5,615.6123	0.1108	0.0244						9.5174	3.1362	0.2233	10.5370
2. Manufacturing industries and construction	563.8972	0.0145	0.0023						0.9216	0.7564	0.2860	0.4152
3. Transport	1,516.0213	0.4009	0.0976						5.9219	24.4735	3.0625	0.2299
4. Other sectors	2,502.5306	1.7835	0.2165						7.8855	35.7839	3.8166	4.8638
5. Other	76.6587	0.0081	0.0020						0.2875	0.4997	0.0785	0.2051
B. Fugitive emissions from fuels	0.4895	27.4107	0.0000						NO	NO	0.4886	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	0.4895	27.4107	0.0000						NO	NO	0.4886	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**452.4924**	**NO**	**0.0000**	**2.3137**	**NO**	**NO**	**NO**	**NO**	**1.2598**	**3.0011**	**22.3412**	**0.4985**
A. Mineral industry	377.0608								1.1298	0.9721	0.0097	0.4479
B. Chemical industry	NO	NO	NO						NO	NO	0.0068	NO
C. Metal industry	32.3806	NO	NO	NO	NO	NO	NO	NO	0.1054	1.3781	0.0401	0.0486
D. Non-energy products from fuels and solvent use	42.0528	NO	NO						0.0040	0.0227	14.1331	0.0020
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				2.3137	NO	NO	NO	NO				
G. Other product manufacture and use	0.9982	NO	0.0000	NO	NO	NO	NO	NO	0.0205	0.6281	0.4537	NO
H. Other									NO	NO	7.6977	NO
3. Agriculture	**1.0992**	**57.3905**	**3.9889**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		51.3040										
B. Manure management		6.0866	1.4681								NO	
C. Rice cultivation		NO										
D. Agricultural soils			2.5208									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	1.0992											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-2,390.6002**	**0.1075**	**0.9134**						**0.0995**	**3.6610**	**NO, NE**	
A. Forest land	-2,232.2854	0.0002	0.0000						0.0001	0.0053	NO, NE	
B. Cropland	1,385.7903	0.1073	0.0028						0.0993	3.6556	NO	
C. Grassland	-1,400.8607	NE	NE						NE	NE	NE	
D. Wetlands	-413.0332	NE	NE						NE	NE	NE	
E. Settlements	100.7954	NO, NE	0.9106						NO, NE	NO, NE	NO, NE	
F. Other land	188.2363	NE	NE						NE	NE	NE	
G. Harvested wood products	-19.2429											
H. Other	NE	NE	NE						NE	NE	NE	

5. Waste	**15.0456**	**61.7851**	**0.2376**						**0.1505**	**2.6305**	**1.4614**	**0.0054**
A. Solid waste disposal	NA, NO	49.8661							NA, NO	NA, NO	1.3847	
B. Biological treatment of solid waste		0.0245	0.0015						NO, NE	0.0034	NO, NE	
C. Incineration and open burning of waste	15.0456	0.3083	0.0054						0.1505	2.6271	0.0581	0.0054
D. Wastewater treatment and discharge		11.5861	0.2307						NA, IE	NA, IE	0.0186	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**66.1918**	**0.0054**	**0.0021**						**0.2640**	**0.1777**	**0.0937**	**0.0210**
Aviation	66.1918	0.0054	0.0021						0.2640	0.1777	0.0937	0.0210
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	291.1280											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**1.1651**									
Indirect CO_2	**32.0911**											

Annex 1-9: Inventory Year - 1998

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**6,859.2972**	**143.4887**	**5.2662**	**3.1372**	**NO**	**NO**	**NO**	**NO**	**21.8827**	**57.7109**	**27.7926**	**12.4820**
1. Energy	**8,891.0345**	**27.2535**	**0.2672**						**20.5268**	**49.2098**	**6.4073**	**12.0120**
A. Fuel combustion Reference approach	8,838.1605											
Sectoral approach	8,890.5850	1.7122	0.2672						20.5268	49.2098	5.9514	12.0120
1. Energy industries	4,836.6106	0.0962	0.0190						8.1103	2.7791	0.1972	7.9288
2. Manufacturing industries and construction	539.2845	0.0149	0.0022						0.8912	0.6944	0.2954	0.3171
3. Transport	1,363.1855	0.4034	0.0827						4.9702	21.3567	2.6620	0.1945
4. Other sectors	2,078.6760	1.1889	0.1612						6.1632	23.7935	2.6926	3.3628
5. Other	72.8283	0.0088	0.0021						0.3919	0.5862	0.1041	0.2088
B. Fugitive emissions from fuels	0.4495	25.5413	0.0000						NO	NO	0.4559	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	0.4495	25.5413	0.0000						NO	NO	0.4559	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**375.5168**	**NO**	**0.0000**	**3.1372**	**NO**	**NO**	**NO**	**NO**	**1.1142**	**2.5238**	**19.9607**	**0.4646**
A. Mineral industry	308.4801								1.0014	0.7878	0.0079	0.4198
B. Chemical industry	NO	NO	NO						NO	NO	0.0066	NO
C. Metal industry	28.6822	NO	NO	NO	NO	NO	NO	NO	0.0934	1.2208	0.0371	0.0431
D. Non-energy products from fuels and solvent use	37.6084	NO	NO						0.0033	0.0185	13.2678	0.0016
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				3.1372	NO	NO	NO	NO				
G. Other product manufacture and use	0.7460	NO	0.0000	NO	NO	NO	NO	NO	0.0162	0.4967	0.3391	NO
H. Other									NO	NO	6.3022	NO
3. Agriculture	**0.2721**	**55.4273**	**3.8036**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		49.8079										

B. Manure management		5.6194	1.3749								NO	
C. Rice cultivation		NO										
D. Agricultural soils			2.4288									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	0.2721											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-2,422.6056**	**0.0989**	**0.9542**						**0.0909**	**3.3430**	**NO, NE**	
A. Forest land	-2,288.4857	0.0023	0.0001						0.0015	0.0529	NO, NE	
B. Cropland	1,412.0577	0.0966	0.0025						0.0894	3.2900	NO	
C. Grassland	-1,436.2698	NE	NE						NE	NE	NE	
D. Wetlands	-384.8303	NE	NE						NE	NE	NE	
E. Settlements	99.0440	NO, NE	0.9516						NO, NE	NO, NE	NO, NE	
F. Other land	185.0077	NE	NE						NE	NE	NE	
G. Harvested wood products	-9.1293											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**15.0794**	**60.7090**	**0.2412**						**0.1508**	**2.6344**	**1.4245**	**0.0054**
A. Solid waste disposal	NA, NO	49.2046							NA, NO	NA, NO	1.3509	
B. Biological treatment of solid waste		0.0248	0.0015						NO, NE	0.0035	NO, NE	
C. Incineration and open burning of waste	15.0794	0.3089	0.0054						0.1508	2.6310	0.0582	0.0054
D. Wastewater treatment and discharge		11.1707	0.2342						NA, IE	NA, IE	0.0155	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**53.5923**	**0.0041**	**0.0017**						**0.2144**	**0.1439**	**0.0721**	**0.0170**
Aviation	53.5923	0.0041	0.0017						0.2144	0.1439	0.0721	0.0170
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	269.0120											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**1.0962**									
Indirect CO_2	**29.9352**											

Annex 1-10: Inventory Year - 1999

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**5,126.5807**	**138.4872**	**4.8700**	**4.0002**	**NO**	**NO**	**NO**	**NO**	**16.0323**	**42.4130**	**23.4240**	**5.9010**
1. Energy	**6,913.7785**	**26.8852**	**0.1824**						**14.8145**	**37.0134**	**5.0420**	**5.4970**
A. Fuel combustion Reference approach	6,851.6906											
Sectoral approach	6,913.3665	1.5525	0.1824						14.8145	37.0134	4.5862	5.4970
1. Energy industries	3,660.2540	0.0727	0.0088						5.8881	2.3787	0.1638	2.1288
2. Manufacturing industries and construction	483.9580	0.0108	0.0016						0.7410	0.5239	0.2274	0.2536
3. Transport	910.5958	0.2475	0.0514						3.3339	12.5288	1.5798	0.1366

4. Other sectors	1,809.4024	1.2151	0.1190						4.7057	21.2190	2.5511	2.8154
5. Other	49.1563	0.0065	0.0016						0.1458	0.3630	0.0640	0.1625
B. Fugitive emissions from fuels	0.4121	25.3327	0.0000						NO	NO	0.4558	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	0.4121	25.3327	0.0000						NO	NO	0.4558	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**338.2305**	**NO**	**0.0000**	**4.0002**	**NO**	**NO**	**NO**	**NO**	**0.9796**	**2.6451**	**17.0520**	**0.3987**
A. Mineral industry	271.7103								0.8542	0.6973	0.0076	0.3494
B. Chemical industry	NO	NO	NO						NO	NO	0.0050	NO
C. Metal industry	31.7942	NO	NO	NO	NO	NO	NO	NO	0.1035	1.3533	0.0408	0.0478
D. Non-energy products from fuels and solvent use	34.0839	NO	NO						0.0031	0.0172	12.7587	0.0015
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				4.0002	NO	NO	NO	NO				
G. Other product manufacture and use	0.6421	NO	0.0000	NO	NO	NO	NO	NO	0.0189	0.5773	0.2919	NO
H. Other									NO	NO	3.9481	NO
3. Agriculture	**0.0034**	**50.9665**	**3.4655**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		46.0727										
B. Manure management		4.8938	1.2401								NO	
C. Rice cultivation		NO										
D. Agricultural soils			2.2253									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	0.0034											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-2,140.4389**	**0.0956**	**0.9861**						**0.0880**	**0.1265**	**NO, NE**	
A. Forest land	-2,336.8468	0.0017	0.0001						0.0011	0.0396	NO, NE	
B. Cropland	1,430.7993	0.0938	0.0024						0.0869	0.0869	NO	
C. Grassland	-1,433.2865	NE	NE						NE	NE	NE	
D. Wetlands	-356.6274	NE	NE						NE	NE	NE	
E. Settlements	111.8259	NO, NE	0.9836						NO, NE	NO, NE	NO, NE	
F. Other land	425.1554	NE	NE						NE	NE	NE	
G. Harvested wood products	18.5414											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**15.0071**	**60.5398**	**0.2360**						**0.1502**	**2.6281**	**1.3300**	**0.0053**
A. Solid waste disposal	NA, NO	49.3861							NA, NO	NA, NO	1.2600	
B. Biological treatment of solid waste		0.0232	0.0014						NO, NE	0.0033	NO, NE	
C. Incineration and open burning of waste	15.0071	0.3077	0.0054						0.1502	2.6248	0.0581	0.0053
D. Wastewater treatment and discharge		10.8228	0.2292						NA, IE	NA, IE	0.0119	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**63.0390**	**0.0040**	**0.0020**						**0.2517**	**0.1574**	**0.0796**	**0.0200**
Aviation	63.0390	0.0040	0.0020						0.2517	0.1574	0.0796	0.0200

Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	266.1120											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**0.9864**									
Indirect CO_2	**28.7113**											

Annex 1-11: Inventory Year - 2000

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**4,095.3870**	**134.8915**	**4.5993**	**5.1199**	**NO**	**NO**	**NO**	**NO**	**14.8344**	**41.2335**	**22.9213**	**4.5137**
1. Energy	**6,189.8822**	**28.1005**	**0.1627**						**13.5115**	**34.6241**	**4.9241**	**3.9685**
A. Fuel combustion Reference approach	6,127.8139											
Sectoral approach	6,189.4898	1.5357	0.1627						13.5115	34.6241	4.4422	3.9685
1. Energy industries	3,155.7517	0.0610	0.0069						5.0439	2.1204	0.1437	0.9753
2. Manufacturing industries and construction	520.9679	0.0098	0.0014						0.7914	0.4871	0.2261	0.2274
3. Transport	982.2638	0.2519	0.0574						3.7206	12.4426	1.5683	0.1582
4. Other sectors	1,494.1182	1.2084	0.0960						3.8246	19.3419	2.4620	2.4553
5. Other	36.3881	0.0046	0.0010						0.1311	0.2320	0.0421	0.1523
B. Fugitive emissions from fuels	0.3924	26.5648	0.0000						NO	NO	0.4819	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	0.3924	26.5648	0.0000						NO	NO	0.4819	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**310.6441**	**NO**	**0.0000**	**5.1199**	**NO**	**NO**	**NO**	**NO**	**1.1392**	**2.7463**	**16.6714**	**0.5399**
A. Mineral industry	240.7803								0.9987	0.5762	0.0068	0.4842
B. Chemical industry	NO	NO	NO						NO	NO	0.0073	NO
C. Metal industry	36.2689	NO	NO	NO	NO	NO	NO	NO	0.1181	1.5438	0.0462	0.0545
D. Non-energy products from fuels and solvent use	32.6395	NO	NO						0.0025	0.0139	12.5638	0.0012
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				5.1199	NO	NO	NO	NO				
G. Other product manufacture and use	0.9554	NO	0.0000	NO	NO	NO	NO	NO	0.0200	0.6124	0.4343	NO
H. Other									NO	NO	3.6129	NO
3. Agriculture	**0.4397**	**47.2751**	**3.2009**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		43.4313										
B. Manure management		3.8438	1.0833								NO	
C. Rice cultivation		NO										
D. Agricultural soils			2.1176									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	0.4397											
I. Other carbon-containing fertilizers	NO, NE											

J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-2,420.5755**	**0.0365**	**0.9944**						**0.0338**	**1.2427**	**NO, NE**	
A. Forest land	-2,307.4384	0.0001	0.0000						0.0000	0.0014	NO, NE	
B. Cropland	1,222.7282	0.0364	0.0009						0.0337	1.2413	NO	
C. Grassland	-1,291.9495	NE	NE						NE	NE	NE	
D. Wetlands	-328.4245	NE	NE						NE	NE	NE	
E. Settlements	100.1768	NO, NE	0.9934						NO, NE	NO, NE	NO, NE	
F. Other land	178.5246	NE	NE						NE	NE	NE	
G. Harvested wood products	5.8073											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**14.9965**	**59.4794**	**0.2413**						**0.1500**	**2.6204**	**1.3258**	**0.0054**
A. Solid waste disposal	NA, NO	48.2815							NA, NO	NA, NO	1.2568	
B. Biological treatment of solid waste		0.0210	0.0013						NO, NE	0.0029	NO, NE	
C. Incineration and open burning of waste	14.9965	0.3073	0.0054						0.1500	2.6175	0.0579	0.0054
D. Wastewater treatment and discharge		10.8697	0.2346						NA, IE	NA, IE	0.0111	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**63.0779**	**0.0043**	**0.0020**						**0.2591**	**0.1688**	**0.0773**	**0.0200**
Aviation	63.0779	0.0043	0.0020						0.2591	0.1688	0.0773	0.0200
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	272.3720											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**0.8910**									
Indirect CO_2	**28.5957**											

Annex 1-12: Inventory Year - 2001

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**5,082.6367**	**134.4106**	**4.8566**	**6.8681**	**NO**	**NO**	**NO**	**NO**	**16.2102**	**40.6409**	**24.4817**	**3.9943**
1. Energy	**6,819.3643**	**28.0333**	**0.1673**						**14.9244**	**33.4823**	**4.8324**	**3.4823**
A. Fuel combustion Reference approach	6,769.5962											
Sectoral approach	6,818.9369	1.4121	0.1673						14.9244	33.4823	4.3519	3.4823
1. Energy industries	3,677.7189	0.0726	0.0080						5.8773	2.5004	0.1689	0.8801
2. Manufacturing industries and construction	601.9346	0.0123	0.0019						1.1500	0.5744	0.2598	0.2566
3. Transport	1,061.7864	0.2667	0.0634						3.9981	13.3140	1.6688	0.1332
4. Other sectors	1,434.1009	1.0554	0.0928						3.7425	16.7367	2.1939	2.1063
5. Other	43.3961	0.0050	0.0012						0.1565	0.3569	0.0605	0.1061
B. Fugitive emissions from fuels	0.4274	26.6212	0.0000						NO	NO	0.4805	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	0.4274	26.6212	0.0000						NO	NO	0.4805	NO

C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**312.9423**	**NO**	**0.0000**	**6.8681**	**NO**	**NO**	**NO**	**NO**	**1.0901**	**2.8557**	**18.4464**	**0.5066**
A. Mineral industry	237.0750								0.9409	0.5713	0.0068	0.4470
B. Chemical industry	NO	NO	NO						NO	NO	0.0080	NO
C. Metal industry	38.6274	NO	NO	NO	NO	NO	NO	NO	0.1257	1.6441	0.0500	0.0580
D. Non-energy products from fuels and solvent use	36.4195	NO	NO						0.0031	0.0174	14.0195	0.0015
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				6.8681	NO	NO	NO	NO				
G. Other product manufacture and use	0.8204	NO	0.0000	NO	NO	NO	NO	NO	0.0203	0.6229	0.3729	NO
H. Other									NO	NO	3.9893	NO
3. Agriculture	**0.1496**	**47.9939**	**3.4503**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		44.1309										
B. Manure management		3.8630	1.1030								NO	
C. Rice cultivation		NO										
D. Agricultural soils			2.3473									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	0.1496											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-2,064.7883**	**0.0508**	**0.9951**						**0.0459**	**1.6868**	**NO, NE**	
A. Forest land	-2,273.7027	0.0039	0.0002						0.0025	0.0896	NO, NE	
B. Cropland	1,560.4352	0.0469	0.0012						0.0434	1.5972	NO	
C. Grassland	-1,290.6541	NE	NE						NE	NE	NE	
D. Wetlands	-300.2217	NE	NE						NE	NE	NE	
E. Settlements	67.0898	NO, NE	0.9937						NO, NE	NO, NE	NO, NE	
F. Other land	178.5246	NE	NE						NE	NE	NE	
G. Harvested wood products	-6.2594											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**14.9689**	**58.3326**	**0.2438**						**0.1497**	**2.6161**	**1.2028**	**0.0054**
A. Solid waste disposal	NA, NO	46.9170							NA, NO	NA, NO	1.1343	
B. Biological treatment of solid waste		0.0190	0.0011						NO, NE	0.0027	NO, NE	
C. Incineration and open burning of waste	14.9689	0.3067	0.0054						0.1497	2.6134	0.0578	0.0054
D. Wastewater treatment and discharge		11.0899	0.2373						NA, IE	NA, IE	0.0106	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**50.4863**	**0.0039**	**0.0016**						**0.1936**	**0.1468**	**0.0630**	**0.0160**
Aviation	50.4863	0.0039	0.0016						0.1936	0.1468	0.0630	0.0160
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	282.2280											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**0.9449**									
Indirect CO_2	**31.6632**											

Annex 1-13: Inventory Year - 2002

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**4,762.9045**	**136.9677**	**5.0563**	**9.1227**	**NO**	**NO**	**NO**	**NO**	**16.8987**	**45.7399**	**26.8842**	**4.8222**
1. Energy	**6,538.3068**	**30.1374**	**0.2146**						**15.5363**	**40.7317**	**5.9151**	**4.2675**
A. Fuel combustion Reference approach	6,479.3085											
Sectoral approach	6,537.9006	1.7746	0.2146						15.5363	40.7317	5.3987	4.2675
1. Energy industries	2,933.2101	0.0614	0.0069						4.6959	2.0055	0.1356	0.6884
2. Manufacturing industries and construction	411.7767	0.0077	0.0011						0.6019	0.4089	0.1809	0.2019
3. Transport	1,405.6363	0.3418	0.0947						5.6192	17.2878	2.2088	0.1735
4. Other sectors	1,747.8245	1.3555	0.1103						4.4782	20.7434	2.8052	3.0494
5. Other	39.4529	0.0083	0.0016						0.1411	0.2860	0.0683	0.1543
B. Fugitive emissions from fuels	0.4062	28.3628	0.0000						NO	NO	0.5164	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	0.4062	28.3628	0.0000						NO	NO	0.5164	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**361.1500**	**NO**	**0.0000**	**9.1227**	**NO**	**NO**	**NO**	**NO**	**1.2039**	**2.0646**	**19.7692**	**0.5494**
A. Mineral industry	301.4884								1.1197	0.7266	0.0084	0.5172
B. Chemical industry	NO	NO	NO						NO	NO	0.0104	NO
C. Metal industry	20.5030	NO	NO	NO	NO	NO	NO	NO	0.0667	0.8725	0.0263	0.0308
D. Non-energy products from fuels and solvent use	38.3743	NO	NO						0.0027	0.0153	14.8206	0.0013
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				9.1227	NO	NO	NO	NO				
G. Other product manufacture and use	0.7843	NO	0.0000	NO	NO	NO	NO	NO	0.0147	0.4503	0.3565	NO
H. Other									NO	NO	4.5471	NO
3. Agriculture	**0.0470**	**49.0432**	**3.5951**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		45.0244										
B. Manure management		4.0188	1.1134								NO	
C. Rice cultivation		NO										
D. Agricultural soils			2.4816									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	0.0470											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-2,151.5395**	**0.0106**	**0.9965**						**0.0092**	**0.3385**	**NO, NE**	
A. Forest land	-2,267.6159	0.0021	0.0001						0.0013	0.0481	NO, NE	
B. Cropland	1,156.5876	0.0085	0.0002						0.0079	0.2904	NO	
C. Grassland	-1,235.1380	NE	NE						NE	NE	NE	
D. Wetlands	-272.0188	NE	NE						NE	NE	NE	
E. Settlements	67.0898	NO, NE	0.9961						NO, NE	NO, NE	NO, NE	
F. Other land	456.2431	NE	NE						NE	NE	NE	

G. Harvested wood products	-56.6873											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**14.9402**	**57.7765**	**0.2500**						**0.1493**	**2.6051**	**1.1999**	**0.0054**
A. Solid waste disposal	NA, NO	45.6713							NA, NO	NA, NO	1.1318	
B. Biological treatment of solid waste		0.0209	0.0013						NO, NE	0.0029	NO, NE	
C. Incineration and open burning of waste	14.9402	0.3059	0.0054						0.1493	2.6022	0.0576	0.0054
D. Wastewater treatment and discharge		11.7785	0.2434						NA, IE	NA, IE	0.0104	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**59.9541**	**0.0036**	**0.0020**						**0.2413**	**0.1619**	**0.0653**	**0.0190**
Aviation	59.9541	0.0036	0.0020						0.2413	0.1619	0.0653	0.0190
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	322.0800											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**0.9828**									
Indirect CO_2	**33.3896**											

Annex 1-14: Inventory Year - 2003

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**5,501.9182**	**133.3682**	**4.6000**	**12.1632**	**NO**	**NO**	**0.0000**	**NO**	**17.9406**	**55.2708**	**27.8119**	**6.3270**
1. Energy	**7,179.5364**	**32.0059**	**0.2087**						**16.5078**	**49.7946**	**7.0723**	**5.7398**
A. Fuel combustion Reference approach	7,144.5381											
Sectoral approach	7,178.4599	2.2674	0.2087						16.5078	49.7946	6.4898	5.7398
1. Energy industries	3,036.7432	0.0626	0.0069						4.8529	2.0895	0.1407	0.5251
2. Manufacturing industries and construction	439.9447	0.0083	0.0011						0.6706	0.3922	0.1897	0.1716
3. Transport	1,588.6955	0.4003	0.0912						6.1096	20.6504	2.5992	0.2110
4. Other sectors	2,084.6537	1.7920	0.1085						4.7321	26.3815	3.5078	4.7236
5. Other	28.4228	0.0043	0.0009						0.1427	0.2811	0.0524	0.1085
B. Fugitive emissions from fuels	1.0765	29.7385	0.0000						NO	NO	0.5825	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	1.0765	29.7385	0.0000						NO	NO	0.5825	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**386.3885**	**NO**	**0.0000**	**12.1632**	**NO**	**NO**	**0.0000**	**NO**	**1.2824**	**2.8260**	**19.6528**	**0.5819**
A. Mineral industry	309.0730								1.1464	0.7495	0.0092	0.5274
B. Chemical industry	NO	NO	NO						NO	NO	0.0123	NO
C. Metal industry	35.4283	NO	NO	NO	NO	NO	NO	NO	0.1153	1.5074	0.0456	0.0532
D. Non-energy products from fuels and solvent use	40.9252	NO	NO						0.0026	0.0145	14.8735	0.0013
E. Electronic industry				NO	NO	NO	NO	NO				

F. Product uses as substitutes for ODS				12.1632	NO	NO	NO	NO				
G. Other product manufacture and use	0.9620	NO	0.0000	NO	NO	NO	0.0000	NO	0.0181	0.5545	0.4373	NO
H. Other									NO	NO	4.2749	NO
3. Agriculture	**0.2381**	**44.8709**	**3.1618**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		41.1415										
B. Manure management		3.7294	1.0567								NO	
C. Rice cultivation		NO										
D. Agricultural soils			2.1051									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	0.2381											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-2,079.1549**	**0.0024**	**0.9877**						**0.0016**	**0.0573**	**NO, NE**	
A. Forest land	-2,270.1176	0.0023	0.0001						0.0015	0.0526	NO, NE	
B. Cropland	1,237.5523	0.0001	0.0000						0.0001	0.0046	NO	
C. Grassland	-1,007.1842	NE	NE						NE	NE	NE	
D. Wetlands	-243.8159	NE	NE						NE	NE	NE	
E. Settlements	67.8615	NO, NE	0.9876						NO, NE	NO, NE	NO, NE	
F. Other land	201.6619	NE	NE						NE	NE	NE	
G. Harvested wood products	-65.1129											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**14.9100**	**56.4890**	**0.2418**						**0.1488**	**2.5930**	**1.0868**	**0.0054**
A. Solid waste disposal	NA, NO	44.0789							NA, NO	NA, NO	1.0191	
B. Biological treatment of solid waste		0.0219	0.0013						NO, NE	0.0031	NO, NE	
C. Incineration and open burning of waste	14.9100	0.3050	0.0054						0.1488	2.5899	0.0574	0.0054
D. Wastewater treatment and discharge		12.0831	0.2351						NA, IE	NA, IE	0.0103	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**34.7676**	**0.0035**	**0.0012**						**0.1317**	**0.1223**	**0.0403**	**0.0110**
Aviation	34.7676	0.0035	0.0012						0.1317	0.1223	0.0403	0.0110
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	373.5760											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**0.8836**									
Indirect CO_2	**33.6837**											

Annex 1-15: Inventory Year - 2004

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**5,853.5527**	**131.9612**	**4.8205**	**16.0027**	**NO**	**NO**	**0.0000**	**NO**	**19.3032**	**52.6872**	**39.4607**	**5.4764**
1. Energy	**7,630.4387**	**34.1013**	**0.2113**						**17.7126**	**46.7598**	**7.1333**	**4.8271**
A. Fuel combustion Reference approach	7,595.3946											
Sectoral approach	7,629.3163	1.9771	0.2113						17.7126	46.7598	6.2260	4.8271
1. Energy industries	3,107.0816	0.0639	0.0071						4.9649	2.1435	0.1442	0.4804
2. Manufacturing industries and construction	448.3884	0.0097	0.0014						0.7048	0.4457	0.2047	0.2034
3. Transport	1,786.1813	0.4311	0.1062						7.1263	22.4044	2.8401	0.2464
4. Other sectors	2,260.0278	1.4692	0.0957						4.7005	21.4786	2.9899	3.8578
5. Other	27.6373	0.0031	0.0010						4.7005	21.4786	2.9899	3.8578
B. Fugitive emissions from fuels	1.1223	32.1242	0.0000						NO	NO	0.9073	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	1.1223	32.1242	0.0000						NO	NO	0.9073	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**456.1463**	**NO**	**0.0001**	**16.0027**	**NO**	**NO**	**0.0000**	**NO**	**1.4368**	**3.2083**	**31.1819**	**0.6438**
A. Mineral industry	350.4572								1.2780	0.8629	0.0106	0.5790
B. Chemical industry	NO	NO	NO						NO	NO	0.0129	NO
C. Metal industry	40.5084	NO	NO	NO	NO	NO	NO	NO	0.1318	1.7236	0.0522	0.0608
D. Non-energy products from fuels and solvent use	64.1303	NO	NO						0.0082	0.0459	25.3328	0.0041
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				16.0027	NO	NO	NO	NO				
G. Other product manufacture and use	1.0504	NO	0.0001	NO	NO	NO	0.0000	NO	0.0188	0.5759	0.4774	NO
H. Other									NO	NO	5.2960	NO
3. Agriculture	**0.3669**	**41.9611**	**3.4051**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		38.4568										
B. Manure management		3.5042	1.0264								NO	
C. Rice cultivation		NO										
D. Agricultural soils			2.3786									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	0.3669											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-2,248.2613**	**0.0080**	**0.9736**						**0.0057**	**0.1401**	**NO, NE**	
A. Forest land	-2,334.7768	0.0061	0.0003						0.0039	0.1383	NO, NE	
B. Cropland	1,198.5883	0.0020	0.0001						0.0018	0.0018	NO	
C. Grassland	-1,120.4767	NE	NE						NE	NE	NE	
D. Wetlands	-215.6130	NE	NE						NE	NE	NE	
E. Settlements	53.6737	NO, NE	0.9732						NO, NE	NO, NE	NO, NE	
F. Other land	223.8177	NE	NE						NE	NE	NE	
G. Harvested wood products	-53.4745											
H. Other	NE	NE	NE						NE	NE	NE	

5. Waste	**14.8621**	**55.8907**	**0.2305**						**0.1481**	**2.5791**	**1.1456**	**0.0054**
A. Solid waste disposal	NA, NO	43.4137							NA, NO	NA, NO	1.0781	
B. Biological treatment of solid waste		0.0230	0.0014						NO, NE	0.0032	NO, NE	
C. Incineration and open burning of waste	14.8621	0.3039	0.0053						0.1481	2.5759	0.0572	0.0054
D. Wastewater treatment and discharge		12.1502	0.2238						NA, IE	NA, IE	0.0103	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**34.7903**	**0.0035**	**0.0012**						**0.1283**	**0.1296**	**0.0344**	**0.0110**
Aviation	34.7903	0.0035	0.0012						0.1283	0.1296	0.0344	0.0110
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	307.6800											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**0.9226**									
Indirect CO_2	**56.7824**											

Annex 1-16: Inventory Year - 2005

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**6,484.7979**	**132.6848**	**4.8969**	**22.5106**	**NO**	**NO**	**0.0000**	**NO**	**19.9710**	**54.7851**	**42.1519**	**5.1861**
1. Energy	**7,873.9844**	**35.9818**	**0.2113**						**18.0996**	**48.4438**	**7.2370**	**4.4251**
A. Fuel combustion Reference approach	7,835.8382											
Sectoral approach	7,872.8438	2.0747	0.2113						18.0996	48.4438	6.4175	4.4251
1. Energy industries	3,229.4503	0.0660	0.0072						5.1572	2.2318	0.1500	0.4400
2. Manufacturing industries and construction	576.6569	0.0113	0.0015						0.8627	0.4875	0.2515	0.1899
3. Transport	1,821.7199	0.4397	0.1150						7.5129	22.8675	2.9169	0.0452
4. Other sectors	2,219.0765	1.5553	0.0866						4.3367	22.7299	3.0691	3.7081
5. Other	25.9403	0.0024	0.0010						0.2301	0.1272	0.0300	0.0418
B. Fugitive emissions from fuels	1.1406	33.9070	0.0000						NO	NO	0.8196	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	1.1406	33.9070	0.0000						NO	NO	0.8196	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**550.4807**	**NO**	**0.0001**	**22.5106**	**NO**	**NO**	**0.0000**	**NO**	**1.7183**	**3.4998**	**33.6173**	**0.7558**
A. Mineral industry	439.1892								1.5556	1.1045	0.0135	0.6890
B. Chemical industry	NO	NO	NO						NO	NO	0.0149	NO
C. Metal industry	41.9358	NO	NO	NO	NO	NO	NO	NO	0.1364	1.7839	0.0545	0.0630
D. Non-energy products from fuels and solvent use	68.1910	NO	NO						0.0077	0.0431	27.2264	0.0038
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				22.5106	NO	NO	NO	NO				
G. Other product manufacture and use	1.1646	NO	0.0001	NO	NO	NO	0.0000	NO	0.0186	0.5683	0.5294	NO
H. Other									NO	NO	5.7786	NO
3. Agriculture	**0.1739**	**40.6563**	**3.5122**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		36.9611										

B. Manure management		3.6952	1.1022								NO	
C. Rice cultivation		NO										
D. Agricultural soils			2.4100									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	0.1739											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-1,954.3081**	**0.0099**	**0.9615**						**0.0090**	**0.3317**	**NO, NE**	
A. Forest land	-2,409.5185	0.0006	0.0000						0.0004	0.0132	NO, NE	
B. Cropland	1,271.6794	0.0093	0.0002						0.0087	0.3185	NO	
C. Grassland	-1,058.1239	NE	NE						NE	NE	NE	
D. Wetlands	-187.4101	NE	NE						NE	NE	NE	
E. Settlements	53.6737	NO, NE	0.9613						NO, NE	NO, NE	NO, NE	
F. Other land	416.5012	NE	NE						NE	NE	NE	
G. Harvested wood products	-41.1098											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**14.4670**	**56.0368**	**0.2118**						**0.1442**	**2.5098**	**1.2975**	**0.0053**
A. Solid waste disposal	NA, NO	43.7444							NA, NO	NA, NO	1.2315	
B. Biological treatment of solid waste		0.0241	0.0014						NO, NE	0.0034	NO, NE	
C. Incineration and open burning of waste	14.4670	0.2957	0.0052						0.1442	2.5064	0.0556	0.0053
D. Wastewater treatment and discharge		11.9725	0.2051						NA, IE	NA, IE	0.0103	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**37.9260**	**0.0035**	**0.0013**						**0.1433**	**0.1362**	**0.0373**	**0.0120**
Aviation	37.9260	0.0035	0.0013						0.1433	0.1362	0.0373	0.0120
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	307.3920											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**0.9665**									
Indirect CO_2	**61.0627**											

Annex 1-17: Inventory Year - 2006

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**5,697.7447**	**127.1264**	**4.7940**	**33.2493**	**0.0231**	**NO**	**0.0000**	**NO**	**19.0350**	**55.2438**	**47.5410**	**5.3328**
1. Energy	**7,114.2233**	**32.1351**	**0.2164**						**17.0365**	**49.3930**	**7.3505**	**4.5538**
A. Fuel combustion Reference approach	7,075.9753											
Sectoral approach	7,112.9809	2.2706	0.2164						17.0365	49.3930	6.6436	4.5538
1. Energy industries	2,492.9310	0.0517	0.0057						3.9840	1.7263	0.1160	0.3339
2. Manufacturing industries and construction	635.2427	0.0119	0.0015						0.9501	0.4873	0.2692	0.1695
3. Transport	1,742.1028	0.4060	0.1198						7.4749	21.0274	2.7125	0.0436

4. Other sectors	2,203.6648	1.7981	0.0881						4.2950	25.7482	3.4823	3.8856
5. Other	39.0397	0.0029	0.0013						0.3325	0.4037	0.0635	0.1212
B. Fugitive emissions from fuels	1.2424	29.8644	0.0000						NO	NO	0.7069	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	1.2424	29.8644	0.0000						NO	NO	0.7069	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**645.4865**	**NO**	**0.0001**	**33.2493**	**0.0231**	**NO**	**0.0000**	**NO**	**1.8503**	**3.1294**	**38.8065**	**0.7739**
A. Mineral industry	535.4220								1.7321	1.3597	0.0165	0.7272
B. Chemical industry	NO	NO	NO						NO	NO	0.0130	NO
C. Metal industry	27.0182	NO	NO	NO	NO	NO	NO	NO	0.0879	1.1492	0.0355	0.0406
D. Non-energy products from fuels and solvent use	81.9807	NO	NO						0.0124	0.0697	33.2258	0.0062
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				33.2493	NO	NO	NO	NO				
G. Other product manufacture and use	1.0655	NO	0.0001	NO	0.0231	NO	0.0000	NO	0.0180	0.5508	0.4843	NO
H. Other									NO	NO	5.0313	NO
3. Agriculture	**0.1460**	**39.5494**	**3.4111**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		35.7523										
B. Manure management		3.7971	1.1361								NO	
C. Rice cultivation		NO										
D. Agricultural soils			2.2750									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	0.1460											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-2,076.2371**	**0.0100**	**0.9483**						**0.0075**	**0.2706**	**NO, NE**	
A. Forest land	-2,366.5168	0.0063	0.0003						0.0040	0.1427	NO, NE	
B. Cropland	1,303.2724	0.0038	0.0001						0.0035	0.1279	NO	
C. Grassland	-1,056.3692	NE	NE						NE	NE	NE	
D. Wetlands	-159.2073	NE	NE						NE	NE	NE	
E. Settlements	53.6737	NO, NE	0.9479						NO, NE	NO, NE	NO, NE	
F. Other land	189.4964	NE	NE						NE	NE	NE	
G. Harvested wood products	-40.5864											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**14.1260**	**55.4319**	**0.2180**						**0.1408**	**2.4509**	**1.3840**	**0.0051**
A. Solid waste disposal	NA, NO	43.5887							NA, NO	NA, NO	1.3194	
B. Biological treatment of solid waste		0.0261	0.0016						NO, NE	0.0037	NO, NE	
C. Incineration and open burning of waste	14.1260	0.2888	0.0051						0.1408	2.4472	0.0543	0.0051
D. Wastewater treatment and discharge		11.5283	0.2114						NA, IE	NA, IE	0.0103	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**37.9241**	**0.0039**	**0.0013**						**0.1428**	**0.1424**	**0.0397**	**0.0120**
Aviation	37.9241	0.0039	0.0013						0.1428	0.1424	0.0397	0.0120
Navigation	NO	NO	NO						NO	NO	NO	NO

Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	361.4360											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**0.9556**									
Indirect CO_2	**74.1622**											

Annex 1-18: Inventory Year - 2007

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**5,888.6802**	**120.3744**	**4.1482**	**44.7872**	**0.0231**	**NO**	**0.0000**	**NO**	**20.0202**	**51.1171**	**47.4475**	**4.0330**
1. Energy	**7,251.2550**	**33.6430**	**0.2092**						**17.4545**	**42.9555**	**6.7550**	**3.1042**
A. Fuel combustion Reference approach	7,206.8061											
Sectoral approach	7,249.9793	1.8066	0.2092						17.4545	42.9555	5.8517	3.1042
1. Energy industries	2,890.4481	0.0592	0.0063						4.6122	2.0151	0.1350	0.2113
2. Manufacturing industries and construction	801.5026	0.0149	0.0017						1.1306	0.5048	0.3350	0.0989
3. Transport	1,846.7731	0.4274	0.1253						7.9312	21.7418	2.8091	0.0462
4. Other sectors	1,666.7458	1.3012	0.0741						3.3949	18.3862	2.5173	2.6494
5. Other	44.5097	0.0039	0.0017						0.3855	0.3075	0.0552	0.0983
B. Fugitive emissions from fuels	1.2757	31.8364	0.0000						NO	NO	0.9033	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	1.2757	31.8364	0.0000						NO	NO	0.9033	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**892.1071**	**NO**	**NO**	**44.7872**	**0.0231**	**NO**	**0.0000**	**NO**	**2.3881**	**4.3206**	**39.1522**	**0.9238**
A. Mineral industry	767.6859								2.2296	1.9983	0.0245	0.8593
B. Chemical industry	NO	NO	NO						NO	NO	0.0139	NO
C. Metal industry	38.6127	NO	NO	NO	NO	NO	NO	NO	0.1256	1.6426	0.0508	0.0580
D. Non-energy products from fuels and solvent use	84.7433	NO	NO						0.0130	0.0732	34.9915	0.0065
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				44.7872	NO	NO	NO	NO				
G. Other product manufacture and use	1.0652	NO	NO	NO	0.0231	NO	0.0000	NO	0.0198	0.6066	0.4842	NO
H. Other									NO	NO	3.5873	NO
3. Agriculture	**0.2631**	**31.5420**	**2.8030**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		28.8838										
B. Manure management		2.6582	0.8615								NO	
C. Rice cultivation		NO										
D. Agricultural soils			1.9415									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	0.2631											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-2,268.7122**	**0.0607**	**0.9330**						**0.0405**	**1.4511**	**NO, NE**	

A. Forest land	-2,460.3855	0.0546	0.0030						0.0349	1.2432	NO, NE	
B. Cropland	1,266.1250	0.0061	0.0002						0.0056	0.2079	NO	
C. Grassland	-1,031.2350	NE	NE						NE	NE	NE	
D. Wetlands	-131.0044	NE	NE						NE	NE	NE	
E. Settlements	49.2742	NO, NE	0.9298						NO, NE	NO, NE	NO, NE	
F. Other land	83.1072	NE	NE						NE	NE	NE	
G. Harvested wood products	-44.5936											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**13.7672**	**55.1286**	**0.2031**						**0.1372**	**2.3898**	**1.5403**	**0.0050**
A. Solid waste disposal	NA, NO	43.6535							NA, NO	NA, NO	1.4772	
B. Biological treatment of solid waste		0.0339	0.0020						NO, NE	0.0047	NO, NE	
C. Incineration and open burning of waste	13.7672	0.2814	0.0049						0.1372	2.3851	0.0529	0.0050
D. Wastewater treatment and discharge		11.1599	0.1961						NA, IE	NA, IE	0.0102	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**44.2052**	**0.0027**	**0.0015**						**0.1782**	**0.1296**	**0.0393**	**0.0140**
Aviation	44.2052	0.0027	0.0015						0.1782	0.1296	0.0393	0.0140
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	304.6560											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**0.7714**									
Indirect CO_2	**78.0464**											

Annex 1-19: Inventory Year - 2008

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**6,574.2719**	**119.6418**	**4.4739**	**57.3610**	**0.0288**	**NO**	**0.0000**	**NO**	**20.8656**	**53.3534**	**41.0502**	**5.6386**
1. Energy	**7,548.6755**	**33.5536**	**0.2128**						**18.1364**	**45.6619**	**7.3512**	**4.6736**
A. Fuel combustion Reference approach	7,504.2095											
Sectoral approach	7,547.3826	1.8613	0.2127						18.1364	45.6619	6.1704	4.6736
1. Energy industries	2,990.8419	0.0652	0.0072						4.7865	2.0898	0.1404	0.3057
2. Manufacturing industries and construction	885.5633	0.0154	0.0045						1.3642	2.2677	0.4690	1.8477
3. Transport	1,949.9802	0.4511	0.1272						8.2916	22.7260	2.9400	0.0485
4. Other sectors	1,677.3708	1.3260	0.0723						3.3719	18.2724	2.5708	2.3550
5. Other	43.6263	0.0036	0.0015						0.3223	0.3060	0.0503	0.1167
B. Fugitive emissions from fuels	1.2929	31.6922	0.0000						NO	NO	1.1807	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	1.2929	31.6922	0.0000						NO	NO	1.1807	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**967.6859**	**NO**	**NO**	**57.3610**	**0.0288**	**NO**	**0.0000**	**NO**	**2.5679**	**4.3540**	**32.0314**	**0.9601**
A. Mineral industry	864.4658								2.4282	2.2832	0.0278	0.9032

B. Chemical industry	NO	NO	NO						NO	NO	0.0122	NO
C. Metal industry	35.4118	NO	NO	NO	NO	NO	NO	NO	0.1152	1.5064	0.0465	0.0532
D. Non-energy products from fuels and solvent use	66.7047	NO	NO						0.0075	0.0427	26.5891	0.0037
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				57.3610	NO	NO	NO	NO				
G. Other product manufacture and use	1.1036	NO	NO	NO	0.0288	NO	0.0000	NO	0.0170	0.5217	0.5016	NO
H. Other									NO	NO	4.8542	NO
3. Agriculture	**0.8505**	**30.1478**	**3.1612**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		27.5714										
B. Manure management		2.5764	0.8529								NO	
C. Rice cultivation		NO										
D. Agricultural soils			2.3083									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	0.8505											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-1,956.3934**	**0.0308**	**0.9128**						**0.0274**	**1.0067**	**NO, NE**	
A. Forest land	-2,462.7874	0.0038	0.0002						0.0024	0.0864	NO, NE	
B. Cropland	1,236.6745	0.0270	0.0007						0.0250	0.9203	NO	
C. Grassland	-932.1498	NE	NE						NE	NE	NE	
D. Wetlands	-102.8015	NE	NE						NE	NE	NE	
E. Settlements	49.2742	NO, NE	0.9119						NO, NE	NO, NE	NO, NE	
F. Other land	291.0044	NE	NE						NE	NE	NE	
G. Harvested wood products	-35.6078											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**13.4533**	**55.9096**	**0.1871**						**0.1339**	**2.3308**	**1.6676**	**0.0049**
A. Solid waste disposal	NA, NO	44.3767							NA, NO	NA, NO	1.6057	
B. Biological treatment of solid waste		0.0401	0.0024						NO, NE	0.0056	NO, NE	
C. Incineration and open burning of waste	13.4533	0.2748	0.0048						0.1339	2.3252	0.0517	0.0049
D. Wastewater treatment and discharge		11.2179	0.1799						NA, IE	NA, IE	0.0102	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**44.1680**	**0.0016**	**0.0014**						**0.1855**	**0.1080**	**0.0365**	**0.0140**
Aviation	44.1680	0.0016	0.0014						0.1855	0.1080	0.0365	0.0140
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	352.4520											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**0.8405**									
Indirect CO_2	**59.5995**											

Annex 1-20: Inventory Year - 2009

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**7,009.2673**	**116.7794**	**4.4226**	**67.4790**	**0.0288**	**NO**	**0.0000**	**NO**	**19.4651**	**50.9631**	**35.9526**	**5.2233**
1. Energy	**8,093.8632**	**28.9540**	**0.1933**						**18.0332**	**45.9932**	**7.2201**	**4.6938**
A. Fuel combustion Reference approach	8,049.3971											
Sectoral approach	8,092.5702	1.9828	0.1933						18.0332	45.9932	6.0503	4.6938
1. Energy industries	3,835.5110	0.0831	0.0092						6.1430	2.6585	0.1791	0.6150
2. Manufacturing industries and construction	501.9635	0.0080	0.0030						0.7725	1.6620	0.2842	1.4375
3. Transport	1,919.6624	0.4575	0.1112						7.5165	22.6058	2.8767	0.0046
4. Other sectors	1,824.9424	1.4331	0.0696						3.4994	18.9129	2.6852	2.6186
5. Other	10.4909	0.0011	0.0003						0.1018	0.1540	0.0251	0.0182
B. Fugitive emissions from fuels	1.2930	26.9712	0.0000						NO	NO	1.1698	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	1.2930	26.9712	0.0000						NO	NO	1.1698	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**462.2951**	**NO**	**NO**	**67.4790**	**0.0288**	**NO**	**0.0000**	**NO**	**1.2921**	**2.3712**	**26.6433**	**0.5246**
A. Mineral industry	386.8478								1.2106	0.9874	0.0123	0.4962
B. Chemical industry	NO	NO	NO						NO	NO	0.0100	NO
C. Metal industry	17.0619	NO	NO	NO	NO	NO	NO	NO	0.0555	0.7255	0.0227	0.0256
D. Non-energy products from fuels and solvent use	57.5805	NO	NO						0.0056	0.0316	22.9783	0.0028
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				67.4790	NO	NO	NO	NO				
G. Other product manufacture and use	0.8048	NO	NO	NO	0.0288	NO	0.0000	NO	0.0205	0.6267	0.3658	NO
H. Other									NO	NO	3.2541	NO
3. Agriculture	**0.5864**	**31.4621**	**3.1480**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		28.5438										
B. Manure management		2.9183	0.9659								NO	
C. Rice cultivation		NO										
D. Agricultural soils			2.1821									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	0.5864											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-1,560.6386**	**0.0126**	**0.8904**						**0.0090**	**0.3239**	**NO, NE**	
A. Forest land	-2,526.0659	0.0093	0.0005						0.0059	0.2108	NO, NE	
B. Cropland	1,390.6850	0.0033	0.0001						0.0031	0.1130	NO	
C. Grassland	-447.6932	NE	NE						NE	NE	NE	
D. Wetlands	-74.5986	NE	NE						NE	NE	NE	

E. Settlements	45.5694	NO, NE	0.8898						NO, NE	NO, NE	NO, NE	
F. Other land	79.9357	NE	NE						NE	NE	NE	
G. Harvested wood products	-28.4708											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**13.1613**	**56.3507**	**0.1909**						**0.1308**	**2.2748**	**2.0892**	**0.0048**
A. Solid waste disposal	NA, NO	45.5616							NA, NO	NA, NO	2.0285	
B. Biological treatment of solid waste		0.0446	0.0027						NO, NE	0.0062	NO, NE	
C. Incineration and open burning of waste	13.1613	0.2686	0.0047						0.1308	2.2685	0.0505	0.0048
D. Wastewater treatment and discharge		10.4759	0.1835						NA, IE	NA, IE	0.0102	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**44.1719**	**0.0017**	**0.0014**						**0.1878**	**0.1094**	**0.0380**	**0.0140**
Aviation	44.1719	0.0017	0.0014						0.1878	0.1094	0.0380	0.0140
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	362.1000											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**0.8652**									
Indirect CO_2	**51.3571**											

Annex 1-21: Inventory Year - 2010

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**7,729.4961**	**117.4269**	**4.6666**	**78.1507**	**0.0403**	**NO**	**0.0000**	**NO**	**21.4739**	**53.2513**	**40.8386**	**5.3806**
1. Energy	**8,719.0513**	**28.5855**	**0.2105**						**19.9684**	**48.6806**	**7.2606**	**4.8053**
A. Fuel combustion Reference approach	8,677.6661											
Sectoral approach	8,717.7555	2.1371	0.2105						19.9684	48.6806	6.3424	4.8053
1. Energy industries	4,047.8107	0.0891	0.0098						6.4814	2.8196	0.1898	0.5281
2. Manufacturing industries and construction	516.1412	0.0094	0.0030						0.8397	1.5071	0.2868	1.2574
3. Transport	2,140.5138	0.4708	0.1225						8.7584	22.2774	2.8861	0.0052
4. Other sectors	1,985.9921	1.5654	0.0746						3.7644	21.8247	2.9363	2.9155
5. Other	27.2976	0.0023	0.0006						0.1245	0.2519	0.0434	0.0991
B. Fugitive emissions from fuels	1.2958	26.4485	0.0000						NO	NO	0.9181	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	1.2958	26.4485	0.0000						NO	NO	0.9181	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**482.3543**	**NO**	**NO**	**78.1507**	**0.0403**	**NO**	**0.0000**	**NO**	**1.3736**	**2.2003**	**31.1949**	**0.5705**
A. Mineral industry	405.3915								1.3115	1.0242	0.0127	0.5525
B. Chemical industry	NO	NO	NO						NO	NO	0.0143	NO
C. Metal industry	9.6985	NO	NO	NO	NO	NO	NO	NO	0.0315	0.4121	0.0128	0.0145

D. Non-energy products from fuels and solvent use	66.2398	NO	NO						0.0069	0.0392	26.4907	0.0034
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				78.1507	NO	NO	NO	NO				
G. Other product manufacture and use	1.0245	NO	NO	NO	0.0403	NO	0.0000	NO	0.0237	0.7247	0.4657	NO
H. Other									NO	NO	4.1987	NO
3. Agriculture	**1.7443**	**31.4952**	**3.4048**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		28.3270										
B. Manure management		3.1682	1.0080								NO	
C. Rice cultivation		NO										
D. Agricultural soils			2.3968									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	1.7443											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-1,486.5202**	**0.0056**	**0.8665**						**0.0042**	**0.1529**	**NO, NE**	
A. Forest land	-2,484.1627	0.0032	0.0002						0.0021	0.0737	NO, NE	
B. Cropland	1,271.7754	0.0023	0.0001						0.0022	0.0792	NO	
C. Grassland	-691.9874	NE	NE						NE	NE	NE	
D. Wetlands	-46.3958	NE	NE						NE	NE	NE	
E. Settlements	45.5694	NO, NE	0.8663						NO, NE	NO, NE	NO, NE	
F. Other land	441.4824	NE	NE						NE	NE	NE	
G. Harvested wood products	-22.8014											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**12.8663**	**57.3406**	**0.1848**						**0.1277**	**2.2175**	**2.3831**	**0.0048**
A. Solid waste disposal	NA, NO	46.4268							NA, NO	NA, NO	2.3236	
B. Biological treatment of solid waste		0.0430	0.0026						NO, NE	0.0060	NO, NE	
C. Incineration and open burning of waste	12.8663	0.2624	0.0046						0.1277	2.2115	0.0492	0.0048
D. Wastewater treatment and discharge		10.6084	0.1776						NA, IE	NA, IE	0.0102	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**41.0593**	**0.0026**	**0.0014**						**0.1667**	**0.1218**	**0.0377**	**0.0130**
Aviation	41.0593	0.0026	0.0014						0.1667	0.1218	0.0377	0.0130
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	341.0480											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**0.9310**									
Indirect CO_2	**59.3041**											

Annex 1-22: Inventory Year - 2011

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**8,094.7768**	**119.2316**	**4.5853**	**90.5042**	**0.0403**	**NO**	**0.0000**	**NO**	**22.1003**	**56.0110**	**43.5601**	**5.5088**
1. Energy	**8,926.8957**	**31.8482**	**0.2164**						**20.3098**	**51.1208**	**7.8715**	**4.8128**
A. Fuel combustion Reference approach	8,885.4717											
Sectoral approach	8,925.5610	2.2550	0.2164						20.3098	51.1208	6.8151	4.8128
1. Energy industries	3,746.1444	0.0799	0.0087						5.9885	2.6096	0.1753	0.3978
2. Manufacturing industries and construction	576.1765	0.0107	0.0036						0.9067	1.8629	0.3338	1.5810
3. Transport	2,272.6744	0.4687	0.1281						9.1192	22.9464	2.9620	0.0056
4. Other sectors	2,310.7777	1.6944	0.0756						4.1423	23.3551	3.2990	2.7405
5. Other	19.7881	0.0013	0.0004						0.1531	0.3469	0.0449	0.0879
B. Fugitive emissions from fuels	1.3347	29.5932	0.0000						NO	NO	1.0564	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	1.3347	29.5932	0.0000						NO	NO	1.0564	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**573.6077**	**NO**	**NO**	**90.5042**	**0.0403**	**NO**	**0.0000**	**NO**	**1.6612**	**2.5605**	**33.5228**	**0.6913**
A. Mineral industry	488.1986								1.5879	1.2450	0.0156	0.6681
B. Chemical industry	NO	NO	NO						NO	NO	0.0157	NO
C. Metal industry	12.8556	NO	NO	NO	NO	NO	NO	NO	0.0418	0.5465	0.0169	0.0193
D. Non-energy products from fuels and solvent use	71.3244	NO	NO						0.0078	0.0443	28.6400	0.0039
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				90.5042	NO	NO	NO	NO				
G. Other product manufacture and use	1.2291	NO	NO	NO	0.0403	NO	0.0000	NO	0.0237	0.7248	0.5587	NO
H. Other									NO	NO	4.2760	NO
3. Agriculture	**3.6752**	**29.6755**	**3.3378**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		26.6765										
B. Manure management		2.9990	0.9189								NO	
C. Rice cultivation		NO										
D. Agricultural soils			2.4190									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	3.6752											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-1,421.9811**	**0.0064**	**0.8455**						**0.0047**	**0.1694**	**NO, NE**	
A. Forest land	-2,390.5712	0.0043	0.0002						0.0028	0.0987	NO, NE	
B. Cropland	1,230.6841	0.0021	0.0001						0.0019	0.0707	NO	
C. Grassland	-638.1726	NE	NE						NE	NE	NE	
D. Wetlands	-75.3129	NE	NE						NE	NE	NE	
E. Settlements	62.0438	NO, NE	0.8452						NO, NE	NO, NE	NO, NE	

F. Other land	393.7285	NE	NE						NE	NE	NE	
G. Harvested wood products	-4.3808											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**12.5793**	**57.7015**	**0.1856**						**0.1246**	**2.1602**	**2.1659**	**0.0047**
A. Solid waste disposal	NA, NO	47.0716							NA, NO	NA, NO	2.1076	
B. Biological treatment of solid waste		0.0437	0.0026						NO, NE	0.0061	NO, NE	
C. Incineration and open burning of waste	12.5793	0.2562	0.0045						0.1246	2.1541	0.0480	0.0047
D. Wastewater treatment and discharge		10.3301	0.1785						NA, IE	NA, IE	0.0102	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	41.0082	0.0028	0.0013						0.1611	0.1246	0.0496	0.0130
Aviation	41.0082	0.0028	0.0013						0.1611	0.1246	0.0496	0.0130
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	384.6400											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**0.8990**									
Indirect CO_2	**64.2370**											

Annex 1-23: Inventory Year - 2012

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**7,780.7180**	**116.6790**	**4.3276**	**100.4768**	**0.0403**	**NO**	**0.0000**	**NO**	**20.9436**	**55.4622**	**44.8404**	**5.5982**
1. Energy	**8,614.8544**	**31.6092**	**0.2019**						**19.2239**	**49.8924**	**7.6602**	**4.9700**
A. Fuel combustion Reference approach	8,567.2666											
Sectoral approach	8,613.5235	2.4176	0.2019						19.2239	49.8924	6.6913	4.9700
1. Energy industries	3,803.4077	0.0755	0.0086						6.0853	2.6153	0.1756	0.6665
2. Manufacturing industries and construction	539.1478	0.0106	0.0030						0.8256	1.4506	0.3009	1.1715
3. Transport	1,992.5651	0.4049	0.1152						8.2265	19.3038	2.5284	0.0048
4. Other sectors	2,271.4679	1.9260	0.0750						4.0329	26.3885	3.6707	3.1225
5. Other	6.9350	0.0006	0.0002						0.0536	0.1342	0.0157	0.0047
B. Fugitive emissions from fuels	1.3309	29.1916	0.0000						NO	NO	0.9690	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	1.3309	29.1916	0.0000						NO	NO	0.9690	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**581.6659**	**NO**	**NO**	**100.4768**	**0.0403**	**NO**	**0.0000**	**NO**	**1.5683**	**2.4006**	**35.1868**	**0.6236**
A. Mineral industry	493.1587								1.5008	1.2782	0.0159	0.6001
B. Chemical industry	NO	NO	NO						NO	NO	0.0150	NO
C. Metal industry	12.6973	NO	NO	NO	NO	NO	NO	NO	0.0413	0.5398	0.0171	0.0191
D. Non-energy products from fuels and solvent use	74.6523	NO	NO						0.0088	0.0500	30.6212	0.0044

E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				100.4768	NO	NO	NO	NO				
G. Other product manufacture and use	1.1575	NO	NO	NO	0.0403	NO	0.0000	NO	0.0174	0.5326	0.5261	NO
H. Other									NO	NO	3.9915	NO
3. Agriculture	**5.5908**	**27.9757**	**3.1555**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		25.2109										
B. Manure management		2.7648	0.8439								NO	
C. Rice cultivation		NO										
D. Agricultural soils			2.3116									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	5.5908											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-1,433.6639**	**0.0467**	**0.7833**						**0.0299**	**1.0665**	**NO, NE**	
A. Forest land	-2,294.8221	0.0464	0.0026						0.0296	1.0564	NO, NE	
B. Cropland	1,236.5016	0.0003	0.0000						0.0003	0.0101	NO	
C. Grassland	-562.7510	NE	NE						NE	NE	NE	
D. Wetlands	-15.4700	NE	NE						NE	NE	NE	
E. Settlements	11.8882	NO, NE	0.7807						NO, NE	NO, NE	NO, NE	
F. Other land	114.1449	NE	NE						NE	NE	NE	
G. Harvested wood products	76.8444											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**12.2708**	**57.0474**	**0.1870**						**0.1214**	**2.1026**	**1.9934**	**0.0046**
A. Solid waste disposal	NA, NO	46.5498							NA, NO	NA, NO	1.9364	
B. Biological treatment of solid waste		0.0447	0.0027						NO, NE	0.0063	NO, NE	
C. Incineration and open burning of waste	12.2708	0.2498	0.0044						0.1214	2.0963	0.0468	0.0046
D. Wastewater treatment and discharge		10.2031	0.1799						NA, IE	NA, IE	0.0101	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**47.3142**	**0.0028**	**0.0015**						**0.1806**	**0.1322**	**0.0558**	**0.0150**
Aviation	47.3142	0.0028	0.0015						0.1806	0.1322	0.0558	0.0150
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	403.3840											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**0.8550**									
Indirect CO_2	**68.5241**											

Annex 1-24: Inventory Year - 2013

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**7,577.6937**	**112.5614**	**4.7193**	**109.0841**	**0.0403**	**NO**	**0.0000**	**NO**	**21.2300**	**55.9651**	**43.8719**	**13.1659**
1. Energy	**8,227.6443**	**29.7144**	**0.2194**						**19.3494**	**50.9262**	**7.6008**	**12.4523**
A. Fuel combustion Reference approach	8,185.8950											
Sectoral approach	8,225.9844	2.4705	0.2194						19.3494	50.9262	6.7020	12.4523
1. Energy industries	3,596.7176	0.0677	0.0188						6.2249	2.0253	0.1397	7.1268
2. Manufacturing industries and construction	577.6855	0.0097	0.0042						0.8830	2.3030	0.3557	2.0352
3. Transport	2,101.2934	0.4086	0.1153						8.4230	18.8125	2.4595	0.0049
4. Other sectors	1,947.9381	1.9842	0.0809						3.7783	27.7557	3.7434	3.2852
5. Other	2.3497	0.0003	0.0001						0.0403	0.0297	0.0037	0.0003
B. Fugitive emissions from fuels	1.6599	27.2439	0.0000						NO	NO	0.8989	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	1.6599	27.2439	0.0000						NO	NO	0.8989	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**623.1087**	**NO**	**NO**	**109.0841**	**0.0403**	**NO**	**0.0000**	**NO**	**1.7397**	**2.1714**	**34.2507**	**0.7091**
A. Mineral industry	544.8742								1.6927	1.3902	0.0172	0.6929
B. Chemical industry	NO	NO	NO						NO	NO	0.0159	NO
C. Metal industry	7.6569	NO	NO	NO	NO	NO	NO	NO	0.0249	0.3250	0.0100	0.0115
D. Non-energy products from fuels and solvent use	69.4810	NO	NO						0.0088	0.0501	28.2397	0.0044
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				109.0841	NO	NO	NO	NO				
G. Other product manufacture and use	1.0965	NO	NO	NO	0.0403	NO	0.0000	NO	0.0133	0.4062	0.4984	0.0003
H. Other									NO	NO	5.4694	NO
3. Agriculture	**4.1840**	**28.1102**	**3.5830**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		25.3945										
B. Manure management		2.7156	0.7857								NO	
C. Rice cultivation		NO										
D. Agricultural soils			2.7973									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	4.1840											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-1,289.1465**	**0.0349**	**0.7290**						**0.0230**	**0.8236**	**NO, NE**	
A. Forest land	-2,141.8702	0.0322	0.0018						0.0206	0.7339	NO, NE	
B. Cropland	1,139.9149	0.0026	0.0001						0.0024	0.0898	NO	
C. Grassland	-360.1740	NE	NE						NE	NE	NE	
D. Wetlands	-106.0998	NE	NE						NE	NE	NE	
E. Settlements	13.7512	NO, NE	0.7272						NO, NE	NO, NE	NO, NE	

F. Other land	103.4500	NE	NE						NE	NE	NE	
G. Harvested wood products	61.8814											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**11.9033**	**54.7019**	**0.1879**						**0.1179**	**2.0438**	**2.0204**	**0.0045**
A. Solid waste disposal	NA, NO	44.1567							NA, NO	NA, NO	1.9649	
B. Biological treatment of solid waste		0.0486	0.0029						NO, NE	0.0068	NO, NE	
C. Incineration and open burning of waste	11.9033	0.2424	0.0043						0.1179	2.0370	0.0454	0.0045
D. Wastewater treatment and discharge		10.2543	0.1807						NA, IE	NA, IE	0.0101	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**41.0717**	**0.0046**	**0.0013**						**0.1592**	**0.1584**	**0.0571**	**0.0130**
Aviation	41.0717	0.0046	0.0013						0.1592	0.1584	0.0571	0.0130
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	429.2796											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**0.9257**									
Indirect CO_2	**63.2239**											

Annex 1-25: Inventory Year - 2014

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**7,945.4252**	**114.4810**	**5.2731**	**122.9816**	**0.0403**	**NO**	**0.0000**	**NO**	**20.9724**	**82.3162**	**56.3396**	**5.3742**
1. Energy	**8,214.8567**	**31.2848**	**0.2441**						**19.1555**	**77.8236**	**11.7283**	**4.6819**
A. Fuel combustion Reference approach	8,160.7414											
Sectoral approach	8,213.1659	4.5778	0.2441						19.1555	77.8236	10.9231	4.6819
1. Energy industries	3,555.9756	0.0750	0.0082						5.6971	2.4781	0.1664	0.4068
2. Manufacturing industries and construction	563.8971	0.0099	0.0036						0.8995	1.9366	0.3298	1.6679
3. Transport	2,140.5508	0.4056	0.1070						8.0152	18.5701	2.4006	0.0049
4. Other sectors	1,927.7357	4.0868	0.1247						4.4921	54.5828	8.0026	2.4012
5. Other	25.0067	0.0006	0.0005						0.0516	0.2560	0.0237	0.2011
B. Fugitive emissions from fuels	1.6908	26.7070	0.0000						NO	NO	0.8052	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	1.6908	26.7070	0.0000						NO	NO	0.8052	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**636.1602**	**NO**	**NO**	**122.9816**	**0.0403**	**NO**	**0.0000**	**NO**	**1.6990**	**2.3772**	**42.6162**	**0.6880**
A. Mineral industry	533.8710								1.6295	1.3602	0.0167	0.6601
B. Chemical industry	NO	NO	NO						NO	NO	0.0166	NO
C. Metal industry	13.8464	NO	NO	NO	NO	NO	NO	NO	0.0450	0.5882	0.0186	0.0208

D. Non-energy products from fuels and solvent use	87.2367	NO	NO						0.0128	0.0723	36.3007	0.0064
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				122.9816	NO	NO	NO	NO				
G. Other product manufacture and use	1.2062	NO	NO	NO	0.0403	NO	0.0000	NO	0.0117	0.3565	0.5483	0.0007
H. Other									NO	NO	5.7153	NO
3. Agriculture	**10.2058**	**28.9203**	**4.1636**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		26.1032										
B. Manure management		2.8171	0.8671								NO	
C. Rice cultivation		NO										
D. Agricultural soils			3.2966									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	10.2058											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-927.3346**	**0.0047**	**0.6794**						**0.0036**	**0.1293**	**NO, NE**	
A. Forest land	-2,134.7390	0.0027	0.0001						0.0017	0.0603	NO, NE	
B. Cropland	1,174.6145	0.0020	0.0001						0.0019	0.0690	NO	
C. Grassland	-341.1085	NE	NE						NE	NE	NE	
D. Wetlands	-139.7535	NE	NE						NE	NE	NE	
E. Settlements	18.9848	NO, NE	0.6792						NO, NE	NO, NE	NO, NE	
F. Other land	436.6463	NE	NE						NE	NE	NE	
G. Harvested wood products	58.0208											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**11.5371**	**54.2712**	**0.1860**						**0.1144**	**1.9861**	**1.9951**	**0.0043**
A. Solid waste disposal	NA, NO	44.0518							NA, NO	NA, NO	1.9411	
B. Biological treatment of solid waste		0.0508	0.0030						NO, NE	0.0071	NO, NE	
C. Incineration and open burning of waste	11.5371	0.2351	0.0041						0.1144	1.9790	0.0441	0.0043
D. Wastewater treatment and discharge		9.9335	0.1788						NA, IE	NA, IE	0.0100	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**53.6855**	**0.0034**	**0.0018**						**0.2110**	**0.1599**	**0.0553**	**0.0170**
Aviation	53.6855	0.0034	0.0018						0.2110	0.1599	0.0553	0.0170
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	1,314.4896											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**1.0793**									
Indirect CO_2	**81.0677**											

Annex 1-26: Inventory Year - 2015

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**7,536.3186**	**112.5958**	**4.4226**	**157.0394**	**0.0403**	**NO**	**0.0000**	**NO**	**21.8835**	**87.3129**	**54.1274**	**4.8979**
1. Energy	**8,277.6210**	**30.5108**	**0.2660**						**20.0982**	**81.9714**	**12.2797**	**4.2232**
A. Fuel combustion Reference approach	8,220.4351											
Sectoral approach	8,275.9434	4.8476	0.2660						20.0982	81.9714	11.5338	4.2232
1. Energy industries	3,684.4508	0.0658	0.0067						5.8503	2.5548	0.1705	0.1072
2. Manufacturing industries and construction	517.0989	0.0100	0.0035						0.7978	1.8079	0.3136	1.5442
3. Transport	2,261.4456	0.4285	0.1197						8.8431	19.1901	2.5021	0.0051
4. Other sectors	1,790.2120	4.3428	0.1357						4.5595	58.1877	8.5261	2.3805
5. Other	22.7360	0.0005	0.0004						0.0475	0.2309	0.0216	0.1861
B. Fugitive emissions from fuels	1.6776	25.6632	0.0000						NO	NO	0.7458	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	1.6776	25.6632	0.0000						NO	NO	0.7458	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**606.9922**	**NO**	**NO**	**157.0394**	**0.0403**	**NO**	**0.0000**	**NO**	**1.6355**	**2.4169**	**39.6803**	**0.6699**
A. Mineral industry	504.2041								1.5589	1.2767	0.0159	0.6393
B. Chemical industry	NO	NO	NO						NO	NO	0.0119	NO
C. Metal industry	17.2792	NO	NO	NO	NO	NO	NO	NO	0.0561	0.7340	0.0221	0.0259
D. Non-energy products from fuels and solvent use	84.5691	NO	NO						0.0089	0.0501	34.9703	0.0044
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				157.0394	NO	NO	NO	NO				
G. Other product manufacture and use	0.9397	NO	NO	NO	0.0403	NO	0.0000	NO	0.0116	0.3561	0.4271	0.0003
H. Other									NO	NO	4.2329	NO
3. Agriculture	**11.2402**	**27.9230**	**3.3285**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		25.1684										
B. Manure management		2.7546	0.8386								NO	
C. Rice cultivation		NO										
D. Agricultural soils			2.4899									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	11.2402											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-1,372.8484**	**0.0261**	**0.6385**						**0.0171**	**0.6122**	**NO, NE**	
A. Forest land	-2,159.4439	0.0246	0.0014						0.0157	0.5596	NO, NE	
B. Cropland	1,112.6279	0.0015	0.0000						0.0014	0.0526	NO	
C. Grassland	-418.4569	NE	NE						NE	NE	NE	
D. Wetlands	-82.7917	NE	NE						NE	NE	NE	
E. Settlements	39.1617	NO, NE	0.6371						NO, NE	NO, NE	NO, NE	
F. Other land	86.8192	NE	NE						NE	NE	NE	

G. Harvested wood products	49.2353											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**13.3135**	**54.1360**	**0.1897**						**0.1326**	**2.3124**	**2.1675**	**0.0049**
A. Solid waste disposal	NA, NO	44.1799							NA, NO	NA, NO	2.1063	
B. Biological treatment of solid waste		0.0508	0.0030						NO, NE	0.0071	NO, NE	
C. Incineration and open burning of waste	13.3135	0.2721	0.0048						0.1326	2.3053	0.0512	0.0049
D. Wastewater treatment and discharge		9.6331	0.1819						NA, IE	NA, IE	0.0100	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**56.8077**	**0.0056**	**0.0018**						**0.2255**	**0.1841**	**0.0817**	**0.0180**
Aviation	56.8077	0.0056	0.0018						0.2255	0.1841	0.0817	0.0180
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	1,428.4386											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**0.8886**									
Indirect CO_2	**77.8743**											

Annex 1-27: Inventory Year - 2016

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**7,841.2042**	**115.3513**	**4.8650**	**166.7099**	**0.0403**	**NO**	**0.0000**	**NO**	**22.5896**	**90.1410**	**55.4061**	**4.0432**
1. Energy	**8,353.8926**	**32.7079**	**0.2853**						**20.9516**	**85.7020**	**12.9977**	**3.4387**
A. Fuel combustion Reference approach	8,253.5211											
Sectoral approach	8,352.2025	5.2344	0.2853						20.9516	85.7020	12.2579	3.4387
1. Energy industries	3,644.8751	0.0657	0.0069						5.7964	2.5196	0.1682	0.2330
2. Manufacturing industries and construction	488.6172	0.0092	0.0026						0.7463	1.2679	0.2653	1.0227
3. Transport	2,428.3642	0.4966	0.1370						9.8296	19.6407	2.5824	0.0054
4. Other sectors	1,767.4874	4.6624	0.1384						4.5317	62.0479	9.2199	1.9853
5. Other	22.8586	0.0005	0.0004						0.0476	0.2260	0.0221	0.1923
B. Fugitive emissions from fuels	1.6900	27.4735	0.0000						NO	NO	0.7398	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	1.6900	27.4735	0.0000						NO	NO	0.7398	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**579.1078**	**NO**	**NO**	**166.7099**	**0.0403**	**NO**	**0.0000**	**NO**	**1.4983**	**1.8206**	**40.1156**	**0.5998**
A. Mineral industry	488.0182								1.4633	1.2375	0.0154	0.5879
B. Chemical industry	NO	NO	NO						NO	NO	0.0131	NO
C. Metal industry	5.2203	NO	NO	NO	NO	NO	NO	NO	0.0169	0.2204	0.0075	0.0078
D. Non-energy products from fuels and solvent use	84.8044	NO	NO						0.0076	0.0429	34.9327	0.0038
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				166.7099	NO	NO	NO	NO				

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
G. Other product manufacture and use	1.0649	NO	NO	NO	0.0403	NO	0.0000	NO	0.0105	0.3198	0.4841	0.0003
H. Other									NO	NO	4.6628	NO
3. Agriculture	**12.2747**	**27.4424**	**3.7863**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		24.8801										
B. Manure management		2.5622	0.8631								NO	
C. Rice cultivation		NO										
D. Agricultural soils			2.9232									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	12.2747											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-1,117.1054**	**0.0143**	**0.6016**						**0.0097**	**0.3467**	**NO, NE**	
A. Forest land	-2,115.7622	0.0123	0.0007						0.0079	0.2809	NO, NE	
B. Cropland	1,111.9941	0.0019	0.0001						0.0018	0.0658	NO	
C. Grassland	-402.3693	NE	NE						NE	NE	NE	
D. Wetlands	-82.7917	NE	NE						NE	NE	NE	
E. Settlements	19.3071	NO, NE	0.6008						NO, NE	NO, NE	NO, NE	
F. Other land	351.6349	NE	NE						NE	NE	NE	
G. Harvested wood products	0.8816											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**13.0346**	**55.1867**	**0.1918**						**0.1301**	**2.2716**	**2.2928**	**0.0047**
A. Solid waste disposal	NA, NO	45.2784							NA, NO	NA, NO	2.2326	
B. Biological treatment of solid waste		0.0505	0.0030						NO, NE	0.0071	NO, NE	
C. Incineration and open burning of waste	13.0346	0.2667	0.0047						0.1301	2.2645	0.0502	0.0047
D. Wastewater treatment and discharge		9.5911	0.1841						NA, IE	NA, IE	0.0100	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**100.9698**	**0.0062**	**0.0033**						0.4139	0.2665	0.1113	0.0320
Aviation	100.9698	0.0062	0.0033						0.4139	0.2665	0.1113	0.0320
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	1,603.1890											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**0.9869**									
Indirect CO_2	**77.9170**											

Annex 1-28: Inventory Year - 2017

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**7,402.2253**	**119.9717**	**5.1810**	**185.8945**	**0.0403**	**NO**	**0.0000**	**NO**	**22.9324**	**113.1404**	**64.7482**	**4.9513**
1. Energy	**7,934.3500**	**35.6745**	**0.3312**						**21.2407**	**107.7886**	**16.2093**	**4.3204**
A. Fuel combustion Reference approach	7,787.7356											
Sectoral approach	7,932.6739	6.9284	0.3312						21.2407	107.7886	15.4842	4.3204
1. Energy industries	2,996.5052	0.0543	0.0055						4.7627	2.0849	0.1391	0.0472
2. Manufacturing industries and construction	501.6022	0.0128	0.0029						0.9406	1.3692	0.2706	1.1299
3. Transport	2,451.2471	0.4838	0.1350						9.7868	19.0444	2.5083	0.0054
4. Other sectors	1,960.6971	6.3772	0.1874						5.7093	85.0674	12.5450	2.9370
5. Other	22.6223	0.0002	0.0004						0.0414	0.2226	0.0212	0.2009
B. Fugitive emissions from fuels	1.6760	28.7461	0.0000						NO	NO	0.7251	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	1.6760	28.7461	0.0000						NO	NO	0.7251	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**592.6872**	**NO**	**NO**	**185.8945**	**0.0403**	**NO**	**0.0000**	**NO**	**1.5316**	**2.2987**	**46.2368**	**0.6257**
A. Mineral industry	475.6060								1.4527	1.2025	0.0146	0.5922
B. Chemical industry	NO	NO	NO						NO	NO	0.0123	NO
C. Metal industry	18.8842	NO	NO	NO	NO	NO	NO	NO	0.0613	0.8019	0.0249	0.0283
D. Non-energy products from fuels and solvent use	97.0212	NO	NO						0.0097	0.0547	40.4418	0.0048
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				185.8945	NO	NO	NO	NO				
G. Other product manufacture and use	1.1757	NO	NO	NO	0.0403	NO	0.0000	NO	0.0078	0.2396	0.5344	0.0003
H. Other									NO	NO	5.2088	NO
3. Agriculture	**26.2081**	**25.6519**	**4.0746**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		23.1354										
B. Manure management		2.5165	0.8177								NO	
C. Rice cultivation		NO										
D. Agricultural soils			3.2570									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	26.2081											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-1,165.6648**	**0.0199**	**0.5767**						**0.0136**	**0.4867**	**NO, NE**	
A. Forest land	-2,016.4373	0.0170	0.0009						0.0109	0.3878	NO, NE	
B. Cropland	1,089.5602	0.0029	0.0001						0.0027	0.0990	NO	
C. Grassland	-384.0392	NE	NE						NE	NE	NE	
D. Wetlands	-82.8162	NE	NE						NE	NE	NE	
E. Settlements	77.3098	NO, NE	0.5757						NO, NE	NO, NE	NO, NE	
F. Other land	218.2055	NE	NE						NE	NE	NE	

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
G. Harvested wood products	-67.4476											
H. Other	NE											
5. Waste	**14.6448**	**58.6255**	**0.1985**						**0.1465**	**2.5663**	**2.3021**	**0.0052**
A. Solid waste disposal	NA, NO	48.8363							NA, NO	NA, NO	2.2355	
B. Biological treatment of solid waste		0.0578	0.0035						NO, NE	0.0081	NO, NE	
C. Incineration and open burning of waste	14.6448	0.3001	0.0053						0.1465	2.5582	0.0566	0.0052
D. Wastewater treatment and discharge		9.4312	0.1897						NA, IE	NA, IE	0.0100	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**148.2788**	**0.0058**	**0.0048**						**0.5821**	**0.3478**	**0.1423**	**0.0470**
Aviation	148.2788	0.0058	0.0048						0.5821	0.3478	0.1423	0.0470
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	2,122.7228											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**1.0411**									
Indirect CO_2	**90.1477**											

Annex 1-29: Inventory Year - 2018

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**8,165.9880**	**119.7841**	**5.2421**	**198.8877**	**0.0403**	**NO**	**0.0001**	**NO**	**24.8089**	**162.1584**	**95.9239**	**4.4461**
1. Energy	**8,350.5473**	**37.7167**	**0.3805**						**22.6342**	**156.7217**	**23.6900**	**3.5780**
A. Fuel combustion Reference approach	8,182.3371											
Sectoral approach	8,348.8621	10.6064	0.3805						22.6342	156.7217	22.9976	3.5780
1. Energy industries	3,255.3655	0.0593	0.0060						5.1810	2.2679	0.1513	0.0570
2. Manufacturing industries and construction	594.3248	0.0144	0.0031						1.2726	1.2408	0.2948	0.9561
3. Transport	2,529.5773	0.5024	0.1334						9.7840	19.8910	2.5892	0.0056
4. Other sectors	1,946.2502	10.0301	0.2376						6.3540	133.0922	19.9404	2.3520
5. Other	23.3443	0.0002	0.0004						0.0427	0.2297	0.0219	0.2073
B. Fugitive emissions from fuels	1.6852	27.1103	0.0000						NO	NO	0.6924	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	1.6852	27.1103	0.0000						NO	NO	0.6924	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**764.3984**	**NO**	**NO**	**198.8877**	**0.0403**	**NO**	**0.0001**	**NO**	**2.0269**	**2.7602**	**70.1396**	**0.8631**
A. Mineral industry	591.9454								1.9255	1.4894	0.0186	0.8185
B. Chemical industry	NO	NO	NO						NO	NO	0.0155	NO
C. Metal industry	20.2133	NO	NO	NO	NO	NO	NO	NO	0.0657	0.8586	0.0267	0.0303

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
D. Non-energy products from fuels and solvent use	151.1809	NO	NO						0.0273	0.1534	64.9072	0.0136
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				198.8877	NO	NO	NO	NO				
G. Other product manufacture and use	1.0589	NO	NO	NO	0.0403	NO	0.0001	NO	0.0085	0.2587	0.4813	0.0007
H. Other									NO	NO	4.6903	NO
3. Agriculture	**43.3624**	**22.8526**	**4.1028**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		20.6594										
B. Manure management		2.1932	0.7210								NO	
C. Rice cultivation		NO										
D. Agricultural soils			3.3818									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	43.3624											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-1,006.6081**	**0.0068**	**0.5550**						**0.0046**	**0.1654**	**NO, NE**	
A. Forest land	-1,969.3582	0.0059	0.0003						0.0037	0.1334	NO, NE	
B. Cropland	1,206.3949	0.0009	0.0000						0.0009	0.0321	NO	
C. Grassland	-440.1513	NE	NE						NE	NE	NE	
D. Wetlands	-82.8253	NE	NE						NE	NE	NE	
E. Settlements	21.6217	NO, NE	0.5546						NO, NE	NO, NE	NO, NE	
F. Other land	321.2138	NE	NE						NE	NE	NE	
G. Harvested wood products	-63.5037											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**14.2880**	**59.2080**	**0.2038**						**0.1432**	**2.5112**	**2.0943**	**0.0051**
A. Solid waste disposal	NA, NO	49.2990							NA, NO	NA, NO	2.0288	
B. Biological treatment of solid waste		0.0521	0.0031						NO, NE	0.0073	NO, NE	
C. Incineration and open burning of waste	14.2880	0.2931	0.0051						0.1432	2.5039	0.0553	0.0051
D. Wastewater treatment and discharge		9.5637	0.1955						NA, IE	NA, IE	0.0102	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**170.4060**	**0.0071**	**0.0058**						0.6507	0.5113	0.1537	0.0540
Aviation	170.4060	0.0071	0.0058						0.6507	0.5113	0.1537	0.0540
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	3,583.0567											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**1.0303**									
Indirect CO_2	**143.8546**											

Annex 1-30: Inventory Year - 2019

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**9,242.8298**	**107.2865**	**5.3796**	**235.5397**	**0.0403**	**NO**	**0.0001**	**NO**	**25.0345**	**147.0344**	**90.1994**	**5.2165**
1. Energy	**8,583.6814**	**28.1492**	**0.3826**						**23.0076**	**141.6541**	**21.1796**	**4.4562**
A. Fuel combustion Reference approach	8,434.0311											
Sectoral approach	8,582.0532	9.3467	0.3826						23.0076	141.6541	20.6437	4.4562
1. Energy industries	3,124.4150	0.0562	0.0057						4.9700	2.1753	0.1451	0.0468
2. Manufacturing industries and construction	717.7258	0.0298	0.0052						1.2740	1.5229	0.4796	0.9216
3. Transport	2,611.5525	0.4983	0.1390						10.1388	20.5687	2.6841	0.0058
4. Other sectors	2,105.4970	8.7623	0.2323						6.5829	117.1622	17.3135	3.2791
5. Other	22.8629	0.0002	0.0004						0.0418	0.2250	0.0215	0.2030
B. Fugitive emissions from fuels	1.6282	18.8024	0.0000						NO	NO	0.5359	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	1.6282	18.8024	0.0000						NO	NO	0.5359	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**754.2055**	**NO**	**NO**	**235.5397**	**0.0403**	**NO**	**0.0001**	**NO**	**1.8762**	**2.5375**	**66.6190**	**0.7554**
A. Mineral industry	593.6612								1.7986	1.5265	0.0187	0.7216
B. Chemical industry	NO	NO	NO						NO	NO	0.0170	NO
C. Metal industry	15.7926	NO	NO	NO	NO	NO	NO	NO	0.0513	0.6704	0.0209	0.0237
D. Non-energy products from fuels and solvent use	143.6217	NO	NO						0.0186	0.1047	61.3608	0.0093
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				235.5397	NO	NO	NO	NO				
G. Other product manufacture and use	1.1299	NO	NO	NO	0.0403	NO	0.0001	NO	0.0077	0.2360	0.5136	0.0008
H. Other									NO	NO	4.6880	NO
3. Agriculture	**39.6306**	**19.6977**	**4.2505**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		17.6379										
B. Manure management		2.0599	0.6536								NO	
C. Rice cultivation		NO										
D. Agricultural soils			3.5969									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	39.6306											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-148.6229**	**0.0160**	**0.5421**						**0.0107**	**0.3821**	**NO, NE**	
A. Forest land	-1,950.6476	0.0143	0.0008						0.0091	0.3254	NO, NE	
B. Cropland	1,507.3962	0.0017	0.0000						0.0015	0.0568	NO	
C. Grassland	-293.2923	NE	NE						NE	NE	NE	
D. Wetlands	-82.8099	NE	NE						NE	NE	NE	
E. Settlements	116.5030	NO, NE	0.5412						NO, NE	NO, NE	NO, NE	
F. Other land	611.7881	NE	NE						NE	NE	NE	

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
G. Harvested wood products	-57.5604											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**13.9352**	**59.4236**	**0.2045**						**0.1400**	**2.4607**	**2.4008**	**0.0049**
A. Solid waste disposal	NA, NO	49.5684							NA, NO	NA, NO	2.3365	
B. Biological treatment of solid waste		0.0522	0.0031						NO, NE	0.0073	NO, NE	
C. Incineration and open burning of waste	13.9352	0.2863	0.0050						0.1400	2.4534	0.0541	0.0049
D. Wastewater treatment and discharge		9.5168	0.1963						NA, IE	NA, IE	0.0102	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**151.5015**	**0.0055**	**0.0051**						**0.6236**	**0.4162**	**0.1199**	**0.0480**
Aviation	151.5015	0.0055	0.0051						0.6236	0.4162	0.1199	0.0480
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	2,976.2234											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**1.0565**									
Indirect CO_2	**136.1237**											

Annex 1-31: Inventory Year - 2020

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
Total national emissions and removals	**9,608.0373**	**95.7174**	**4.7326**	**245.3168**	**0.0403**	**NO**	**0.0001**	**NO**	**24.4909**	**142.0826**	**111.5648**	**4.2932**
1. Energy	**8,972.1085**	**18.6747**	**0.3722**						**22.4651**	**136.3310**	**20.4625**	**3.4896**
A. Fuel combustion Reference approach	8,933.5232											
Sectoral approach	8,970.5288	9.0656	0.3722						22.4651	136.3310	20.0607	3.4896
1. Energy industries	3,634.3761	0.0654	0.0066						5.7797	2.5315	0.1688	0.0361
2. Manufacturing industries and construction	801.4383	0.0298	0.0049						0.4409	1.4200	0.5045	0.7768
3. Transport	2,462.2411	0.4352	0.1302						9.7000	18.3931	2.4165	0.0054
4. Other sectors	2,050.0916	8.5350	0.2302						6.5036	113.7660	16.9499	2.4726
5. Other	22.3816	0.0002	0.0004						0.0409	0.2203	0.0210	0.1987
B. Fugitive emissions from fuels	1.5797	9.6091	0.0000						NO	NO	0.4018	NO
1. Solid fuels	NO	NO	NO						NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	1.5797	9.6091	0.0000						NO	NO	0.4018	NO
C. CO_2 Transport and storage	NO											
2. Industrial processes and product use	**751.8959**	**NO**	**NO**	**245.3168**	**0.0403**	**NO**	**0.0001**	**NO**	**1.8679**	**2.6172**	**88.9154**	**0.7987**
A. Mineral industry	536.8930								1.7673	1.3540	0.0171	0.7550
B. Chemical industry	NO	NO	NO						NO	NO	0.0177	NO
C. Metal industry	18.6972	NO	NO	NO	NO	NO	NO	NO	0.0607	0.7940	0.0247	0.0280

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions / removals	CH_4	N_2O	HFCs	PFCs	Unspecified mix of HFCs and PFCs	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)					(kt)			
D. Non-energy products from fuels and solvent use	195.3645	NO	NO						0.0301	0.1689	84.9204	0.0149
E. Electronic industry				NO	NO	NO	NO	NO				
F. Product uses as substitutes for ODS				245.3168	NO	NO	NO	NO				
G. Other product manufacture and use	0.9412	NO	NO	NO	0.0403	NO	0.0001	NO	0.0098	0.3004	0.4278	0.0008
H. Other									NO	NO	3.5077	NO
3. Agriculture	**42.6156**	**17.3363**	**3.5920**						**NO**	**NO**	**NE, NO**	
A. Enteric fermentation		15.5616										
B. Manure management		1.7747	0.5584								NO	
C. Rice cultivation		NO										
D. Agricultural soils			3.0335									
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		IE	IE						IE	IE	IE	
G. Liming	NO											
H. Urea application	42.6156											
I. Other carbon-containing fertilizers	NO, NE											
J. Other	NO	NO	NO						NO	NO	NO	
4. Land use, land-use change and forestry	**-172.3409**	**0.0321**	**0.5638**						**0.0200**	**0.7154**	**NO, NE**	
A. Forest land	-1,887.3228	0.0289	0.0016						0.0185	0.6586	NO, NE	
B. Cropland	1,629.9020	0.0032	0.0001						0.0015	0.0568	NO	
C. Grassland	-223.1528	NE	NE						NE	NE	NE	
D. Wetlands	-82.8099	NE	NE						NE	NE	NE	
E. Settlements	27.2098	NO, NE	0.5621						NO, NE	NO, NE	NO, NE	
F. Other land	329.1445	NE	NE						NE	NE	NE	
G. Harvested wood products	34.6883											
H. Other	NE	NE	NE						NE	NE	NE	
5. Waste	**13.7583**	**59.6743**	**0.2046**						**0.1379**	**2.4190**	**2.1869**	**0.0049**
A. Solid waste disposal	NA, NO	49.8473							NA, NO	NA, NO	2.1235	
B. Biological treatment of solid waste		0.0567	0.0034						NO, NE	0.0079	NO, NE	
C. Incineration and open burning of waste	13.7583	0.2823	0.0050						0.1379	2.4110	0.0533	0.0049
D. Wastewater treatment and discharge		9.4880	0.1963						NA, IE	NA, IE	0.0101	
E. Other	NO	NO	NO						NO	NO	NO	
6. Other	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Memo items:												
International bunkers	**35.2495**	**0.0002**	**0.0010**						**0.1233**	**0.0493**	**0.0247**	**0.0000**
Aviation	35.2495	0.0002	0.0010						0.1233	0.0493	0.0247	0.0000
Navigation	NO	NO	NO						NO	NO	NO	NO
Multilateral operations	**NO**	**NO**	**NO**						**NO**	**NO**	**NO**	**NO**
CO_2 emissions from biomass	2,985.9162											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NE											
Indirect N_2O			**0.9052**									
Indirect CO_2	**187.7661**											

ANNEX 2: NATIONALLY APPROPRIATE MITIGATION ACTIONS CONSIDERED, PLANNED AND ONGOING IN THE REPUBLIC OF MOLDOVA

The actions are presented based of the information available in the draft of the Low Emission Development Program of the Republic of Moldova until 2030 and the Action Plan for its implementation (2022)[564], in the Third Biennial Update Report of the Republic of Moldova to the UNFCC (2021), as well as in other relevant sources.

Mitigation action 1: Construction of capacities for producing electricity and heat from renewable sources

Description	Nature of the action	Energy production from renewable sources
	Sector	Electric power
	GHG	CO_2, CH_4
	Quantitative targets	- installed capacity of maximum 460 MW and 1.40 billion kWh of electricity produced from RES by 2025; - installed capacity of maximum 700 MW and 1.87 billion kWh of electricity produced from RES by 2030.
	Progress indicators	- RES capacity in operation, MW - electricity produced by RES, MWh - GHG emissions reductions, kt CO_2 eq.
Methods		- application of fixed tariffs and cap prices; - annual tenders for building, capacities pre-established for each type of RES: wind, solar, hydro, biogas, singas and direct combustion.
Assumptions		- wind energy technical potential – 9,000 MW[565]; - maximum potential of biogas sources - 150 MW; - hydro energy technical potential - 5 MW.
Goals		- increasing energy security; - GHG emissions reductions.
Undertaken steps		- in 2007 the Law on Renewable Energy was approved; - in 2009 the Methodology for calculating the Feed-in tariffs was approved; - in 2013, the Energy Strategy of the Republic of Moldova until 2030 was published; - in 2013 the Government approved the National Action Plan on renewable energy for 2013-2020; - in 2016, the Law on promoting Use of Energy from Renewable Energy Sources was approved; - in 2017, the Methodology for calculating fixed tariffs and prices for electricity produced by eligible producers from renewable energy sources was approved[566]; - on March 26, 2018, ANRE approved Feed-in tariffs for wind farms, biogas plants, hydro plants and photovoltaic plants for electricity production; - in 2020, fixed tariffs and cap prices for electricity produced from renewable sources were approved.
Planned steps		Amendment of the Government Decision on approval of capacity limits, maximum quotas and capacity categories in the field of renewable energy, project developed in 2020 and subject to public consultation[567].
Implementation progress	Environmental achievements	- By the end of 2019, the total installed capacity of power plants producing energy from renewable sources was 41.8 MW, except for the existing HPPs for which the support scheme does not apply. The total energy produced from RES was 67.43 million kWh. In 2020, the status of eligible producer was confirmed by ANRE[568] for the capacity of 35,631MW to be installed by the eligible producers.
	GHG emissions reductions	- minimum 844,536 tons CO_2 by 2025; - maximum 1,126,048 tons CO_2 by 2030.

Mitigation action 2: Construction of electrical interconnections with the ENTSO-E power system

Description	Nature of the action	Increasing the capacity to import electricity from neighboring countries, which would also serve to export and transit electricity
	Sector	Electric power
	GHG	CO_2
	Quantitative targets	- increasing electricity import capacity up to 870 MW from ENTSO-E by 2030; - electricity import capacity up to 4.5 billion kWh per year.
	Progress indicators	- interconnections capacity with Romania, MW - the amount of electricity imported from ENTSO-E, MWh - GHG emissions reductions, CO_2 tons equivalent
Methods		- construction and commissioning of the first 400 kV asynchronous interconnection with Romania by the end of 2024[569], through the back-to-back station to be installed at the Vulcanesti power station of the transmission system operator “Moldelectrica” S.E. - construction of 2, 400 kV interconnection with Romania by 2025-2027; - promoting the platform for the competitive sale of electricity, by 2024.
Assumptions		- average increase in electricity demand - 2.1%/year; - Romania will have electricity generation capacities, including from RES, sufficient for export to the Republic of Moldova until 2030; - Ukrainian and CTEM suppliers will be able to participate competitively in the sale of energy on the electricity market in the Republic of Moldova;
Goals		- increasing energy security; - ensuring competition on the electricity market, currently non-existing; - GHG emissions reduction.

[564] Ministry of Environment of the Republic of Moldova (2022), <https://mediu.gov.md/ro/content/evaluare-strategic%C4%83-de-mediu-la-nivel-na%C8%9Bional>.
[565] V. Rachier, I. Sobor, A. Chiciuc, Assessment of Wind Energy Resource of Moldova. Meridian Ingineresc, No. 2, 2014, pp. 23-29. ISSN 1683-853X.
[566] ANRE Decision no. 375 of 28.09.2017 on approval of the Methodology for calculating fixed tariffs and prices for electricity produced by eligible producers from renewable energy sources, Official Gazette No. 390-395 / 1988of 10.11.2017.
[567] <https://particip.gov.md/ro/document/stages/projectul-hotararii-guvernului-pentru-modificación-hotararii-guvernului-nr-6892018-cu-privire-la-approvarea-limitelor-de-capacitate-cota- maximum-and-capacity-categories-in-the-field-of-electricity-from-renewable-sources-until-the-year-2020/7841>
[568] <http://www.anre.md/registrul-producatorilor-eligibili-3-339>
[569] <https://mepiu.md/rom/noutati/deschiderea-ofertelor-pentru-procuarea-servciilor-de-constructie-a-lea-vulcanesti-chisinau>

Undertaken steps		- The Energy Strategy of the Republic of Moldova until 2030 established that one of the electricity supply scenarios is construction of interconnections with the Romanian electricity system for asynchronous operation through back-to-back stations; - The World Bank's study of 2013-2015, justified importing electricity to Moldova from ENTSO-E, instead of building power plants in the country, the latter option to be decided by the electricity market; - in 2015 the Government approved the Roadmap in the electricity sector for the period 2015-2030; - in 2015 the design of the respective interconnections started; - in December 2017, the Agreement between the Republic of Moldova, the EBRD, the EIB, the WB and the EU on granting of loans and the grant for financing the construction of the back-to-back Vulcan station and the transmission power lines was signed; - at the beginning of November 2020, the bids opening meeting for the international tender for purchasing of design, construction and installation services for the 400 kV high voltage transmission power line Vulcanesti-Chisinau[570], the duration of the works being estimated at approximately 42 months, from the time the contract is signed.
Planned steps		- establishing the form of ownership and management of interconnections; - launching the tender for construction of interconnections, by 2021; - creation of the Electricity Market Operator, with already approved Electricity Market Rules.
Implementation progress	Environmental achievements	At the request of the Government of the Republic of Moldova, the WB conducted a study that economically justified the feasibility of the solution to cover the demand for electricity by import of electricity
	GHG emissions reductions	- at least 10% of CO_2 emissions under the WEM scenario, measured at regional level.

Mitigation action 3: Implementation of the energy management system (EnMS) and the National Standard SM ISO 50001: 2012 in manufacturing and construction industry

Description	Nature of the action	Implementation of the energy management system (EnMS) and the National Standard SM ISO 50001: 2012 in manufacturing and construction industry
	Sector	Manufacturing and construction industry
	GHG	CO_2, CH_4, N_2O
	Quantitative targets	– minimum 103,000 kt CO_2 by 2025 – minimum 384,700 kt CO_2 by 2030 – minimum 666,330 kt CO_2 by 2035
	Progress indicators	– Energy Management System (EnMS) and the National Standard SM ISO 50001: 2012 implemented – modern technologies implemented, units; – reductions in GHG emissions, CO tons $_2$ eq..
Methods		– state support in launching advantageous credit lines (including with a grant component) by donor financial institutions (EBRD, EIB, FVC, etc.); – developing and promoting smart specialization.
Assumptions		– at least 20% of small and medium companies will implement energy efficiency projects, 50% by 2030.
Goals		– reducing energy intensity in manufacturing and construction industry; – GHG emissions reduction.
Undertaken steps		– in 2014, the Republic of Moldova - EU Association Agreement was signed[571]; – in 2018 the EU4Bussiness project for the implementation of the Moldova-EU Association Agreement, financed by the EBRD, was launched[572]; – in 2018, the Law on Energy Efficiency no.139, which provides for the mandatory implementation of energy efficiency/energy management measures for large companies, was passed; – in 2019 the Government approved the National Action Plan on Energy Efficiency for 2019-2021, GD no. 698; – In 2016, the Low Emission Development Strategy of the Republic of Moldova until 2030 was approved in 2017, the Program for promotion of "green" economy in the Republic of Moldova for the years 2018-2020 and the Action Plan for its implementation were approved; During 2012-2017, a large number of companies applied for support provided under the European Programs MoSEFF and GGF TAF, due to which advanced production technologies were implemented.
Planned steps		– In the end of 2020, the GEFF (Moldova Green Economy Finance Facility) project was launched, financed by the EBRD for the period 2020-2024, which will stimulate the use of "gold" class technologies, with significantly higher efficiency than those currently used; – the EU4Bussiness project financed by the EBRD has extended its duration for the period 2021-2022; – in 2023 the Government will approve the ECNP according to the requirements of the Energy Community, which will require a decrease in energy intensity in all sectors of the economy.
Implementation progress	Environmental achievements	– Currently more than 300 companies have implemented production technologies modernization projects under the EU4Bussiness project, which have reduced their CO_2 emissions by at least 30%; – During 2012-2017, energy efficiency projects were implemented with the support of the European Programs MoSEFF and GGF TAF, which resulted in implementation of advanced production technologies, thus ensuring CO_2 emissions reduction by at least 15%.
	GHG emissions reductions	– minimum 103,000 kt CO_2 by 2025; – minimum 384,700 kt CO_2 by 2030; – minimum 666,330 kt CO_2 by 2035.

[570] < https://mepiu.md/rom/noutati/deschiderea-ofertelor-pentru-procuarea-servciilor-de-constructie-a-lea-vulcanesti-chisinau>
[571] <http://dcfta.md/continutul-acordului-de-asociere-dintre-rm-si-ue>
[572] <https://eu4business.eu/moldova>

Mitigation action 4: Reducing GHG emissions in buildings sector

Description	Nature of the action	Development of the legislative and regulatory framework, enhancing energy efficiency, promotion of RES
	Sector	Energy
	GHG	CO_2, CH_4, N_2O
	Quantitative targets	- unconditional reduction, of GHG emissions from the building sector by 77% by 2030, and conditional reduction of GHG by 80% compared to 1990[573]; - renovation of 1%/year of identified and selected public buildings, with an area of 4,251 m^2, which will generate approximately 59.75 toe energy savings annually[574]; - primary energy savings in 2021 of 21.52 ktep[575] in the residential and public sector;
	Progress indicators	- legislative and regulatory acts in the field of construction developed and approved annually; - building codes developed and approved annually; - share of rehabilitated buildings in the total housing stock, %; - energy saved annually, GJ/year (MWh / year); - total capacity of installed biomass boilers, MW; - area of the installed solar collectors; - substituted solar energy, MWh/year; - thermal power of the installed heat pumps, MW; - GHG emissions reductions, kt CO_2 equivalent
Methods		1. Development and approval[576] of the regulatory framework on energy performance of buildings, the secondary legal framework related to Law no.139/2018 on Energy Efficiency, the National Plan for increasing the number of buildings with almost zero energy consumption, the Building Renovation Strategy, etc.; 2. Implementation of the energy savings M&V tool; 3. Promotion of energy performance contracts and energy service companies (ESCOs); 4. Assessing the energy efficiency potential; 5. Training and education, including consultancy programs in energy, research, awareness-raising activities; 6. Establishing and implementing financial incentives for[577]: a) improving energy efficiency in residential buildings; b) improving energy efficiency in the public construction sector. 7. Promotion of NAMA; 8. Promoting energy efficiency in the heat distribution system by installing individual thermal points, replacing the vertical heating system with the horizontal one, with separate metering in each apartment, equipping the heating system with regulation/automation elements with the possibility of regulating air temperature in the rooms[578].
Assumptions		1) Continuation of existing financing projects in the field of energy performance of buildings; 2) After merging the EEE with the EFF, the financing of energy efficiency projects in the public sector will continue; 3) Lending to the residential and public sector by local commercial banks.
Goals		- development and implementation of national programs and action plans on improving the energy performance of buildings[579]; - establishing and implementing financial incentives for: implementing measures to improve the energy performance of existing buildings, their units and elements; promoting the construction of new buildings with almost zero energy consumption and promoting the transformation of existing buildings into buildings with almost zero energy consumption[580]; - use of renewable energy sources; - increasing energy security; - reducing energy consumption costs; - GHG emissions reduction.
Undertaken steps		- In 2015, Law no. 128 on Energy performance of buildings[581] was approved. The clauses regarding ventilation, cooling and lighting came into force in 2017; - The Action Plan on the harmonization of technical regulations and national standards in the field of constructions with European legislation and standards for the years 2014-2020 was adopted[582]. - In 2013, more than 100 EU standards in the field of energy performance of buildings were adopted, and after 2013 several new regulations were adopted, others being in the process of adoption; - Reorganization of the AEE by merging with FEE[583]; - On August 17, 2018, the Law no. 139 on Energy Efficiency[584] came into force; - 57 residential blocks with 3117 apartments have autonomous central heating with thermal energy consumption savings up to 30%[585].
Planned steps		- Development and adoption of the Building Renovation Strategy; - Development and approval of the energy saving validation system; - Launching of new tenders by the Energy Efficiency Agency to finance eligible projects.
Implementation progress	Environmental achievements	- About 1200 renovation and/or endowment subprojects with a total cost of 29 million Euro[586]. - Under the EU Energy and Biomass Project II in Moldova in 2015-2018[587]: 79 biomass heating systems and 49 solar energy based hot water production systems installed in public institutions; 121 schools, kindergartens, community centers, hospitals have modern biomass heating systems; 523 households and micro-enterprises are heated with green energy; 30 companies assemble or produce biomass boilers locally and offer them to the beneficiaries; etc. - primary energy savings in 2018 in the building sector were 75.09 ktoe[588]
	GHG emissions reductions	136.5 kt CO_2 eq. in 2019-2021 resulting from the expected energy reductions[589] 893.2 kt CO_2 eq. by 2030[590]

[573] The draft Low Emissions Development Strategy of the Republic of Moldova until 2030.
[574] National Action Plan on Energy Efficiency for 2019-2021. Government Decision no.698 of 27.12.2019. Official Gazettenr.7-13 from 17.01.2020
[575] Based on the National Action Plan on Energy Efficiency for 2019-2021. Government Decision no.698 of 27.12.2019. Official Gazette nr.7-13 of 17.01.2020
[576] Based on the National Action Plan on Energy Efficiency for 2019-2021. Government Decision no.698 of 27.12.2019. Official Gazette nr.7-13 of 17.01.2020
[577] Based on the National Action Plan on Energy Efficiency for 2019-2021. Government Decision no.698 of 27.12.2019. Official Gazette nr.7-13 of 17.01.2020
[578] Termoelectrica SA <https://www.termoelectrica.md/ro_RO/dezvoltare/pti-distributia-pe-orizontala/>
[579] Law on Energy Performance of Buildings, No.128 of 11.07.2014. Official Gazette nr.297-309 of 10.10.2014
[580] Law on Energy Performance of Buildings, No.128 of 11.07.2014. Official Gazette nr.297-309 of 10.10.2014
[581] Law on Energy Performance of Buildings, No.128 of 11.07.2014. Official Gazette nr.297-309 of 10.10.2014
[582] On Harmonization of technical regulations and national standards in the field of construction with European legislation and standards. Government Decision no. 933 of 12.11.2014. Official Gazette nr.340-343 of 14.11.2014
[583] On the organization and functioning of the Energy Efficiency Agency. Government Decision no.45 of 30.01.2019. Official Gazette nr.38-47 of 18.02.2019
[584] Law on Energy Efficiency, no.139 of 19.07.2018. Official Gazette nr.309-320 of 17.08.2018
[585] <https://www.termoelectrica.md/ro_RO/dezvoltare/realizari/>
[586] <http://curentul.md/stiri/directorul-ip-fism-despre-programul-de-asistenta-tehnica-si-financiara-acordata-de-guvernul-romaniei-pentru-institutiile-prescolare-din-republica-moldova .html>
[587] Energy and Biomass (phase 2). <https://www.md.undp.org/content/moldova/ro/home/projects/moldova-energy-and-biomass-project2.html>
[588] Based on the National Action Plan on Energy Efficiency for 2019-2021. Government Decision no.698 of 27.12.2019. Official Gazette nr.7-13 of 17.01.2020.
[589] Based on the National Action Plan on Energy Efficiency for 2019-2021. Government Decision no.698 of 27.12.2019. Official Gazette nr.7-13 of 17.01.2020.
[590] Government Decision no.1470 of 30.12.2016 on approval of the Low Emissions Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation. Official Gazette nr.85-91/222 of 24.03.2017.

Mitigation action 5: Reducing GHG emissions in heat production, transmission and distribution

Description	Nature of the action	Development of the legislative and regulatory framework, enhancing energy efficiency, promotion of RES
	Sector	Energy
	GHG	CO_2, CH_4, N_2O
	Quantitative targets	- Unconditional reduction, by 2030, of GHG emissions from the Energy sector by 74% and conditional GHG emissions reduction up to 82% compared to 1990[591] - energy savings of 21.35 ktep in 2020 [592] - energy savings of 1.05 ktep in 2020 [593]
	Progress indicators	- legislation and regulatory framework developed and approved; - database on thermal energy sources; - plans for production of thermal energy in cogeneration mode developed and approved; - global energy demand of the country, ktep; - GHG emissions reductions, CO_2 tons eq.
Methods		1. Assessment of the national energy efficiency potential; 2. Training and education, including consultancy programs in the field of energy, research, awareness-raising activities; 3. Replacement of existing thermal points with individual thermal points; 4. Reducing losses in the distribution network; 5. Promoting the refurbishment of heat plants into modern mini-CHPs; 6. Installation of condensing economizers on existing boilers.
Assumptions		- the second project to improve the efficiency of the district heating system, worth US$ 100 million, will be carried out in 2020-2024 at "Termoelectrica SA"[594] – the Budget of the Balti Heat Supply System Modernization Project (within S.A. „CET Nord"), worth 10.7 mil. euro (7 mil. euro EBRD loan, 0.7 mil. euro – grant provided by the EBRD Shareholders Special Fud, 3 mil. euro – grant from the E5P Fund)[595].
Goals		- promoting efficient cogeneration depending on the useful heat demand; - creation of databases for monitoring heat consumption and planning; - favoring the optimization of heat production and distribution. The actions included in this measure refer to the energy efficiency of the district heating system in Chisinau and Balti municipalities. - mobilizing efforts and planning the efficiency of the thermal energy system, - reducing operational costs; - improving services; - increasing energy security; - modernization of heat plants and energy distribution system; - GHG emissions reduction.
Undertaken steps		- at "Termoelectrica" SA: modernization of the internal heat distribution system by installing 900[596] Individual Thermal Points, including installation of about 500 ITPs in residential buildings and public institutions in the capital city[597]; - modernization of about 175 km of heat pipes over 30 years old, by replacing them with modern, pre-insulated and energy efficient pipes; – 57 residential buildings with 3117 apartments have de Autonomous Centralized Heating [598]; - replacement of 1300 heat meters and 1600 hot water meters with modern ultrasonic meters; – in 2021 the first modular biomass-based power plant, integrated into the district heating system of Chisinau municipality, was inaugurated [599]; - in 2020 „CET-Nord" SA allocated 33.8 million MDL for renovation and modernization of the production equipment and of the thermal networks, two times more compared to 2019[600]. For capital repairs 9.2 mil lei were earmarked, for current repairs - 4.2 mil and a little more than 20 mil lei were earmarked for investments in production capacities development[601]. Among the implemented measures - modernization of the main thermal network of about 1.7 km[602]; - implementation at "CET-Nord" SA of ISO standards: ISO 9001: 2015 which aims to increase the overall efficiency of the enterprise; ISO 50001: 2018 which allows the establishment, implementation, maintenance and improvement of the energy management system; ISO 14001: 2015 environmental management system implemented leads to: reducing energy consumption, increasing the efficiency of using products, processes and providing services; reducing costs by using raw materials more efficiently and improving performance; use of renewable resources[603]; - restored the hot water supply system at "CET-Nord" SA. Since 2019, the heat supplier has advanced technologies for supplying thermal energy for water heating[604]; built the cogeneration plant for electricity and heat production equipped with 4 Jenbacher internal combustion natural gas – based engines[605]; installed 169 individual thermal points in 130 residential buildings[606].
Planned steps		- Improving energy performance of centralized heat supply systems by optimizing the heat production, distribution and supply related processes, especially in the Centralized Heat Supply Systems (SACET) in Chisinau and Balti with primary energy savings of approx. 5.91 ktoe during 2019-2021. – development of the energy sector of the Republic of Moldova with the World Bank's support – Centralized heat Supply System Efficiency Enhancement Project 2, aimed at continuation of efforts to modernize the heat supply infrastructure of Termoelectrica S.A. – improving the operational and energy efficiency of the heat supply system in Balti municipality by implementing the "Heat supply system in Balti municipality – Phase II" Project financed from the EBRD loan worth 17 million euro for the CHP-Nord in Balti[607]
Implementation progress	Environmental achievements	- primary energy savings related to the thermal energy sector in 2017-2018 are about 1.44 ktoe[608];
	GHG emissions reductions	13.88 kt CO_2 eq. in 2019-2021, based on the estimated energy reductions

591 Draft Government Decision approving the Low Emission Development Strategy of the Republic of Moldova until 2030.
592 The Low-Emission Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation. Government Decision No. 1470 of 30.12.2016. Official Gazette No. 85-91/222 of 24.03.2017
593 Based on the National Energy Efficiency Action Plan for 2019-2021. Government Decision No. 698 of 27.12.2019. Official Gazette No. 7-13 of 17.01.2020
594 <https://www.termoelectrica.md/ro_RO/dezvoltare/realizari/>
595 Based on the National Energy efficiency Action Plan for 2019-2021. Government Decision No. 698 of 27.12.2019. Official Gazette No. 7-13 of 17.01.2020 0
596 <https://www.termoelectrica.md/ro_RO/dezvoltare/realizari/>
597 < https://www.termoelectrica.md/ro_RO/termoelectrica-investeste-in-modernizzazione-sistemului-de-termoficare-in-124-de-blocuri-locative-si-34-de-cladiri-administrative/ >
598 <https://www.termoelectrica.md/ro_RO/dezvoltare/realizari/>
599 The first Biomass Thermal plant was inaugurated in SACET Chisinau <https://agrobiznes.md/a-fost-inaugurata-prima-centrala-termica-pe-biomasa-miscanthus-in-sacet-chisinau.html?goal=0_2cfa20d609-91e09b 3e83-122646673>
600 <https://www.cet-nord.md/ro/press-center/373-din-prima-sursa-interviu-cu-igor-savin-director-tehnic-al-cet-nord-sa>
601 <https://www.cet-nord.md/ro/press-center/373-din-prima-sursa-interviu-cu-igor-savin-director-tehnic-al-cet-nord-sa>
602 <https://www.cet-nord.md/ro/press-center/news/329-cet-nord-sa-modernizeaz-o-re-ea-termic-magistral-de-1-7-km>
603 <https://www.cet-nord.md/ro/press-center/news/362-cet-nord-sa-a-ini-iat-implementarea-standardelor-iso>
604 <https://www.cet-nord.md/ro/press-center/news/332-economise-te-contract-nd-serviciul-de-aprovizizare-cu-ap-cald-de-la-cet-nord -sa>
605 <https://www.cet-nord.md/ro/press-center/news/256-cet-nord-utilizeaz-echipament-modern-n-producerea-energiei-termice-i-electrice>
606 <https://www.cet-nord.md/ro/press-center/news/256-cet-nord-utilizeaz-echipament-modern-n-producerea-energiei-termice-i-electrice>
607 The Republic of Moldova will benefit from 17 million euros for retrofitting the central heating system in Balti <https://midr.gov.md/noutati/republica-moldova-va-beneficia-de-17-mil-de-euro-pentru-modernizarea-sistemului-de-incalzire-centralizata-in-balti>
608 Based on the National Action Plan on Energy Efficiency for 2019-2021. Government Decision no.698 of 27.12.2019. Official Gazette nr.7-13 of 17.01.2020

Mitigation action 6: Increasing the share of compressed natural gas use in the automotive sector

Description	Nature of the action	Cleaner fuels –compressed natural gas
	Sector	Automotive
	GHG	CO_2, CH_4, N_2O
	Quantitative targets	– replacing traditional fuels with compressed natural gas
	Progress indicators	– wider use of vehicles with engine based on compressed natural gas – GHG emissions reductions, kt CO_2 equivalent
Methods		– motivation for marketing and consumption of natural gas and LPG – monitoring of natural gas purchases by car owners – monitoring of the natural gas import
Assumptions		– in 2019, the consumption of compressed natural gas amounted to 17 million. m^3, which accounts for only 2% of total fuel consumption in the automotive sector[609].
Goals		– increasing energy security – reduction of GHG emissions
Undertaken steps		In 2014 the Government approved the Environmental Strategy for 2014-2023 and the Action Plan for its implementation, GD no. 301 of 24.04.2014. In 2016 the Government approved the Low Emission Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation and in 2018 the Government approved the Green Economy Promotion Program for 2018-2020 and the Action Plan for its implementation. Among the actions are the replacement of traditional fuels with compressed natural gas and liquefied well gas, which are less polluting and integration of environmental provisions related to encouraging use of alternative fuels and new technologies in all types of transport into transport policies.
Planned steps		– development and approval of the secondary regulatory framework
Implementation progress	Environmental achievements	Use of 1 million.m^3 of compressed natural gas instead of 1 thousand tons of petrol results into a 1.5-fold reduction in GHG emissions expressed in CO_2 equivalent.
	GHG emissions reductions	Annual use of 1 million m^3 of natural gas instead of 1 thousand tons of petrol in motor vehicles over 10 years will contribute to GHG emissions reduction by 11 kt CO_2 eq. until 2030.

Mitigation action 7: Biofuels in the transport sector

Description	Nature of the action	Renewable sources in transport
	Sector	Transport
	GHG	CO_2
	Quantitative targets	- 10% share of biofuels in total fuels used in the country
	Progress indicators	- amount of biofuels used; - GHG emissions reduction, CO_2 tons equivalent.
Methods		- motivation for sale and consumption of biofuels; - monitoring purchase of biofuels by car owners; - monitoring import of biofuels; - monitoring of rapeseed exports; - creation of MRV bodies dedicated to the actual consumption of biofuels; - publicity and training.
Assumptions		- by 2020 consumption of biofuels was 38.5 ktoe, including 11.7 ktoe bioethanol and 26.8 ktoe biodiesel; - until 2020 no biofuel production in the country for own consumption.
Goals		- increasing energy security; - reducing GHG emissions.
Undertaken steps		- the Moldovan-German company "Bio-Company-Raps" has been operating in Lipcani since 2006; - The Energy Strategy until 2030 provides for 10% of biofuel blends in the amount of fuel sold by 2020; - in 2013 the Government approved the National Action Plan on Renewable Energy for 2013-2020, according to which the planned contribution of biofuels to reaching the 10%target of energy from renewable sources in energy consumption in transport by 2020 will be ensured entirely on the basis of imports, while the domestic contribution will only become relevant if it can compete with import prices; - in 2018 the Government approved the Program for promoting "green" economy for 2018-2020 and the Action Plan for its implementation, which among the actions includes integration of environmental provisions related to encouraging the use of alternative fuels and new technologies in all types of transport in the transport policies.
Planned steps		- development and approval of the secondary regulatory framework.
Implementation progress	Achieved results:	- biofuels were not used in the country, though 887.05 tons of rapeseed were processed in 2009, with subsequent extraction of more than 261.5 tons of biofuel for export[610].
	GHG emissions reductions	50 kt CO_2 by 2030

Mitigation action 8: Electric buses in Chisinau

Description	Nature of the action	Electric public transport, Chisinau
	Sector	Transport
	GHG	CO_2, N_2O, CH_4
	Quantitative targets	- within 10 years, 100% of the diesel buses in Chisinau replaced with other with electric motors.
	Progress indicators	- number of public transport units replaced; - GHG emissions reductions, CO_2 tons equivalent.
Methods		- monitoring the procurement of public transport units with electric motors; - publicity and training.
Assumptions		- by 2030 all diesel buses in Chisinau will be replaced by other with electric motors

[609] <https://statistica.gov.md/pageview.php?l=ro&idc=263&id=2197>
[610] <http://mediu.gov.md/images/documente/starea_mediului/rapoarte/nationale/p7_Anuarul_IES_2009.pdf>

Goals		- increasing energy security; - GHG emissions reduction; - reducing local pollution, including noise pollution; - reducing the frequency of human diseases caused by air pollution.
Undertaken steps		- the amendments operated to the Fiscal Code, starting with the year 2020, exempted vehicles with electric engine from VAT; - in 2018, the Program for promoting the "green" economy for 2018-2020 was published.
Planned steps		- development and approval of the secondary regulatory framework, amendments to the existing normative framework
Implementation progress	Achieved results:	Launching of the project "Facilitating Green Public Investment in Moldova: Implementing the Clean Public Transport Program", funded under the European Union for the Environment (EU4Environment) Program.
	GHG emissions reductions	5.5 kt CO_2 by 2030

Mitigation action 9: Co-incineration of alternative fuels (biomass and solid municipal waste) in the clinker kiln, in order to recover the energy from waste in cement production and partial substitution of clinker at Lafarge Cement (Moldova) enterprise (member of LafargeHolcim Group)

Description	Nature of the action	Co-incineration of alternative fuels (biomass and solid municipal waste) in the clinker kiln, aimed at producing energy from the waste generated during cement production, and partial substitution of clinker at Lafarge Cement (Moldova) (member of LafargeHolcim Group)
	Sector	Industrial processes and product use
	GHG	CO_2
	Quantitative targets	The member companies of LafargeHolcim Group set their goal to reduce net CO_2 per ton of cement produced by 40% by 2030[611], compared to 1990
	Progress indicators	- total quantities of cement and clinker produced annually, thousands of tons/year; - the specific amount of clinker used to produce cement, tons/tons; - total fuel consumption used in cement production, TJ/year; - CO_2 emissions from cement production process, thousand tons/year; - CO_2 emissions from burning fuel in the cement production process, thousands of tons/year; - trend of the default emission factor value, tons CO_2 from burning fuel/ton of cement; - trend of the default emission factor value, tons CO_2 process /ton of cement; - trend of the default emission factor value, total tons CO_2 (combustion + process)/ton of cement.
Methods		- CO_2 combustion emissions and, projected CO_2 combustion emissions from cement production, were calculated by Tier 1 methodology available in the IPCC Guide 2006, Vol. 2, Chapters 1 and 2; - CO_2 process emissions and, respectively, projected CO_2 process emissions from production of cement, were calculated by Tier 2 methodology available in the IPCC Guide 2006, Vol. 3, Chapter 2; - MRV for CO_2 mitigation measures from clinker production.
Assumptions		With reference to Lafarge Cement (Moldova), the following outputs are expected: 2025 - 725 thousand tons of cement, 2030 - 825 thousand tons of cement, 2035 – 925 thousand tons of cement (for comparison, the level of cement production in 1990 - 1100 thousand tons of cement, and in 2020 – 670.3 thousand tons of cement); specific consumption of clinker per ton of cement: 2025 - 0.740 t/c, 2030 - 0.705 t/c; (equivalent with 0.788 t/t in 1990, and 0.749 t/t in 2020); with reference to historical fuel consumption during 1990-1995 and 2015-2020, the company used massive oil coke (petcock), consumption of which varied between 112.1 in 1990 and 28.3 kt in 2020, during 1995-2020 natural gas is used and in combination with other fuels, but natural gas consumption has fallen considerably from 85.4 million m^3 in 2007 up to 2.3 million m^3 in 2020, as a result of the high price of this energy source; since 2008 the company has started consuming coal (anthracite), including as a result of the lower price compared to natural gas, and its consumption varied between 22 and 81 kt over 2008-2020; it is assumed that in the short term the company will continue to use coal, but later this type of fuel will be replaced by natural gas, which is more harmless in terms of environmental pollution due to lower carbon content and organic waste (during 2009-2017 the company used rubber waste (used tires), and its consumption varied between 2 and 37 kt, while during 2015-2017 oil sludge was also used, its consumption varying between 4.0 and 10.7 kt) .
Goals		- LafargeHolcim was the first building materials company to commit to reducing its CO_2 emissions in 2000 as part of its partnership with the World Wildlife Fund (WWF), the leading environmental non-governmental organization. - LafargeHolcim is a leader in cement industry in climate action and a founding member of the cement Sustainability Initiative, an initiative of the World Business Council for Sustainable Development. It brings together key actors in the cement industry to adopt an approach that will involve the whole sector in reducing CO_2 emissions; – With reference to climate change and CO_2 mitigation measures, LafargeHolcim Group focused on the variable cost of cement production, focusing on alternative fuels, defining the company following priorities: management of alternative energy resources; increasing industrial and operational capacity, permits and local communities management; - On September 21, 2020, LafargeHolcim signed the commitment "net zero carbon emissions, science-based objective" in New York. As the first global building materials company to sign the "Business ambition for the 1.5°C climate target", commitment with intermediate targets validated by the Science-based Goals Initiative (SBTi), in line with the net zero CO_2 emissions path. This commitment is based on LafargeHolcim's global leadership in the construction sector, with state-of-the-art "green" solutions such as ECOPact green concrete and Susteno circular cement; – In its 2030 target, LafargeHolcim Group sets out its ambition to increase CO_2 mitigation targets by reducing the intensity of cement emissions from around 800 kg CO_2 net emissions per ton of cement produced in 1990, up to 475 kg CO_2 net emissions per ton of cement produced in 2030, based on an investment roadmap of around 160 million Swiss francs; – Thus, the target of reducing specific CO_2 emissions per ton of cement announced by LafargeHolcim Group for 2030 is minus 40% compared to 1990.

[611] LafargeHolcim <https://www.lafargeholcim.com/our-climate-pledge>

Undertaken steps	The following were approved: - National Energy Efficiency Program for 2011-2020, GD No. 833/2011[612], - Energy Strategy of the Republic of Moldova until 2030, GD No. 102/203[613], - Waste management strategy of the Republic of Moldova for 2013-2027, GD No. 248/2013[614], - The Environmental strategy for 2014-2023 and the Action Plan for its implementation, GD No. 301/2014[615], - The Low-Emission Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation, GD no. 1470/2016[616] (Specific objective 4 involves an unconditional reduction, by 2030, of GHG emissions from the industrial sector by 45% and a reduction of conditional GHG emissions by 56% compared to 1990, and measure 4.4 of the Action Plan for the Strategy implementation, specifies substitution of clinker in cement production); - The efforts of the LafargeHolcim group to reduce net CO_2 emissions per ton of cement produced resulted in 21.7%[617] reduction by the end of 2010, 24% reduction by the end of 2015, and by 27%[618] by the end of 2019 compared to the 1990 reference year; - In order to honor its environmental sustainability commitment, the LafargeHolcim Group has developed new types of cement, such as CEMFORT[619], with a lower clinker content than in traditional products[620, 621], as well as hydraulic binders (ROADMIX, FILLER) for road infrastructure projects, new products have been created to better meet customers' needs. Recently, eco-friendly ECOPact concrete has been launched on the market, which allows carbon-neutral construction and Susteno basic circular cement; - On 16.11.2017 Lafarge Ciment (Moldova) inaugurated an Innovation Center[622] in Chisinau, which is part of LafargeHolcim's international network of construction research laboratories, created to capitalize on the Group's global experience and technical know-how to develop construction solutions adapted to the unique characteristics of local markets; 200 engineers work in Lyon in the Group's Research Center, looking for optimal solutions to anticipate and meet customer expectations and needs to meet the challenges of the 21st century, their effort already recognized through more than 280 patents. The new Innovation Center in Chisinau is the channel through which modern solutions and technologies born in Lyon reach the local consumer. Some solutions have already been spread on the Moldovan market. – The environmental-oriented solution that LafargeHolcim currently offers is the ability to provide environmental services to municipalities, by co-processing and converting waste into alternative fuels and raw materials used in the cement manufacturing process; this method, commonly used to treat waste under controlled and safe conditions, has a number of advantages, such as: disposal of waste, conservation of natural resources, reduction of gas emissions that would result if such waste were treated by landfilling or incineration, extension of the life of land allocated for waste disposal and lower than current costs for municipalities for waste management.
Planned steps	By 2030, the LafargeHolcim group will: - accelerate the use of its low or neutral carbon footprint products, such as ECOPact, which allows carbon-neutral construction and Susteno, the basic circular cement, and will continue to develop new types of cement with a lower clinker content than in traditional products; - intensify the use of calcined clay and will develop cements with new binders; - recover 100 million tons of waste and by-products as energy sources and raw materials; - double the usability of waste-derived fuels in the production process, to achieve a substitution rate of 37%; - reach 550 kg CO_2 net emissions per ton of cement by 2022, respectively 457 kg CO_2 net emissions per ton of cement produced by 2030; - operate its first zero-carbon production unit. The target of reducing CO_2 intensity up to 475 kg per ton of cement produced by 2030 is to be achieved due to the following activities: - *Reducing clinker content by up to 68%:* the reduction of primary carbon emissions will be achieved by changing the clinker-cement ratio. In production of clinker, the main component of cement, the highest CO_2 emissions associated with cement production are produced. Most of these emissions result from the chemical reaction that occurs when the raw material (limestone) are calcined in a combustion furnace to the clinker. This decarbonization process is the largest source of CO_2 emissions, accounting for about 65% of the total level 1 emissions associated with cement production. Replacing clinker with alternative mineral components in finished products reduces the intensity of carbon when cement is produced. The main reduction will be achieved not only by recycling waste from the construction industry or by-products from other industries, but also by investing in clay calcination plants and developing new types of cement and new binders. It is anticipated that calcined clay will gradually replace traditional mineral components such as slag or ash; - *Wider use of waste derived fuels to achieve a 37% substitution rate.* Implementing the circular economy approach will contribute to achieving the target of reducing carbon intensity in the types of cement produced, by replacing fossil fuels with waste-based pre-treated, recyclable and biomass fuels in the operation of cement production kilns; The production, recovery and recycling of waste-derived fuels and materials in industrial processes will enable the redirection of waste from incineration or landfilling and improve the local waste management hierarchy. In order to increase the "thermal substitution rate", investments in facilities for co-processing and optimization of technological processes will be made. The Group's cement plants in Europe are expected to reach an even higher substitution rate of around 70% in the same time frame, as waste in European countries is more available compared to other markets. - *Alternative raw materials:* most CO_2 emissions come from high-temperature calcination of raw materials to produce clinker. The use of alternative sources of decarbonized raw materials is a key way to reduce the intensity of CO_2 emissions per ton of cement produced. Waste materials and by-products from other industries may be used to replace part of the limestone used as a raw material. These materials may include waste from demolition, slag, waste from lime production. The Group's roadmap will evolve steadily as cooperation with innovative companies will raise standards and develop new streams of decarbonized alternative materials. This replacement trend is at an early stage, but will be actively continued in the near future; - *Carbon capture and storage*: The production of cement with zero net carbon emissions will require the efficient Carbon Capture and Usage or Storage (or CCUS). The LafargeHolcim Group is currently piloting over twenty projects implementing CCUS technology in Europe and North America. Over the next 10 years, CCUS technologies will be explored to reach cost-effective solutions that the cement industry needs to achieve its proposed carbon neutrality target by 2050;

[612] Government Decision no. 833 of 10.11.2011 on the National Energy Efficiency Program 2011-2020. Published: 18.11.2011 in the Official Gazette no. 197-202, Art. no: 914 <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=340940.

[613] Government Decision no. 102 of 05.02.2013 on the Energy Strategy of the Republic of Moldova until 2030. Published: 08.02.2013 in the Official Gazette no. 27-30, Art. no: 146. <http://lex.justice.md/md/346670/>

[614] Government Decision no. 248 of 10.04.2013 on the approval of the Waste Management Strategy in the Republic of Moldova for 2013-2027. Published: 12.04.2013 in the Official Gazette no. 82 Art. no: 306. <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=347341>

[615] Government Decision no. 301 of 24.04.2014 on approval of the Environmental Strategy for the years 2014-2023 and of the Action Plan for its implementation. Published: 06.05.2014 in the Official Gazette no. 104-109, Art. no: 328. <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=352740>

[616] Government Decision no. 1470 of 30.12.2016 on approval of Low Emissions Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation. Published: 24.03.2017 in the Official Gazette no. 85-91, Art. no. 222. <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=369528>

[617] <http://www.lafarge.md/wps/portal/md/7_3-TheNews_Detail?WCM_GLOBAL_CONTEXT=/wps/wcm/connectlib_md/Site_md/AllPR2/PressRelease_1327993713495/PR_Header>

[618] <https://www.lafargeholcim.com/our-climate-actions-today>

[619] Lafarge Cement Plant (Moldova) (2017), CEMFORT is a Portland cement composite with fast curing (R) and high workability. The main constituents are the Portland Clinker between 65–79% and the addition of limestone with a high category in the proportion of 21–35%. <http://docplayer.ru/51293331-Cement-pentru-betoane.html>

[620] Lafarge Cement Plant (Moldova) (2017), CEM II AS 32.5R Cement is a Portland type composite cement for ordinary concrete with high initial strength and high workability. The main constituents are clinker between 80-94% and a mixed addition of 6-20%. <http://www.lafarge.md/wps/portal/md/2_3_A-Detail?WCM_GLOBAL_CONTEXT=/wps/wcm/connectlib_md/Site_md/AllProductDataSheet/ProductDatasheet+Example_1413538963872/Prod

[621] Lafarge Cement Plant (Moldova) (2017), CEM I 42.5R Cement is a Portland type cement for extra hard concrete. It is a cement without addition, with high initial strength for concrete, with fast hardening. The main constituents are Portland clinker (95-100%) and minor components (0-5%). <http://www.lafarge.md/wps/portal/md/2_3_A-Detail?WCM_GLOBAL_CONTEXT=/wps/wcm/connectlib_md/Site_md/AllProductDataSheet/ProductDatasheet+Example_1308902180501/PRO

[622] Lafarge Cement Plant (Moldova) (2017), Press release of 16.11.2017. Lafarge Moldova inaugurates an Innovation Center in Chisinau. <http://www.lafarge.md/wps/portal/md/7_2-LatestNews_Detail?WCM_GLOBAL_CONTEXT=/wps/wcm/connectlib_md/Site_md/AllPR/PressRelease_1511126081427/PR_RO>

Planned steps		The target to reduce the intensity of emissions from the purchase of electricity up to 13 kg CO_2 per ton of cement produced by 2030 (or by 65% compared to 2018), will be achieved due to the following activities: - *Residual heat recovery*: energy generation assets will be optimized across the entire cement plant portfolio by installing residual heat recovery units to generate electricity from thermal processes. Currently, five waste heat recovery units are operated in four countries, with a plan to triple their number in two stages by 2030; - *Expanding the renewable energy portfolio:* continue the process of expanding the renewable energy portfolio by working with clean energy producers, generating renewable energy on the group's land by installing wind turbines and solar panels; monitoring the progressive decarbonization of the electricity grid and the supply of electricity from renewable sources to reduce the carbon intensity of the electricity purchased where such opportunities arise; The target to reduce emissions from transportation of finished product will be achieved due to the following activities: - *Optimization of transport networks*: the Group is implementing a "network optimization modeling tool" to achieve the smallest carbon footprint and optimize the finished production transportation network. The tool has been implemented in 7 countries and there is progress on its implementation; - *Optimization of routes and loads by better logistics and distribution:* the group implements 'tools to optimize the transport routes of finished production' to support operational decisions on road transport that reduce transport distances and fuel consumption; - *Optimizing the car fleet to reduce traditional fuel consumption:* the group works with vehicle suppliers to improve their design and weight. Wherever possible, preference is given to transport companies using environmentally friendly vehicles within the optimized models, it is planned to use electric or liquefied gas operated trucks. Also, car drivers (own truck fleet and third-party fleet) are trained to drive more efficiently and safely (fuel consumption can thus be reduced by 3-6%); - *Fossil fuel consumption:* Emissions from fossil fuels transportation are optimized by purchasing fossil fuels in local markets and using environmentally friendly transport.
Implementation progress	Achieved results:	- LafargeHolcim Group has reduced its net emissions per ton of cement produced from around 0.800 tons of CO_2 net emissions per ton of cement in 1990, up to 0.576 ton of CO_2 net emissions per ton of cement produced in 2018, and respectively up to 0.561 ton of CO_2 net emissions per ton of cement produced in 2019; - In 2019, about 21% of the energy needed is produced from alternative fuels, low carbon fuels and biomass; alternative energy sources contribute to the reduction of CO_2 emissions, i.e. the redirection of waste streams from incineration plants or storages at solid waste deposit sites; on its path toward the net zero emission target, LafargeHolcim Group accelerated the implementation of the circular economy by using recyclable materials in its products and processes, recovering materials at the end of their life cycle; thus, only in 2019, the LafargeHolcim group recovered about 48 million tons of waste, being recognized as one of the global leaders in sustainable waste management solutions, contributing to the conservation of the planet's finite resources; - Cement production is an energy-intensive process, energy costs and security of supply are key factors for this sector; improving energy efficiency reduces the carbon footprint and reduces production costs; as a result of these efforts, at the group level LafargeHolcim group, reduced energy consumption per ton of clinker produced from 4,532 MJ in 1990, to 3,526 MJ in 2019 compared to 1990, while specific energy consumption increased three times slower compared to the increase in cement production; - The group's products currently use on average about 29% alternative constituents to replace clinker (0.710 ton of clinker per 1 ton of cement produced), one of the lowest average levels of clinker content in the cement industry worldwide; - With reference to the Lafarge Cement plant (Moldova), during 1990-2019, the cement production decreased by 39.1%, from 1100.3 thousand tons to 670.3 kt; clinker production decreased by 42.1%, from 866.7 kt to 502.2 kt; energy consumption decreased by 56.8%, from 3881.2 TJ to 1676.7 TJ; the specific consumption of clinker per ton of cement has reduced by 7.7%, from 0.788 t / t to 0.749 t/t; the implied emission factor expressed in tons of CO_2 from combustion per TJ, decreased by 1.7% from 97.5 t CO_2/TJ up to 95.9 t CO_2/TJ; at the same time in the period 1995-2007 when the enterprise used only natural gas, the default emission factor was 56.1 t CO_2/TJ; the default emission factor, tons of CO_2 from combustion per ton of cement, was reduced by about 30.3%, from 0.344 t CO_2/t cement in 1990 to 0.240 t CO_2/t cement in 2020; the default emission factor, total t CO_2 (combustion + process) per ton of cement, was reduced by about 16.8%, from 0.769 t CO_2/t cement in 1990 to 0.639 t CO_2/t cement in 2020.
	GHG emissions reductions	- Reduction of total CO_2 emissions (fuel burning and process) from cement production at Lafarge Cement plant (Moldova), under the WEM scenario, by circa 40% by 2030 as compared to the 1990.

Mitigation action 10: Implementation of the energy management system (EnMS) and the National Standard SM ISO 50001: 2012, promotion of energy efficiency and increasing the share of glass shards in charge to reduce production cost and CO_2 at the SE "Chisinau Glass Factory"

Description	Nature of the action	Implementation of EnMS and SM ISO 50001: 2012, promoting energy efficiency and increasing the share of glass shards in the batch in order to reduce the production cost and reduce CO_2 emissions at the SE "Chisinau Glass Factory"
	Sector	Industrial processes and product use
	GHG	CO_2
	Quantitative targets	– 77% reduction in total CO_2 (combustion + process) emissions from glass production at the SE "Chisinau Glass Factory" by 2035 compared to 1990
	Progress indicators	- total quantities of glass produced annually, thousands of tons/year; - total fuel consumption used to produce glass, TJ/year; - CO_2 process emissions from glass production, thousands of tons/year; - CO_2 combustion emissions in glass production process, thousands of tons/year; - trend of the default emission factor value, tons CO_2 from combustion/ton of glass; - trend of the default emission factor value, tons CO_2 from process/ton of glass; - trend of the default emission factor value, total tons CO_2 (combustion + process)/ton of glass.
Methods		- CO_2 combustion emissions and respectively, projected CO_2 combustion emissions from glass production calculated by Tier 1 methodology available in the IPCC Guide 2006, Vol. 2, Chapters 1 and 2; - CO_2 process emissions and respectively, projected CO_2 process emissions from glass production calculated by Tier 2 methodology available in the IPCC Guide 2006, Vol. 3, Chapter 2; - MRV for CO_2 mitigation measures from glass production.

Assumptions		With reference to SE "Chisinau Glass Factory" the following production volumes are expected: 2025 – 65 thousand tons of glass, 2030 – 70 thousand tons of glass, 2035 – 80 thousand tons of glass; it is expected to increase the share of glass shards in the batch: in 2025 – up to 40%, in 2030 – up to 45%, in 2035 – up to 55% (for comparison, in 2020 the share of glass shards in charge was 36.8%); Natural gas consumption will be about 293 TJ in 2025, about 303.5 TJ in 2030, and about 317.5 TJ in 2035; The values of the default emission factor of CO_2 emissions of combustion will be in 2025 – 252.9 kg CO_2 per ton of glass, in 2030 – 243.3 kg CO_2 per ton of glass, in 2035 – 222.7 kg CO_2 per ton of glass (for comparison: in 1990 – 1003.3 kg CO_2 per ton of glass, in 2000 – 969.1 kg CO_2 per ton of glass, in 2005 – 854.0 kg CO_2 per ton of glass, in 2010 – 494.1 kg CO_2 per ton of glass, in 2020 – 276.1 kg CO_2 per ton of glass); The default emission factor values of process CO_2 emissions will be in 2025 – 120 kg CO_2 per ton of glass, in 2030 – 110 kg CO_2 per ton of glass, in 2035 – 90 kg CO_2 per ton of glass (for comparison: in 2015 – 149.8 kg CO_2 per ton of glass, in 2020 – 126.4 kg CO_2 per ton of glass).
Goals		– With reference to combating climate change and measures to mitigate CO_2 emissions, the SE "Chisinau Glass Factory" focuses on the variable cost of glass production with the focus on energy efficiency measures, defining at company level the following priorities: efficient management of energy resources and increasing industrial and operational capacity. – The company development strategy for the years 2016-2020 provides for development, production and promotion of a wide range of products including standard products and high-quality exclusive products[623]; the main purpose of the enterprise's investment program for the period 2016-2020 is to ensure further development of the enterprise by increasing production efficiency, which means offering high quality products at competitive prices, in compliance with environmental protection rules. – The objectives to be achieved through the implementation of the investment program are: increasing export of products based on the glass products competitiveness; increasing production efficiency as a result of the partial repairs of the glass molten furnace, capital repairs of glass molding machines, modernization of the electric power transmission line. – In particular the investment program provides for: partial repairs of the glass melting furnace using high-quality refractory materials; spending for capital repair of the technological equipment; modernizing the sand processing line in the components section; modernizing the electricity transmission line; capital repairs of the roofs; modernization of buildings (ramp) for products storage (SMC no.1, 2, DPF); purchase of equipment for checking the glass products quality (3 pcs.); partial repairs of the glass molten furnace also involves design work, the procurement of high-quality refractory materials from manufacturers with advanced technologies, delivery and transportation, repairs of the automatic control system, repairs of the glass molten furnace, the heating and starting of the glass molten furnace. – The target of reducing total CO_2 emissions (combustion + process) from glass production by around 77% compared to 1990, including by increasing the share of glass shards in the batch by 2035.
Undertaken steps		The following were approved: - National Energy Efficiency Program for 2011-2020, GD No. 833/2011[624] - The National Action Plan on Energy Efficiency for 2013-2015, GD no. 113/2013[625] - The National Action Plan on Energy Efficiency for 2016-2018, GD no. 1471/2016[626] - The National Action Plan on Energy Efficiency for 2019-2021, GD no. 698/2019[627] - Energy Strategy of the Republic of Moldova until 2030, GD no. 102/2013[628] - Waste Management Strategy in the Republic of Moldova for 2013-2027, GD no. 248/2013[629], - The Environmental Strategy for 2014-2023 and the Action Plan for its implementation, GD no. 301/2014[630], - Government Decision no. 381 of 01.08.2019 on approval of the National Program on Research and Innovation for 2020-2023 and of the Action Plan on its implementation[631] - Government Decision no. 561 of 31.07.2020 on approval of the Regulation on packaging and packing waste[632] - The Low-Emission Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation, GD no. 1470/2016[633] (Specific objective 4 stipulates unconditional reduction, by 2030, of GHG emissions from the industrial sector by 45% and conditional reduction of GHG by 56% compared to 1990, and measure 4.1 of the Action Plan for Strategy implementation, provides for the implementation of the Energy Management System and the National Standard SM ISO 50001: 2012 in 39 industrial enterprises in the country, at the same time, measure 4.3 of the Action Plan for Strategy implementation, provides for promotion of energy efficiency in the industrial sector); - Compared to 1990, by the end of 2005 the efforts of the SE "Chisinau Glass Factory" to reduce CO_2 emissions resulted in a 14.9% reduction in CO_2 emissions per ton of glass, by the end of 2010 the specific CO_2 reductions per ton of glass amounted to 50.8%, By the end of 2015 the specific CO_2 savings per ton of glass accounted for 68.7%, by the end of 2020 the specific CO_2 savings per ton of glass accounted for 72.5%; – To meet its commitment to environmental sustainability, the S.E. "Chisinau Glass Factory" is in the process of implementing the investment program for the period 2016-2020 worth 5,474 million Euro, including from own financial sources – 1,974 million Euro; from the account of financial means granted by financial institutions – 3,500 million Euro.
Planned steps		- implementation of the Energy Management System (EnMS) and the National Standard SM ISO 50001: 2012; - promoting energy efficiency; - increasing the share of glass shards in charge to reduce production costs and CO_2 emissions; - full implementation of the 2016-2020 Investment Program.
Implementation progress	Achieved results:	– Compared to 1990, by the end of 2005 the efforts of the SE "Chisinau Glass Factory" to reduce CO_2 emissions resulted in about 14.9% reduction of CO_2 emissions per ton of glass, by the end of 2010 the specific CO_2 reductions per ton of glass amounted to about 50.8%; by the end of 2015, specific CO_2 reductions per ton of glass accounted for about 68.7%, and by the end of 2020 specific CO_2 reductions per ton of glass amounted to 72.5%.
	GHG emissions reductions	– Reduction of total CO_2 (combustion + process) emissions from glass production of the SE "Chisinau Glass Factory" by about 77% (or by about 83 thousand tons), by 2035, compared to the reference year 1990 level

[623] The SE "Chisinau Glass Factory" Business Plan for 2016-2020 approved by the Decision of the Board of Directors, Minutes No. 29 of 24.11.2016, .<http://www.glass.md/img/files/Panul%20de%20afaceri%202016%20-2020.pdf>.

[624] Government Decision no. 833 of 10.11.2011 on the National Energy Efficiency Program 2011-2020. Published: 18.11.2011 in the Official Gazette no. 197-202, Art. no. 914 <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=340940>

[625] Government Decision no. 113 of 07.02.2013 on approval of the National Action Plan on Energy Efficiency for 2013-2015. Published: 15.02.2013 in the Official Gazette no. 31-35, Art. no. 158. <https://www.legis.md/cautare/getResults?doc_id=47102&lang=ro>

[626] Government Decision no. 1471 of 30.12.2016 on approval of the National Action Plan on Energy Efficiency for 2016-2018. Published: 31.03.2017 in the Official Gazette no. 92-102, Art. no.: 257. <https://www.legis.md/cautare/getResults?doc_id=111780&lang=ro>

[627] Government Decision no. 698 of 27.12.2019 on approval of the National Action Plan on Energy Efficiency for 2019-2021. Published: 17.01.2020 in the Official Gazette no. 7-13, Art. 12. <https://www.legis.md/cautare/getResults?doc_id=119890&lang=ro>

[628] Government Decision no. 102 of 05.02.2013 on the Energy Strategy of the Republic of Moldova until 2030. Published: 08.02.2013 in the Official Gazette no. 27-30, Art. no. 146. <http://lex.justice.md/md/346670/>

[629] Government Decision no. 248 of 10.04.2013 on approval of the Waste Management Strategy of the Republic of Moldova for 2013-2027. Published: 12.04.2013 in the Official Gazette no. 82 art. No: 306. <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=347341>

[630] Government Decision no. 301 of 24.04.2014 on approval of the Environmental Strategy for 2014-2023 and of the Action Plan for its implementation. Published: 06.05.2014 in the Official Gazette no. 104-109, art. No: 328. <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=352740>

[631] Government Decision no. 381 of 01.08.2019 on approval of the National Program on Research and Innovation for 2020-2023 and of the Action Plan on its implementation. Published: 16.08.2019 in the Official Gazette no. 256-259 art. 506. <https://www.legis.md/cautare/getResults?doc_id=115747&lang=ro>

[632] Government Decision No. 561 of 31.07.2020 for approval of the Regulation on packaging and packing waste. Published: 21-08-2020 in the Official Gazette no. 212-220 Art. 743. <https://www.legis.md/cautare/getResults?doc_id=122773&lang=ro>

[633] Government Decision no. 1470 of 30.12.2016 on approval of the Low Emissions Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation. Published: 24.03.2017 in the Official Gazette no. 85-91, Art. no. 222. <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=369528>

Mitigation action 11: Improving livestock and poultry populations in the Republic of Moldova

Description	Nature of the action	Creating more productive livestock and poultry
	Sector	Agriculture, animal husbandry
	GHG	CH_4
	Quantitative targets	By 2035: cattle - 70-80 thousand heads; sheep - 430-440 thousand heads; goats - 115-125 thousand heads; swine - 300-310 thousand heads; poultry - 8.3-8.6 million heads.
	Progress indicators	- livestock and poultry numbers; - productivity.
Methods		- publicity and training for promoting highly productive livestock and poultry breeds; - introducing and breeding highly productive livestock and poultry breeds; - subsidizing promotion of new highly productive livestock and poultry breeding technologies, based on the provisions of Law no. 276 of 16.12.2016 on the principles of subsidizing agricultural producers[634], through the Public Institution "Agency for Intervention and Payments in Agriculture" (AIPA), which is responsible for the efficient management of the National Agriculture and Rural Environment Development Fund (NFARD), respectively under GD no. 455 of June 21, 2017 on the distribution of funds provided by the National Fund for Agricultural and Rural Development[635], in particular for the sub-measure 1.4 "Stimulating investments for operation and technological upgrading of livestock farms" or increasing productivity, competitiveness and ensuring food security by stimulating technological organization and upgrading of livestock farms, and by sub-measure 1.5. "Stimulating procurement of breeding animals and maintaining their genetic pool" or increasing productivity, competitiveness and ensuring food security by stimulating livestock improvement (this support is provided as partial compensation for the investment in the procurement from breeding farms, of animals included in the Nomenclature of breeds, types and crosses of animals, approved (regionalized) in the Republic of Moldova, including from imports); - MRV of mitigation of GHG emissions from the livestock sector; - Tier 1 and Tier 2 calculation methodologies for CH_4 emissions, respectively for projected CH_4 emissions from enteric fermentation, available in the IPCC Guidelines 2006, Volume 4, Chapter 10.
Assumptions		The downward trend in livestock and poultry populations is expected to slow down by 2025; according to the National Dairy Sector Development Program of dairy cows is expected to increase to 6,200 kg per year by 2025; thus, during 2025-2035, the productivity level in the livestock sector of the Republic of Moldova could be similar to the one in countries with a transition economy in Eastern Europe included in Annex I to UNFCCC, respectively emission factors will have similar values to default emission factors used for assessing CH_4 emissions from enteric fermentation specific to Eastern European countries.
Goals		ensuring agri-food security, including efficient low-emissions productivity for meat, milk and eggs.
Undertaken steps		The following documents have been approved and are under implementation: - the Dairy Cattle Breeding Program of the Republic of Moldova for 2014-2020[636]; - the Sheep and Goats Breeding Program of the Republic of Moldova for 2014-2020[637]; - the National Strategy for Agricultural and Rural Development 2014-2020. GD no.409/2014[638] and the Action Plan on implementation of the National Strategy for Agricultural and Rural Development for 2014-2020, GD no. 742/2015[639], the updated National Strategy for Agricultural and Rural Development for 2014-2020 and the Action Plan for implementation of the National Strategy for Agricultural and Rural Development for 2018-2020, GD no. 785/2018[640]; - the Environmental Strategy for 2014-2023 and the Action Plan for its implementation, GD No. 301/2014[641]; - the FAO Project "Development of the National Strategy and Action Plan for Animal Genetic Resources and the Dairy Cows Genetic Improvement Program"[642]; -Law no. 276 of 16.12.2016 on the principles of subsidizing agricultural producers[643]; - the Low-emission Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation, GD No. 1470/2016[644]; - GD no. 455 of 21.06.2017 on the distribution of the funds from the National Fund for Agricultural and Rural Development[645]; - GD no. 836 of 18.11.2020 on approval of the Regulation on granting direct payments per animal[646].
Planned steps		- Approval of the Draft Law on Animal Husbandry (new version)[647]; - Approval of the Draft National Program for the development of the dairy sector for the years 2021-2023[648].

[634] Law No. 276 of 16 December 2016 on the principles of subsidizing the development of agriculture and rural environment. Published: 03.03.2017 in the Official Gazette no. 67-71, art. No: 93. <https://www.legis.md/cautare/getResults?doc_id=122915&lang=ro>.

[635] Government Decision No. 455 of 21.06.2017 on the distribution of funds of the National Fund for Agriculture and Rural Development. Published: 23.06.2017 in the Official Gazette no. 201-213, art. No: 537. <https://www.legis.md/cautare/getResults?doc_id=123859&lang=ro>. Amended by Government Decision No. 772 of 21.10.2020 on the amendment of some Government Decisions. Published: 24.10.2020 in the Official Gazette no. 278, art. No: 909. <https://www.legis.md/cautare/getResults?doc_id=123697&lang=ro>.

[636] Program for the improvement of dairy cattle in the Republic of Moldova for the years 2014-2020, approved for implementation by the Zooveterological Commission of the Technical-Scientific Council of the Ministry of Agriculture and Food industry of the Republic of Moldova, minutes no.2 from 17.10.2013. Focsa, V., Constandoglo, A., Chisinau, Printing House "Print-Caro". 2013, 22 p., ISBN 978-9975-56-122-8.

[637] Program for breeding sheep and goats in the Republic of Moldova for 2014-2020, approved for implementation by the Animal Veterinary Commission of the Technical-Scientific Council of the Ministry of Agriculture and Food industry of the Republic of Moldova, minutes no.3 of 18.12.2013. Masner, O., Liutcanov, P., Evtodienco, S., Danuta, A., Chisinau, Printing House "Print-Caro". 2014, 34 p. ISBN 978-9975-56-197-6.

[638] Government Decision No. 409 of June 04, 2014 on approval of the National Strategy for Agricultural and Rural Development for 2014-2020. Published: 10.06.2014 in the Official Gazette no. 152, art. No: 451. <https://www.legis.md/cautare/getResults?doc_id=110039&lang=ro>.

[639] Government Decision No. 785 of 01.08.2018 on approval of amendments to certain Government Decisions (Amending GD No 409/2014 on approval of the National Agricultural and Rural Development Strategy for 2014-2020 and GD No. 742/2015 on approval of the Action Plan for the implementation of the National Agricultural and Rural Development Strategy for 2014-2020). Published: 28.09.2018 in the Official Gazette no. 366-376, art. No: 962. <https://www.legis.md/cautare/getResults?doc_id=108950&lang=ro>.

[640] Government Decision No. 785 of 01.08.2018 on approval of amendments to certain Government Decisions (Amending GD No. 409/2014 on approval of the National Agricultural and Rural Development Strategy for 2014-2020 and GD No. 742/2015 on approval of the Action Plan for the implementation of the National Agricultural and Rural Development Strategy for 2014-2020). Published: 28.09.2018 in the Official Gazette no. 366-376, art. No: 962. <https://www.legis.md/cautare/getResults?doc_id=108950&lang=ro>.

[641] Government Decision No. 301 of 24.04.2014 on approval of the Environmental Strategy for 2014-2023 and the Action Plan for its implementation. Published: 06.05.2014 in the Official Gazette no. 104-109, art. No: 328. <https://www.legis.md/cautare/getResults?doc_id=114539&lang=ro>.

[642] FAO project "Development of the National Strategy and Action Plan for Animal Genetic Resources and the Dairy Cows Genetic Improvement Program", <http://www.madrm.gov.md/ro/content/moldova-%C3%AE%C8%99i-consolideaz%C4%83-sectorul-cre%C8%99terii-vacilor-de-lapte-cu-suportul-fao>, <http://maia.gov.md/ro/categorii/proiecte-de-asistenta-externa-sectorul-agroalimentar>.

[643] Law No. 276 of 16.12.2016 on the principles of subsidizing the Agriculture and Rural Development. Published: 03.03.2017 in the Official Gazette no. 67-71, art. No: 93. <https://www.legis.md/cautare/getResults?doc_id=122915&lang=ro>.

[644] Government Decision No. 1470 of 30.12.2016 on approval of the Low Emission Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation. Published: 24.03.2017 in the Official Gazette no. 85-91, art. No: 222. <https://www.legis.md/cautare/getResults?doc_id=114408&lang=ro>.

[645] Government Decision No. 455 of 21.06.2017 on the distribution of funds of the National Fund for Agriculture and Rural Development. Published: 23.06.2017 in the Official Gazette no. 201-213, art. No: 537. <https://www.legis.md/cautare/getResults?doc_id=123859&lang=ro>. Amended by Government Decision No. 772 of 21.10.2020 on modification of some Government decisions No. 772 of 21.10.2020. Published: 24.10.2020 in the Official Gazette no. 278, art. No: 909. <https://www.legis.md/cautare/getResults?doc_id=123697&lang=ro>.

[646] Government Decision No. 836 of 18.11.2020 approving the Regulation on granting direct payments per animal head. Published: 02.12.2020 in the Official Gazette no. 318, art. No: 992. <https://www.legis.md/cautare/getResults?doc_id=124163&lang=ro >.

[647] The draft Law on Animal Husbandry (in new edition). Published for consultation by the State Chancellery on March 18, 2020: <https://cancelaria.gov.md/ro/content/cu-privire-la-aprobarea-proiectului-de-lege-zootehniei-238madrm2020>.

[648] Draft National Dairy Sector Development Program in the Republic of Moldova for 2021-2025 and of the Action Plan for its implementation for 2021-2023. <http://particip.gov.md/proiectview.php?l=ro&idd=7741>.

Implementation progress	Achieved results:	- The means of the National Fund for Agricultural and Rural Development (NFARD) amounted to about 1200 mil. lei by 2020, by 26.3% higher than in 2019 - 950 million lei, showing a clear increasing trend from year to year (400 mil. lei in 2011 and 2012, 462.8 mil. lei – 2013, 564.7 mil. lei – 2014, 610 mil. lei – 2015, 700 mil. lei – 2016, 900 mil. lei in 2017 and 2018, 950 mil. lei in 2019); - The number of funding applications to the Public Institution "Agency for Intervention and Payments in Agriculture" (AIPA) in 2020 was 7448 (in 2011 there were 1088 beneficiaries of subsidies, in 2012 - 4457, in 2013 - 4012, in 2014 - 5133, in 2015 – 3801, in 2016 - 4321, in 2017 - 5643, in 2018- 7416, in 2019 - 7505); – With reference to sub-measure 1.4. "*Stimulating investments for the livestock farms use and technological modernization*", increasing productivity, competitiveness and ensuring food safety by stimulating organization and technological modernization of livestock farms is the general objective of stimulating investments for the technological equipment and modernization of livestock farms. –The amount of support provided is calculated as compensation from the cost of the fully paid new technological equipment for the endowment and modernization of livestock farms, including the construction/reconstruction of livestock farms for cattle, sheep and goats, etc. – In 2020, 229 applications for financial support, amounting to 85.9 million lei were submitted for the renovation and technological modernization of: 46 cattle farms, 5 sheep and goat farms, 13 swine farms, 33 poultry farms, 124 apiculture farms, 8 rabbit/other fur animals farms. Thus, in order to provide agricultural producers with subsidies from the state budget, AIPA authorized for payment, under this sub-measure, 40 requests for financial support in the amount of 13.5 million lei. The other amount of the subsidy requested by agricultural producers (72.5 million lei) is to be allocated from NFARD sources for 2021. - In 2019, 251 applications for financial support worth 83.6 million lei were submitted for the refurbishing and technological upgrading of: 49 cattle farms, 12 sheep and goat farms, 10 swine farms, 34 poultry farms, 138 bee farms, 8 rabbit/other fur animals farms; - In 2018, 217 applications for financial support worth 55.8 million lei were submitted for refurbishing and technological upgrading of: 41 cattle farms, 11 sheep and goat farms, 12 swine farms, 28 poultry farms, 126 bee farms, 9 rabbit/other fur animals farms; - In 2017, 153 requests for financial support were submitted, amounting to 45.1 million lei for the renovation and technological modernization of: 34 cattle farms, 7 sheep and goat farms, 12 swine farms, 21 poultry farms, 74 apiculture farms, 5 rabbit/other fur farms; – In 2016, 86 requests for financial support amounting to 34.8 million lei were submitted for the renovation and technological development of: 26 cattle farms, 5 sheep and goat farms, 9 swine farms, 18 poultry farms, 24 apiculture farms; - In 2019, a total of 251 livestock farms were re-equipped and upgraded (for comparison, 215 farms in 2018, 153 farms in 2017, 86 farms in 2016, 67 farms in 2015, 111 farms in 2014 and 64 farms in 2013); With reference to sub-measure 1.5. "*Stimulating the procurement of breeding animals and maintaining their genetic pool*", the general objective of this measure is increasing productivity, competitiveness and ensuring food safety by stimulating the improvement of livestock; – The support is granted for partial compensation of the investment in the purchase of animals included in the Nomenclature of breeds, types and crosses of animals, approved in the Republic of Moldova, from breeding farms, including from imports; – The size of the subsidy is calculated as compensation based on the cost of the animal: (1) 50% for primiparous cows, junks and heifers aged at least 12 months, but not more than 2.5 million lei per beneficiary; (2) 30% for 4-8 months old boars (pure and biracial breed) and uninseminated 5-8 months old sows (pure and biracial breed), but not more than 500.0 thousand lei per beneficiary; (3) 50% for rams and goats aged 6-20 months, but not more than 200.0 thousand lei per beneficiary; (4) 50% for ewe lambs and goats aged 6-20 months, but not more than 500.0 thousand lei per beneficiary; (5) 50% for breeding house rabbits, but not more than 200.0 thousand lei per beneficiary; (6) 50% for bee queens aged no more than 3 months, but not more than 100.0 thousand lei per beneficiary; (7) 50% for bee swarms with bee queens aged no more than 3 months, but no more than 200.0 thousand lei per beneficiary; (8) 50% for one day-old chicks – breeding birds (parental forms), but not more than 1 million lei per beneficiary in a year of subsidization; – In 2020, 77 files were submitted under sub-measure 1.5, and the requested amount was about 29.9 million lei. The financial sources helped stimulate investments in the purchase of 867 cattle; 444 sheep, of which 21 rams, 454 swine; 16 652 bee families and 94 448 one-day-old chicks/parental forms. Thus, AIPA authorized for payment 7.5 million lei, with the remaining amount (22.4 million lei), it is to be authorized from NFARD sources for 2021, as a result of the exhaustion of financial means; - In 2019, 20.6 million lei were requested for subsidizing: 656 cattle, 946 sheep, of which 2 rams, 464 swine of which 22 boars, and 3335 bee families; - In 2018, 13.1 million lei were requested for the subsidization of 263 cattle, 93 goats, 1011 sheep, 683 swine and 4360 queen bees; – In 2017, 12.3 million lei were requested for subsidizing 318 cattle, 557 goats and sheep, 1212 swine and 1811 queen bees; – In 2016, 22.88 million lei were requested for subsidizing 299 cattle, 1345 goats and sheep, 624 swine, 200 breeding rabbits and 1418 queen bees; – The amount requested for subsidy from NFARD in 2015 was 30.85 million lei, in 2014 – 1.73 million lei, and in 2013 – 69.81 million lei. - According to the National Bureau of Statistics and the State Statistical Service of the Ministry of Economic Development of ATULB, the population of domestic animals and poultry evolved in the period 1990-2020 as follows: the total population of cattle decreased by about 88.1%, from 1060.7 thousand heads in 1990 to 125.8 thousand heads in 2020; the population of dairy cows decreased by about 79.7%, from 395.2 thousand heads in 1990 to 80.3 thousand heads in 2020; the population of other cattle decreased by about 93.2%, from 665.5 thousand heads in 1990, to 45.5 thousand heads in 2020; the sheep population decreased by about 61.5%, from 1244.8 thousand heads in 1990 to 479.3 thousand heads in 2020; the population of goats increased by about 303.6%, from 37.1 thousand heads in 1990, to 149.7 thousand heads in 2020; the population of swine decreased by about 80.2%, from 1850.1 thousand heads in 1990 to 366.9 thousand heads in 2020; the population of rabbits increased by about 12.8%, from 283.0 thousand heads in 1990 to 319.2 thousand heads in 2020; the herd of poultry decreased by about 60.6%, from 24,625 million heads in 1990 to 9,693 million heads in 2020.
	GHG emissions reductions	Reduction of methane emissions from category 3A "Enteric fermentation" by 2035 under the WEM scenario, compared to the level reported in the reference year - by about 1.8 Mt CO_2 equivalent, respectively under the WAM scenario - by about 1.9 Mt CO_2 equivalent.

Mitigation action 12: Manure management enhancement

Description	Nature of the action	Concentration of cattle and swine in large farms
	Sector	Agriculture, animal husbandry
	GHG	CH_4, N_2O
	Quantitative targets	Increasing the share of large livestock and poultry farms owned by agricultural enterprises and peasant farms (farmers), in the total number of livestock and poultry in all types of farms, in 2035 compared to the current state (year 2020), as follows: cattle: 80.0% compared to 17.1%; dairy cows: 75.0% compared to 7.7%; other cattle: 85.0% compared to 34.9%; swine: 80.0% compared to 57.9%; sheep and goats: 35.0% compared to 2.9%; poultry: 55.0% compared to 35.3%.
	Progress indicators	- number of large farms - amount of manure in large farms
Methods		- developing policies for concentrating livestock and poultry in large farms; - motivating the development of animal and poultry breeding in large farms; - employing modern animal and poultry breeding technologies on large farms to mitigate GHG emissions from animal husbandry sector; - Tier 1 and 2 calculation methodologies for CH_4 emissions, and projected CH_4 emissions from manure management, available in the IPCC Guidelines 2006, Volume 4, Chapter 10.

Assumptions		- gradual transition to efficient and sustainable manure management practices by 2035; - in accordance with the National Dairy Cattle Breeding Program for 2020-2025 and the Action Plan for its implementation for 2020-2023[649], it is anticipated that the average productivity of dairy cows will increase to 6,200 kg per year by 2025; thus, during 2025-2035, the productivity level in the livestock sector of the Republic of Moldova could be similar to the one in countries with a transition economy in Eastern Europe included in Annex I to UNFCCC, respectively emission factors will have similar values to default emission factors used for assessing CH_4 emissions from manure management specific to the Eastern European countries with economies in transition included in Annex I to the UNFCCC;
Goals		- production of animals and birds at the level of efficiency in the EU countries; - application of efficient and sustainable animal manure management technologies aimed at reducing environmental pollution and greenhouse gas emissions.
Undertaken steps		The following documents have been approved and are under implementation: - the National Energy Efficiency Program 2011-2020, GD No. 833/2011[650]; - the Energy Strategy of the Republic of Moldova until 2030, GD No. 102/2013[651]; - the Waste Management Strategy of the Republic of Moldova for 2013-2027, GD No. 248/2013[652]; - the Dairy Cattle Breeding Program of the Republic of Moldova for 2014-2020; - the Sheep and Goats Breeding Program of the Republic of Moldova for 2014-2020; - the National Strategy for Agricultural and Rural Development for 2014-2020. GD No.409/2014[653] and the Action Plan for the implementation of the National Strategy for Agricultural and Rural Development for 2014-2020, GD No. 742/2015[654], the updated National Strategy for Agricultural and Rural Development for 2014-2020 and the Action Plan for the implementation of the National Strategy for Agricultural and Rural Development for 2018-2020, GD No. 785/2018[655]; - The Environmental Strategy for 2014-2023 and the Action Plan for its implementation, GD No. 301/2014[656]; - FAO Project "Development of the National Strategy and Action Plan for Animal Genetic Resources and the Dairy Cows Genetic Improvement Program"[657]; - Law no. 276 of 16.12.2016 on the principles of subsidizing agricultural producers[658]; - the Low-Emission Development Strategy until 2030 and the Action Plan for its implementation, GD No. 1470/2016[659]; - Government Decision no. 455 of 21.06.2017 on the distribution of the funds from the National Fund for Agricultural and Rural Development[660]; - Government Decision no. 836 of 18.11.2020 on approval of the Regulation on direct payments per animal[661].
Planned steps		- Approval of the Draft Law on Animal Husbandry (new version) [662]; - Approval of the Draft National Dairy Cattle Breeding Program of the Republic of Moldova for the 2017-2025 and of the Action Plan for its implementation for 2021-2023[663].
Implementa-tion progress	Achieved results:	- The means of the National Fund for Agricultural and Rural Development (NFARD) amounted to about 1200 mil. lei by 2020, by 26.3% higher than in 2019 - 950 million lei, showing a clear increasing trend from year to year (400 mil. lei in 2011 and 2012, 462.8 mil. lei – 2013, 564.7 mil. lei – 2014, 610 mil. lei – 2015, 700 mil. lei – 2016, 900 mil. lei in 2017 and 2018, 950 mil. lei in 2019); - The number of funding applications to the Public Institution "Agency for Intervention and Payments in Agriculture" (AIPA) in 2020 was 7448 (in 2011 there were 1088 beneficiaries of subsidies, in 2012 - 4457, in 2013 - 4012, in 2014 - 5133, in 2015 – 3801, in 2016 - 4321, in 2017 - 5643, in 2018- 7416, in 2019 - 7505); - With reference to sub-measure 1.4. "*Stimulating investments for the livestock farms use and technological modernization*", increasing productivity, competitiveness and ensuring food safety by stimulating organization and technological modernization of livestock farms is the general objective of stimulating investments for the technological equipment and modernization of livestock farms. - The amount of support provided is calculated as compensation from the cost of the fully paid new technological equipment for the endowment and modernization of livestock farms, including the construction/reconstruction of livestock farms for cattle, sheep and goats, etc. - In 2020, 229 applications for financial support, amounting to 85.9 million lei were submitted for the renovation and technological modernization of: 46 cattle farms, 5 sheep and goat farms, 13 swine farms, 33 poultry farms, 124 apiculture farms, 8 rabbit/other fur animals farms. Thus, in order to provide agricultural producers with subsidies from the state budget, AIPA authorized for payment, under this sub-measure, 40 requests for financial support in the amount of 13.5 million lei. The other amount of the subsidy requested by agricultural producers (72.5 million lei) is to be allocated from NFARD sources for 2021. - In 2019, 251 applications for financial support worth 83.6 million lei were submitted for the refurbishing and technological upgrading of: 49 cattle farms, 12 sheep and goat farms, 10 swine farms, 34 poultry farms, 138 bee farms, 8 rabbit/other fur animals farms; - In 2018, 217 applications for financial support worth 55.8 million lei were submitted for refurbishing and technological upgrading of: 41 cattle farms, 11 sheep and goat farms, 12 swine farms, 28 poultry farms, 126 bee farms, 9 rabbit/other fur animals farms;

[649] The Dairy Cattle Breeding Program of the Republic of Moldova 2020-2025 and of the Action on its implementation for 2020-2022. <http://particip.gov.md/proiectview.php?l=ro&idd=7741>

[650] Government Decision No.833 of 10.11.2011 on the National Energy Efficiency Program 2011-2020. Published: 18.11.2011 in the Official Gazette no. 197-202, Art. no. 914 <https://www.legis.md/cautare/getResults?doc_id=110334&lang=ro>

[651] Government Decision no. 102 of 05.02.2013 on the Energy Strategy of the Republic of Moldova until 2030. Published: 08.02.2013 in the Official Gazette no. 27-30, Art. no. 146. <https://www.legis.md/cautare/getResults?doc_id=68103&lang=ro/>.

[652] Government Decision no. 248 of 10.04.2013 on the approval of the Waste Management Strategy in the Republic of Moldova for the years 2013-2027. Published: 12.04.2013 in the Official Gazette no. 82 Art. no. 306. <https://www.legis.md/cautare/getResults?doc_id=114412&lang=ro>.

[653] Government Decision no. 409 of 04.06.2014 regarding the approval of the National Strategy for Agricultural and Rural Development for 2014-2020. Published: 10.06.2014 in the Official Gazette no. 152, Art. no. 451. <https://www.legis.md/cautare/getResults?doc_id=110039&lang=ro>

[654] Government Decision no. 742 of 21.10.2015 for the approval of the Action Plan on implementation of the National Strategy for Agricultural and Rural Development for 2014-2020. Published: 30.10.2015 in the Official Gazette no. 297-300, Art. no. 835. <https://www.legis.md/cautare/getResults?doc_id=110254&lang=ro>.

[655] Government Decision No. 785 of 01.08.2018 on approving amendments operated to some Government Decisions (amending GD no. 409/2014 on approval of the National Strategy for Agricultural and Rural Development for 2014-2020 and GD No. 742/2015 on approval of the Action Plan for the implementation of the National Strategy for Agricultural and Rural Development for 2014-2020). Published on 28.09.2018 in the Official Gazette No. 366-376, Art. No: 962. <https://www.legis.md/cautare/getResults?doc_id=108950&lang=ro>.

[656] Government Decision no. 301 of 24.04.2014 on approval of the Environmental Strategy for 2014-2023 and of the Action Plan for its implementation. Published: 06.05.2014 in the Official Gazette no. 104-109, Art. no. 328. <https://www.legis.md/cautare/getResults?doc_id=114539&lang=ro

[657] FAO project "Development of the National Strategy and Action Plan for Animal Genetic Resources and the Dairy Cows Genetic Improvement Program" <http://www.madrm.gov.md/ro/content/moldova-%C3%AE%C8%99i-consolideaz%C4%83-sectorul-cre%C8%99terii-vacilor-de-lapte-cu-suportul-fao>, <http://maia.gov.md/ro/categorii/proiecte-de-asistenta-externa-sectorul-agroalimentar>.

[658] Law no. 276 of 16.12.2016 on the principles of subsidizing agricultural and rural development. Published: 03.03.2017 in the Official Gazette no. 67-71, Art. no. 93. <https://www.legis.md/cautare/getResults?doc_id=122915&lang=ro>.

[659] Government Decision no. 1470 of 30.12.2016 on approval of the Low Emissions Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation. Published: 24.03.2017 in the Official Gazette no. 85-91, Art. no. 222. <https://www.legis.md/cautare/getResults?doc_id=114408&lang=ro>.

[660] Government Decision no. 455 of 21.06.2017 on distribution of funds of the National Fund for Agricultural and Rural Development. Published: 23.06.2017 in the Official Gazette no. 201-213, art. No: 537. <https://www.legis.md/cautare/getResults?doc_id=123859&lang=ro>. Amended by Government Decision No. 772 of 21.10.2020 on amendments operated to some Government Decisions No. 772 of 21.10.2020. Published: 24.10.2020 in the Official Gazette no. 278, Art. no. 909. <https://www.legis.md/cautare/getResults?doc_id=123697&lang=ro>.

[661] Government Decision no. 836 of 18.11.2020 on approval of the Regulation on direct payments per animal. Published: 02.12.2020 in the Official Gazette no. 318, art. No: 992. <https://www.legis.md/cautare/getResults?doc_id=124163&lang=ro>.

[662] Draft Law on Animal Husbandry (new version). Published for consultation by the State Chancellery on March 18, 2020: <https://cancelaria.gov.md/ro/content/cu-privire-la-aprobarea-proiectului-de-lege-zootehniei-238madrm2020>

[663] The Drat National Dairy Cattle Breeding Program of the Republic of Moldova 2021-2025 and of the Action Plan for its implementation for 2021-2023. <http://particip.gov.md/proiectview.php?l=ro&idd=7741>

Implementation progress	Achieved results:	- In 2017, 153 requests for financial support were submitted, amounting to 45.1 million lei for the renovation and technological modernization of: 34 cattle farms, 7 sheep and goat farms, 12 swine farms, 21 poultry farms, 74 apiculture farms, 5 rabbit/other fur farms; - In 2016, 86 requests for financial support amounting to 34.8 million lei were submitted for the renovation and technological development of: 26 cattle farms, 5 sheep and goat farms, 9 swine farms, 18 poultry farms, 24 apiculture farms; - In 2019, a total of 251 livestock farms were re-equipped and upgraded (for comparison, 215 farms in 2018, 153 farms in 2017, 86 farms in 2016, 67 farms in 2015, 111 farms in 2014 and 64 farms in 2013); With reference to sub-measure 1.5. "*Stimulating the procurement of breeding animals and maintaining their genetic pool*", the general objective of this measure is increasing productivity, competitiveness and ensuring food safety by stimulating the improvement of livestock; - The support is granted for partial compensation of the investment in the purchase of animals included in the Nomenclature of breeds, types and crosses of animals, approved in the Republic of Moldova, from breeding farms, including from imports; - The size of the subsidy is calculated as compensation based on the cost of the animal: (1) 50% for primiparous cows, junks and heifers aged at least 12 months, but not more than 2.5 million lei per beneficiary; (2) 30% for 4-8 months old boars (pure and biracial breed) and uninseminated 5-8 months old sows (pure and biracial breed), but not more than 500.0 thousand lei per beneficiary; (3) 50% for rams and goats aged 6-20 months, but not more than 200.0 thousand lei per beneficiary; (4) 50% for ewe lambs and goats aged 6-20 months, but not more than 500.0 thousand lei per beneficiary; (5) 50% for breeding house rabbits, but not more than 200.0 thousand lei per beneficiary; (6) 50% for bee queens aged no more than 3 months, but not more than 100.0 thousand lei per beneficiary; (7) 50% for bee swarms with bee queens aged no more than 3 months, but no more than 200.0 thousand lei per beneficiary; (8) 50% for one day-old chicks - breeding birds (parental forms), but not more than 1 million lei per beneficiary in a year of subsidization; - In 2020, 77 files were submitted under sub-measure 1.5, and the requested amount was about 29.9 million lei. The financial sources helped stimulate investments in the purchase of 867 cattle; 444 sheep, of which 21 rams, 454 swine; 16 652 bee families and 94 448 one-day-old chicks/parental forms. Thus, AIPA authorized for payment 7.5 million lei, with the remaining amount (22.4 million lei), it is to be authorized from NFARD sources for 2021, as a result of the exhaustion of financial means; - In 2019, 20.6 million lei were requested for subsidizing: 656 cattle, 946 sheep, of which 2 rams, 464 swine of which 22 boars, and 3335 bee families; - In 2018, 13.1 million lei were requested for the subsidization of 263 cattle, 93 goats, 1011 sheep, 683 swine and 4360 queen bees; - In 2017, 12.3 million lei were requested for subsidizing 318 cattle, 557 goats and sheep, 1212 swine and 1811 queen bees; - In 2016, 22.88 million lei were requested for subsidizing 299 cattle, 1345 goats and sheep, 624 swine, 200 breeding rabbits and 1418 queen bees; - The amount requested for subsidy from NFARD in 2015 was 30.85 million lei, in 2014 – 1.73 million lei, and in 2013 – 69.81 million lei. - According to the National Bureau of Statistics and the State Statistical Service of the Ministry of Economic Development of ATULB, the population of domestic animals and poultry evolved in the period 1990-2020 as follows: the total population of cattle decreased by about 88.1%, from 1060.7 thousand heads in 1990 to 125.8 thousand heads in 2020; the population of dairy cows decreased by about 79.7%, from 395.2 thousand heads in 1990 to 80.3 thousand heads in 2020; the population of other cattle decreased by about 93.2%, from 665.5 thousand heads in 1990, to 45.5 thousand heads in 2020; the sheep population decreased by about 61.5%, from 1244.8 thousand heads in 1990 to 479.3 thousand heads in 2020; the population of goats increased by about 303.6%, from 37.1 thousand heads in 1990, to 149.7 thousand heads in 2020; the population of swine decreased by about 80.2%, from 1850.1 thousand heads in 1990 to 366.9 thousand heads in 2020; the population of rabbits increased by about 12.8%, from 283.0 thousand heads in 1990 to 319.2 thousand heads in 2020; the herd of poultry decreased by about 60.6%, from 24,625 million heads in 1990 to 9,693 million heads in 2020. - If we consider the total number of animals and poultry in households of all categories, then the share of large livestock and poultry farms of agricultural enterprises and peasant farms (small farmers) decreased considerably in the period 1990-2020: for cattle: from 81.8% in 1990 to 17.1% in 2020, dairy cows: from 74.9% in 1990 to 7.7% in 2020, for other cattle: from 86.0% in 1990 to 34.9% in 2020, for swine: from 81.0% in 1990 to 57.9% in 2020, for sheep and goats: from 35.9% in 1990 to 2.9% in 2020 for poultry: from 53.5% in 1990 to 35.3% in 2020. - The share of manure management systems specific to large farms which contribute to the generation of CH_4 emissions to a large extent, such as liquid manure management systems, has diminished. For dairy cows farms the share of manure management system decreased from 24% of the total in 1990 to about 1.3% of the total in 2020, for other cattle farms, the share of manure management system decreased from 34.0% in 1990 to about 7.1% in 2020, and for swine farms, the share of manure management systems decreased from 73% in 1990 to about 19% in 2020. - The share of the solid manure management system, less responsible for generating CH_4 emissions, has increased, for dairy cow farms, the share of solid manure management system increased from 70.0% of the total in 1990 to 73.5% of the total in 2020, for other cattle farms, the share of solid manure management system increased from 62.0% in 1990 to 75.9% in 2020, and for swine farms, the share of solid manure management system increased from 27.0% in 1990 to 42.0% in 2020.
	GHG emissions reductions	Reduction of methane emissions from category 3B "Manure Management" by 2035 under the WEM scenario compared to the level recorded in the reference year, is by circa 0.45 Mt CO_2 equivalent by 2035, and by circa 0.46 Mt CO_2 equivalent under the WAM scenario.

Mitigation action 13: Soil conservation and fertility enhancement

Description	Nature of the action	Sustainable soil cultivation agricultural practices
	Sector	Agriculture, agricultural soils
	GHG	N_2O
	Quantitative targets	Application of chemical fertilizers: – nitrogenous: 92.0-99.9 thousand tons by 2035; – natural organic: 3.7-4.3 million tons by 2035 Application of green fertilizers, mineral fertilizer equivalent: – 2100-2800 thousand tons by 2035 Area of conservation agriculture systems: – 200-250 thousand hectares by 2035
	Progress indicators	- amount of chemical fertilizers used; - amount of organic fertilizers of animal origin used; - amount of green manure introduced into the soil; - area of farmlands including conservation agriculture lands; - area of lands under sidereal and leguminous crops.

Methods	– Adequate implementation of the soil fertility Conservation and increase Program for 2011-2020, GD No. 626/2011[664], Action Plan on the implementation of the soil fertility Conservation and increase Program for 2014-2016, GD No. 138/2014[665], Action Plan on the implementation of the soil Conservation and fertility increase Program for 2017-2020, GD No. 554/2017[666], the National Agricultural and Rural Development Strategy for 2014-2020, GD No. 409/2014[667] and the Action Plan on the implementation of the National Agricultural and Rural Development Strategy for 2014-2020, GD No. 742/2015[668], Action Plan on the implementation of the updated National Agricultural and Rural Development Strategy for 2018-2020, GD No. 785/2018[669], Respectively in the Land improvement Program in order to ensure the sustainable management of soil resources for 2021-2025 and the Action Plan on its implementation for 2021-2023, GD no. 864/2020[670]; - motivating the development of conservation agriculture; - use of "no-till" and "mini-till" technologies; - publicity and training on sustainable agriculture; - conservation agriculture MRV; - Tier 1 methodology for calculating direct and indirect N_2O emissions, projected direct and indirect N_2O emissions from farmlands, available in the IPCC Guidelines 2006, Volume 3, Chapter 11;
Assumptions	- for green manures (autumn peas as an intermediate crop) the following basic parameters were taken into account: average humidity of the green mass - 80%; average nitrogen content in the green mass - 0.8%; average productivity - 20 t/ha; the coefficient of transition to manure with bedding - 1.4 (by content of nitrogen 1 ton of green mass of peas is equivalent to 1.4 tons of cattle manure with bedding); - introduction of intermediate crops as green manure will be carried out in parallel with the implementation of conservation agriculture tillage system, based on "no-till" and "mini-till" technologies; - the surveys were carried out based on the information available in the Land Reclamation and Soil Fertility Enhancement Program (Part II. Soil Fertility Enhancement), GD no. 841/2004[671], Soil Conservation and Fertility Enhancement Program for 2011-2020, GD no. 626/2011, Action Plan on implementation of the Soil Conservation and Fertility Enhancement Program for 2014-2016, GD no. 138/2014, Action Plan on implementation of the Soil Conservation and Fertility Enhancement Program for 2017-2020, GD no. 554/2017, respectively in the National Agricultural and Rural Development Strategy for 2014-2020, GD No. 409/2014[672] and the Action Plan on implementation of the National Agricultural and Rural Development Strategy for 2014-2020, GD no. 742/2015, respectively in the Land Improvement Program aimed at ensuring sustainable management of soil resources for 2021-2025 and the Action Plan on its implementation for 2021-2023, GD no. 864/2020[673]; - the total amount of mineralized nitrogen was determined in accordance with the "Method for estimating GHG emissions from arable soils" (Banaru, 2000); - on the conservation agriculture areas, the plant residues from the basic crop, in proportion of 75-90% shall remain in the field for the formation of mulch.
Goals	- achieving a neutral or slightly positive balance of carbon and humus in soil by 2035; - increasing soil productivity avoiding its erosion; - limiting growth trend and reducing N_2O emissions from agricultural soils.
Undertaken steps	The following have been approved and are in the process of implementation: - The Soil Conservation and Fertility Enhancement Program for 2011-2020, GD no. 626/2011 - National Development Strategy "Moldova 2020", Law no. 166/2012[674]; - The Environmental Strategy for 2014-2023 and the Action Plan for its implementation, GD No. 301/2014[675]; - National Agricultural and Rural Development Strategy for 2014-2020. 409/2014; - The Action Plan for implementation of the National Agricultural and Rural Development Strategy for 2014-2020, GD no. 742/2015; - The Action Plan on implementation of the Soil Conservation and Fertility Enhancement Program for 2014-2016, GD no. 138/2014; - Rural Program of Inclusive Economic-Climatic Resilience (IFAD VI) for 2014-2020[676]; - Financing Agreement between the Government of the Republic of Moldova and the European Commission on implementation of the ENPARD Moldova Program - support for agriculture and rural development, promulgated by the Decree of the President No. 1815 of 12.11.2015[677]; - The Low-Emission Development Strategy until 2030 and the Action Plan for its implementation, GD no. 1470/2016[678]; - The Action Plan on implementation of the Soil Conservation and Fertility Enhancement Program for 2017-2020, GD no. 554/2017; - Rural Resilience Program (IFAD VII) for 2017-2023[679]; - The program for promoting the "green" economy in the Republic of Moldova for 2018-2020 and the Action Plan for its implementation, GD no. 160/2018[680]; - The Action Plan on implementation of the National Agricultural and Rural Development Strategy updated for 2018-2020, GD no. 785/2018[681].

[664] Government Decision No. 626 of 20.08.2011 on the approval of the Soil Fertility Conservation and Enhancement Program for 2011-2020. Published: 26.08.2011 in the Official Gazette no. 139-145, art. no: 696. <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=339882>.

[665] Government Decision No. 138 of 24.02.2014 on approval of the Action Plan on the implementation of the Soil Fertility Conservation and Enhancement Program for 2014-2016. Published: 28.02.2014 in the Official Gazette no. 49-52, art. no: 154. <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=351879>.

[666] Government Decision No. 554 of 14.07.2017 on approval of the Action Plan on the implementation of the Soil Fertility Conservation and Enhancement Program for 2017-2020. Published: 21.07.2017 in the Official Gazette no. 253-264, art. no: 650. <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=371387>.

[667] Government Decision No. 409 of 04.06.2014 on approval of the National Agricultural and Rural Development Strategy for 2014-2020. Published: 10.06.2014 in the Official Gazette no. 152, art. no: 451. <https://www.legis.md/cautare/getResults?doc_id=110039&lang=ro>.

[668] Government Decision No. 742 of 21.10.2015 on approval of the National Agricultural and Rural Development Strategy for 2014-2020. Published: 30.10.2015 in the Official Gazette no. 297-300, art. No: 835. <https://www.legis.md/cautare/getResults?doc_id=110254&lang=ro>.

[669] Government Decision No. 785 of 01.08.2018 approving the amendments to be made to some Government decisions. Published: 28.09.2018 in the Official Gazette no. 366-376, art. No: 962. <https://www.legis.md/cautare/getResults?doc_id=108950&lang=ro>.

[670] Government Decision No. 864 of 09.12.2020 on approval of the Land Improvement Program to ensure sustainable management of soil resources for 2021-2025 and the Action Plan for its implementation for 2021-2023. Published: 22.01.2021 in the Official Gazette no. 13-20, art. no: 22. <https://www.legis.md/cautare/getResults?doc_id=125027&lang=ro>.

[671] Government Decision no. 841 of 26.07.2004 on approval of the Land Reclamation and Soil Fertility Enhancement Program (Part II. Soil Fertility Enhancement). Published: 13.08.2004 in the Official Gazette no. 138-146, Art. no: 1066. <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=305055>

[672] Government Decision no. 409 of 04.06.2014 regarding approval of the National Agricultural and Rural Development Strategy for 2014-2020. Published: 10.06.2014 in the Official Gazette no. 152, Art. no: 451. <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=353310>

[673] The Land Improvement Program aimed at ensuring sustainable management of soil resources for 2021-2025 and the Action Plan for its implementation for 2021-2023, approved at the Government meeting of December 9, 2020. <https://gov.md/sites /default/files/document/attachments/subiect-04_3.pdf>

[674] Law no. 166 of 11.07.2012 on approval of the National Development Strategy "Moldova 2020". Published: 30.11.2012 in the Official Gazette no. 245-247, Art. no: 791. <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=345635>. Amended by Law no. 121 of 03.07.2014 on amendment and completion of the Annex to Law no. 166 of July 11, 2012 for approval of the National Development Strategy "Moldova 2020". Published [: 03.10.2014 in the Official Gazette no. 293-296, Art. no: 603. <http://lex.justice.md/md/354876/>

[675] Government Decision no. 301 of 24.04.2014 on approval of the Environmental Strategy for the years 2014-2023 and of the Action Plan for its implementation. Published: 06.05.2014 in the Official Gazette no. 104-109, Art. no: 328. <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=352740>

[676] Rural Program for Economic and Inclusive Climate Resilience (IFAD VI) 2014-2020. <https://www.ucipifad.md/programe/programe-in-derulare/proiectul-de-rezilienta-rurala-ifad-vii/>

[677] Decree of the President of the Republic of Moldova No. 1815 of 12.11.2015 on promulgation of the Law for the ratification of the Financing Agreement between the Government of the Republic of Moldova and the European Commission on the implementation of the ENPARD Moldova Program - support for agriculture and rural development. Published: 27.11.2015 in the Official Gazette no. 317-323, Art. no: 575. <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=361905>

[678] Government Decision no. 1470 of 30.12.2016 on approval of the Low Emissions Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation. Published: 24.03.2017 in the Official Gazette no. 85-91, Art. no: 222. <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=369528>

[679] Rural Resilience Program (IFAD VII) 2017-2023. <https://www.ucipifad.md/programe/programe-in-derulare/programul-rural-de-rezilienta-economico-climatica-incluziva-ifad-vi/>

[680] Government Decision no. 160 of 21.02.2018 on approval of the Program for promotion of the "green" economy in the Republic of Moldova for 2018-2020 and of the Action Plan for its implementation. Published: 02.03.2018 in the Official Gazette no. 68-76, art. No: 208. <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=374523>

[681] Government Decision no. 785 of 01.08.2018 on approval of the amendments that are operated in some Government Decisions. Published: 28.09.2018 in the Official Gazette no. 366-376, Art. no: 962. <https://www.legis.md/cautare/getResults?doc_id=108950&lang=ro>

Planned steps		1) Full implementation of: - The Land Improvement Program aimed at ensuring sustainable management of soil resources for 2021-2025 and the Action Plan for its implementation for 2021-2023, GD no. 864/2020[682]; - Regulation on conditions and procedure for granting subsidies in advance for land improvements investment projects for implementation of the Land Improvement Program aimed at ensuring sustainable management of soil resources for 2021-2025, GD no. 985/2020[683]; - Capacity Building Program for Rural Transformation (IFAD VIII) for 2021-2026[684]; 2) Development and approval of the long-term secondary policy, legislative and regulatory framework, including the National Conservation Agriculture Development Program.
Implementation progress	Achieved results:	– the State provides financial incentives for procurement of agricultural machinery needed for advanced soil cultivation technologies (the amount of support for agricultural machinery and equipment is conventional calculated as 25% cost compensation (per unit), but not exceeding 300 thousand MDL per beneficiary, while for "no-till" and "mini-till" technologies, the amount of support is calculated as 30% cost compensation per unit, but not exceeding 500 thousand MDL per beneficiary); according to the GD no. 455 of 21.06.2017 on allocation of the funds of the National Fund for Agriculture and Rural Development (NFARD) [685], the Fund accumulated 1 billion MDL in 2020, or by 26.3% more than in 2019, when 950 million MDL were accumulated, which shows a clear trend for increase from year to year (400 million lei in 2011 and 2012, 462.8 million lei in 2013, 564.7 million lei in 2014, 610 million lei in 2015, 700 million lei in 2016, 900 million lei in 2017 and 2018, 950 million lei in 2019). In 2020 the number of applications for funding amounted to 7448 (in 2011 there were 1088 beneficiaries of grants, 4457 – in 2012, 4012 – in 2013, 5133 – in 2014, 3801 – in 2015, 4321 – in 2016, 5643 – in 2017, 7416 – in 2018, 7505 – in 2019). The largest share of requests for subsidies were directed to: subsidizing investments in the development of post-harvest and processing infrastructure; 569 requests for financial support were received for the total amount of 374.6 million lei, which accounts for 30.8% of the amount of the requested subsidies; subsidizing agricultural machinery and equipment including mini-till and no-till; 2153 applications for financial support were submitted for the total amount of 237.4 million lei, which accounts for 19.5% of the amount of the requested subsidies; stimulating investments in the establishment, modernization of multi-annual plantations and deforestation of non-productive plantations; 1122 requests for financial support were received for the total amount of 212.5 million lei or 17.7% of the total amount of the requested subsidies; development of the livestock sector, 306 requests for financial support were received, of which 229 requests for stimulating investments for modernization of livestock farms (the amount of requested subsidies – 85.93 million lei) and 77 requests for the purchase of breeding animals in the amount of 29.88 million lei; stimulation of lending to agricultural producers -2501 requests were received for financial support for the total amount of 133.3 million lei, which is 11% of the amount of the requested subsidies [686, 687, 688]; – In 2020, AIPA received 222 applications for financial support for the no-till and mini-till agricultural machinery. The amount of the subsidies requested by agricultural producers amounted to 28.7 million lei and were directed for cultivation of 66.0701 thousand ha of agricultural land including 5.1205 thousand ha more in 2020 compared to the previous year, 250 different types of "no-till" and "mini-till" machinery were purchased, including 70 tractors, 179 trailed equipment units and 1 carried equipment unit; – In 2019 the total number of beneficiaries who purchased "no-till" and "mini-till" equipment from NFARD means was 73; the total amount authorized by AIPA – 11.6 million lei; 215 different types of "no-till" and "mini-till" machinery were purchased, the area of agricultural land cultivated using "no-till"/ "mini-till" technology was 51,984 thousand ha; amount authorized by AIPA – 63.7 million lei; 277 different types of "no-till" and "mini-till" machinery were purchased, the area of agricultural land cultivated using "no-till" / "mini-till" technology was 133,524 thousand ha; – In 2017 the total number of beneficiaries who purchased "no-till" and "mini-till" equipment from NFARD means was 217; the total amount authorized by AIPA – 54.4 million lei; various types of "no-till" and "mini-till" machinery were purchased, including: 110 no-till seed drills, 52 scarifiers, 3 multi-purpose combined cultivators, 981agricultural tractors, 128 combines, 2646 other agricultural machinery and machinery, the area of agricultural land cultivated using "no-till" / "mini-till" technology was 101.4 thousand ha; –In 2016 the total number of applicants for purchasing "no-till" and "mini-till" equipment from NFARD means was 121; the total amount requested – 20,901 million lei; the number of beneficiaries – 107; the total amount authorized by AIPA – 18,165 million lei; various types of "no-till" and "mini-till" machinery were purchased, including: 54 no-till seed drills, 38 scarifiers, 31 multi-purpose combined cultivators, 5 combined disk harrows, 128 other agricultural machinery and machines, the area of agricultural land cultivated using "no-till"/"mini-till" technology was 60,634 thousand ha; – In 2018 the total number of beneficiaries who purchased "no-till" and "mini-till" equipment from NFARD means was 278; the total – According to the National Agricultural and Rural Development Strategy implementation report for 2014-2020 (for the calendar year 2017)[689], the area of agricultural land cultivated using the "no-till" / "mini-till" technology has expanded from 51 thousand ha in 2013 to 101.4 thousand ha in 2017; simultaneously, the areas cultivated using the "no-till"/"mini-till" technology with the support of the National Fund for Agriculture and Rural Development Fund (NFARD) decreased from about 133.5 thousand ha in 2018 to about 52.0 thousand ha in 2019, to grow again to 66.0 thousand ha in 2020; – According to the data of the National Bureau of Statistics and the State Statistical Service of the Ministry of Economic Development of the ATULB, in the period 1990-2020 the quantities of chemical nitrogenous fertilizers applied to the soil evolved as follows: 1990 – 92.1 thousand tons active substance, 1995 – 10.5 thousand tons a.s., 2000 – 10.2 thousand tons a.s., 2005 – 16.1 thousand tons a.s., 2010 – 20.6 thousand tons a.s., 2015 – 38.7 thousand tons a.s., 2016 – 43.4 thousand tons a.s., 2017 – 55.7 thousand tons a.s., 2018 – 64.3 thousand tons a.s., 2019 – 77.2 thousand tons a.s.; and 2020 – 75.2 thousand tons a.s.; it is expected that the growing trend for consumption of mineral nitrogenous fertilizers will be maintained in the future;

[682] The Land Improvement Program aimed at ensuring sustainable management of soil resources for 2021-2025 and the Action Plan for its implementation for 2021-2023, approved at the Government meeting of December 9, 2020. <https://gov.md/sites /default/files/document/attachments/subiect-04_3.pdf>

[683]Government Decision on approval of the Regulation on conditions and procedure for granting subsidies in advance for land improvement investment projects aimed at implementing the Land Improvement Program in to ensure sustainable management of soil resources for 2021-2025, approved at the Government meeting of 22 December 2020 (topic of discussion no. 66). <https://gov.md/ro/content/sedinta-guvernului-din-22-decembrie-2020-ora-1600>

[684] Capacity-building program for the transformation of the rural area (IFAD VIII) 2021-2026, <https://www.ucipifad.md/noutati/parlliament-a-ratificat-un-nou-acord-de-finantare-cu-fondul- international-for-agricultural-development />, ratified by Law no. 194 of 19.11.2020 for the ratification of the Financing Agreement between the Republic of Moldova and the International Fund for Agricultural Development for "Improving Capacities for Rural Transformation (IFAD VIII)" Project implementation, published on 18.12.2020 in the Official Gazette no. 329-331, Art. 199 <https://www.legis.md/cautare/getResults?doc_id=124253&lang=ro>

[685] Government Decision No. 455 of 21.06.2017 on the distribution of funds of the National Agriculture and Rural Development Fund. Published: 23.06.2017 in the Official Gazette no. 201-213, art. No: 537. <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=370674>. Amended by the Government Decision No. 903 of 07.11.2017 on amending and supplementing Government Decision No. 455 of 21 June 2017. Published: 10.11.2017 in the Official Gazette no. 390-395, art. No: 1012. <http://lex.justice.md/md/372416%20/>.

[686] Agency for Intervention and Payments in Agriculture (2021), analytical report on management of the financial means allocated to the National Fund for Agricultural and Rural Development. Report for 2020, approved on 20 January 2021. p. 41. <http://aipa.gov.md/ro/rapoarte>.

[687] Agency for Intervention and Payments in Agriculture (2020), AIPA activity Report for 2019 of 15 January 2020. P. 24. <http://aipa.gov.md/ro/rapoarte>.

[688] Agency for Intervention and Payments in Agriculture (2020), Analytical Report for 2019 on management of the financial means allocated to the National Fund for Agricultural and Rural Development. P. 44. <http://aipa.gov.md/ro/rapoarte>.

[689] Ministry of Agriculture, Regional Development and Environment (2018), Report on the implementation of the National Agricultural and Rural Development Strategy for 2014-2020 (for calendar year 2017). Chisinau, March 2018. p. 76. <https://madrm.gov.md/ro/content/rapoarte>.

Implementation progress	Achieved results:	– According to the information available in the “National Inventory Report: 1990-2020. Greenhouse Gases Emissions Sources and Sinks in the Republic of Moldova” (2022), the quantities of natural organic fertilizers applied to the soil (mainly manure with straw bedding from cattle, swine and poultry) evolved in the period 1990-2020 as follows: 1990 – 9.74 million tons, 1995 – 5.96 million tons, 2000 – 3.71 million tons, 2005 – 3.66 million tons, 2010 – 3.26 million tons, 2015 – 2.78 million tons, 2016 – 2.81 million tons, 2017 – 2.68 million tons, 2018 – 2.36 million tons, 2019 – 2.14 million tons; 2020 – 1.85 million tons; based on projected evolution of livestock and poultry in the Republic of Moldova until 2035, it is anticipated that consumption of natural organic fertilizers will show a decreasing trend in the future.
	GHG emissions reductions	– Reduction of total N_2O emissions from the 3D source category “Agricultural soils” by 2035, compared to the level recorded in the reference year, under the WEM scenario – by about 140 kt CO_2 equivalent, and by about 180 kt CO_2 equivalent under the WAM scenario.

Mitigation action 14: Expansion of wooded areas

Description	Nature of the action	Afforestation of new land
	Sector	LULUCF
	GHG	CO_2
	Quantitative targets	Expansion of wooded areas, increase by thousands of hectares: - maximum 32-85 by 2030; The volume of the harvested wood mass, increase thousand m^3: - maximum 127-292 by 2030.
	Progress indicators	- wooded areas; - the volume of the harvested wood mass;
Methods		- identification of new areas for afforestation; - integrated planning on a national and local scale, providing planting and technical material, ensuring methodological and technologic inputs, design, on-the-field-field implementation, etc.; - creation of highly productive and ecologically stable stands; - implementation of the Action Plan on expansion of wooded areas; - MRV for expansion of wooded areas and the amount of harvested wood.
Assumptions		- national emission factors used to assess annual biomass growths and losses in forests; - afforestation will be implemented on 4.5% of rarities, 10.4% in gaps and wastelands, 21.6% in stands affected by calamities, 5.4% on non-regenerated parquets, 20.5% on wood sectors subject to exploitation until 2020 and 37.6% on other lands;
Goals		- attain the afforestation level of about 15% of the country’s territory, appropriate for a healthy ecosystem, which is currently 11.2%; - increase CO_2 removals.
Undertaken steps		The following were approved: - the State Program for Forest Regeneration and Afforestation for 2003-2020, the National Areas Extension Plan for 2014-2018, the National Strategy for Agricultural and Rural Development for 2014-2020; the Environmental Strategy for 2014-2023 and the Action Plan for its implementation.
Planned steps		- develop and approve the Plan for funding the implementation of the State Program for Forest Regeneration and Afforestation; -approve subsequent Action plans, following after 2018; - promote the NAMA project “Afforestation of degraded lands, impracticable for agriculture” developed within the LECB project and registered in the UNFCCC NAMA Registry in 2016.
Implementation progress	Environmental achievements	- regenerated forest areas increased from 3.3 kha in 2006 to approx. 5 kha in 2013; - the area of the forest vegetation covered lands decreased from 7.5 kha in 2006 to 0.1 kha in 2013
	CO_2 emissions removals	By 2030, maximum 414 kt CO_2 eq.

Mitigation action 15: “Soil Conservation Project in Moldova”

Description	Nature of the action	Afforestation of degraded lands
	Sector	LULUCF
	GHG	CO_2
	Quantitative targets	Afforestation of degraded land on 20,291 ha
	Progress indicators	- wooded areas; - the volume of the harvested wood mass; - the amount of reduced certified GHG emissions.
Methods		- identification of new areas for afforestation; - integrated planning on a national and local scale, providing planting and technical material, methodological and technological inputs, design, on-the- field implementation, etc.; - creation of highly productive and ecologically stable stands; - the GHG removal potential was calculated according to the approved CDM methodology AR-AM0002 “Re-afforestation of degraded lands by afforestation / re-afforestation” (UNFCCC, 2009); - media coverage and training on sustainable natural resource management; - MRV expansion of wooded areas.
Assumptions		- to estimate annual growths and losses of biomass in forests, the country specific emission factors have been calculated/developed; - the species for planting are selected according to the criteria of matching with the soil, climate and adaptability characteristics; - afforestation of degraded land will improve soil condition; - increasing access to wood resources and non-wood forest products.
Goals		- attain the afforestation level of about 15% of the country’s territory, appropriate for a healthy ecosystem, which is currently 11.2%; - re-including 20.3 kha of eroded and unproductive lands in the general productive circuit; - increase CO_2 removals.

Undertaken steps		The following documents were approved: - the State Program for Forest Regeneration and Afforestation for 2003-2020, the National Areas Extension Plan for 2014-2018, the National Strategy for Agricultural and Rural Development for 2014-2020; the Environmental Strategy for 2014-2023 and the Action Plan for its implementation. - the Low-Emission Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation.
Planned steps		- replanting within the SCPM the areas initially unsuccessful or destroyed by various natural disasters (1,133 ha); - ensuring the appropriate management for the newly created forests; - monitoring according to the project methodology and reporting the emission reductions achieved under the SCPM.
Implementation progress	Environmental achievements	- SCPM project documents development: PDD and Monitoring Plan; - planting and care of 20.3 kha of forest crops; - registration of the SCPM at the CDM Secretariat (2009); - international monitoring and certification of 864 kt CO_2 eq. GHG emissions reductions during 2002-2012; - monitoring of 1,205 kt CO_2 eq. GHG emissions reductions during 2012-2016 (2016-2017).
	CO_2 emissions removals	About 3,600 kt CO_2 eq. by 2022

Mitigation action 16: Project "Development of the communal forestry sector in the Republic of Moldova"

Description	Nature of the action	Afforestation of degraded lands
	Sector	LULUCF
	GHG	CO_2
	Quantitative targets	Afforestation of degraded land on 8,469 ha
	Progress indicators	- the area of actually wooded lands; - the volume of the harvested wood mass; - the amount of GHG emissions reductions achieved and certified.
Methods		- identification of new areas for afforestation; - integrated planning on a national and local scale, providing planting and technical material, methodological and technological inputs, design, on-the- field implementation, etc.; - creation of highly productive and ecologically stable stands; - the GHG removal potential was calculated according to the approved CDM methodology AR-AM0002 "Re-afforestation of degraded lands by afforestation / re-afforestation" (UNFCCC, 2009); - media coverage and training on sustainable natural resource management; - MRV of wooded areas expansion.
Assumptions		- to estimate annual growths and losses of biomass in forests, the country specific emission factors have been calculated/developed; - the species for planting are selected according to the criteria of matching with the soil, climate and adaptability characteristics; - afforestation of degraded land will improve soil condition; - increasing access to wood resources and non-wood forest products.
Goals		- attain the afforestation level of about 15% of the country's territory, appropriate for a healthy ecosystem, which is currently 11.2%; - re-including 8.5 thousand ha of eroded and unproductive lands in the general productive circuit; - employment of agroforestry practices; - introduction of participatory forest and grassland management practices; - increase CO_2 removals.
Undertaken steps		The following documents were approved: - the State Program for Forest Regeneration and Afforestation for 2003-2020, the National Areas Extension Plan for 2014-2018, the National Strategy for Agricultural and Rural Development for 2014-2020; the Environmental Strategy for 2014-2023 and the Action Plan for its implementation; - the Low-Emission Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation.
Planned steps		- replanting the areas within PDSFCM initially unsuccessful or destroyed by various natural disasters (326 ha); - ensuring the appropriate management for the newly created forests; - monitoring according to the project methodology and reporting the emission reductions achieved in the framework PDSFCM.
Implementation progress	Environmental achievements	- development of project documents for PDSFCM: PDD and Monitoring Plan; - planting and caring for 8.5 kha of forest crops; - registration of PDSFCM at the CDM Secretariat (2012); - international monitoring and certification of 328 kt CO_2 emissions reductions for the period 2006-2013; - monitoring 367 kt CO_2 emissions reductions for the period 2013-2018.
	CO_2 emissions removals	By 2035: about 1,200 kt CO_2

Mitigation action 17: Rehabilitation of forest belts for protection of agricultural fields in the southern part of the Republic of Moldova

Description	The nature of the action	Rehabilitation of forest belts protecting agricultural fields
	sector	LULUCF
	GHG	CO_2
	Quantitative objectives	Rehabilitation of forest belts for protection of agricultural fields on 2,242 hectares.
	Progress indicators	- the area of the rehabilitated forest protection belts; - the area of the protected adjacent agricultural lands; - the volume of the harvested wood mass; - the amount of reduced GHG emissions, achieved and certified.

Methods		- integrated planning on a national and local scale, providing planting and technical material, methodological and technological inputs, design, on-the- field implementation, etc.; - creation of forest protection belts with multiple protection functions; - the GHG removal potential was calculated according to the approved CDM methodology AR-AM0002 "Re-afforestation of degraded lands by afforestation/re-afforestation" (UNFCCC, 2009); - media coverage and training on sustainable management of natural resources, including forest belts protecting agricultural fields (104 events); - MRV of forest belts rehabilitation and maintenance process.
Assumptions		- a sample of markets (43 PP) was placed to establish annual biomass growths and losses in rehabilitated forest protection belts; - the species for planting will be selected according to the criteria of matching with the soils, climate and adaptability characteristics; - rehabilitation of forest protection belts will ensure protection of the adjacent agricultural lands; - increasing access to wood resources and non-wood forest products.
Goals		- ensuring the appropriate degree of protection for agricultural lands with forest belts - 4%, which is currently 1.7% or 30.7 kha; - curbing the degradation processes of the adjacent agricultural lands; - employment of agroforestry practices; - increasing CO_2 removals.
Undertaken steps		The following were approved: - the Land Reclamation and Soil fertility Enhancement Program for 2003-2010 and 2011-2020, the National Areas Expansion Plan for 2014-2018, the National Strategy for Agricultural and Rural Development for 2014-2020; the Environmental Strategy for 2014-2023 and Action Plan for its implementation; the Low-Emission Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation.
Planned steps		- replanting of areas initially unsuccessful or destroyed by various natural disasters; - ensuring proper management for rehabilitated forest protection belts; - monitoring the emission reductions due to rehabilitated forest protection belts.
Implementation progress	Environmental achievements	- rehabilitation of forest belts for protection of agricultural fields on 2,242 hectares; - monitoring 43.04 kt CO_2 eq GHG emissions reductions during 2014-2016.
	CO_2 emissions removals	About 430.44 kt CO_2 eq. by 2034

Mitigation action 18: Afforestation of degraded lands, riparian areas and protection curtains in the Republic of Moldova

Description	The nature of the action	Land afforestation
	Sector	LULUCF
	GHG	CO_2
	Quantitative targets	- afforestation of degraded lands on 45.0 kha; - afforestation of riparian strips on 15.0 kha; - creation of belts for the protection of agricultural fields on 1.5 kha.
	Progress indicators	- wooded areas; - the volume of the harvested wood mass.
Methods		- identification of new areas for afforestation; - integrated planning on a national and local scale, providing planting and technical material, methodological and technological inputs, design, on-the- field implementation, etc.; - creation of highly productive and ecologically stable stands; - the GHG removal potential was calculated according to the approved CDM methodology AR-AM0002 "Re-afforestation of degraded lands by afforestation / re-afforestation" (UNFCCC, 2009); - media coverage and training on sustainable natural resource management; - MRV of the wooded areas expanding process.
Assumptions		- to estimate annual growths and losses of biomass in forests, the country specific emission factors have been calculated/developed; - the species for planting will be selected according to the criteria of matching with the soil, climate and adaptability characteristics; - afforestation of degraded land will improve soil condition.
Goals		- attain the afforestation level of about 15% of the country's territory, appropriate for a healthy ecosystem, which is currently 11.2%; - increase CO_2 removals.
Undertaken steps		The following were approved: - the State Program for Forest Regeneration and Afforestation for 2003-2020, the National Areas Extension Plan for 2014-2018, the National Strategy for Agricultural and Rural Development for 2014-2020; the Environmental Strategy for 2014-2023 and the Action Plan for its implementation. - the Low-Emission Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation.
Planned steps		Subsequent promotion of the NAMA document on afforestation of degraded lands, riparian areas and protection belts in the Republic of Moldova.
Implementation progress	Environmental achievements	The NAMA document on afforestation of degraded lands, riparian areas and protection belts in the Republic of Moldova was developed in pre-feasibility study format.
	CO_2 emissions removals	About 2,000 kt CO_2 by 2030

Mitigation action 19: Smart climate management of forests and grasslands

Description	The nature of the action	Land afforestation, grasslands rehabilitation
	Sector	LULUCF
	GHG	CO_2
	Quantitative targets	- afforestation of degraded lands on 1,500 hectares; - afforestation of riparian strips on 320 hectares; - creation of belts for protection of agricultural fields on 560 hectares; - rehabilitation of forest protection belts on 750 ha; - rehabilitation of degraded grasslands on 1,000 ha.
	Progress indicators	- wooded area; - the area of the rehabilitated forest protection belts; - the area of improved grasslands; - the amount of CO_2 removed.
Methods		- identification of new areas for afforestation; - integrated planning on a national and local scale, providing planting and technical material, methodological and technological inputs, design, on-the-field implementation, etc.; - creation of highly productive and ecologically stable stands; - creation of highly productive and multifunctional grasslands; - MRV.
Assumptions		- to estimate annual growths and losses of biomass in forests, the country specific emission factors have been calculated/developed; - the species for planting are selected according to the criteria of matching with the soil, climate and adaptability characteristics; - afforestation of degraded land will improve soil condition
Goals		- rehabilitation of forest protection belts and degraded grasslands; - planting new forest protection belts; - attain the afforestation level of about 15% of the country's territory, appropriate for a healthy ecosystem, which is currently 11.2%; - increase in CO_2 removals.
Undertaken steps		The following were approved: - the State Program for Forest Regeneration and Afforestation for 2003-2020, the National Areas Extension Plan for 2014-2018, the Low Emission Development Strategy of the Republic of Moldova until 2030 and Action Plan for its implementation, the Climate Change Adaptation Strategy until 2020.
Planned steps		- development of environmental management plans; - selection of LPAs in the central and southern areas of the country, considered to be more vulnerable to climate change; - evaluation of plots of land for afforestation or for the creation/rehabilitation of forest protection curtains.
Implementation progress	Environmental achievements	The actions described are the component part of the climate change adaptation project of the Republic of Moldova.
	CO_2 emissions removals	Circa 50 kt CO_2 annually

Mitigation action 20: Improving eroded land by conversion to pastures

Description	The nature of the action	Conversion of moderately and heavily eroded lands into pastures
	Sector	LULUCF
	GHG	CO_2
	Quantitative targets	- conversion of 40.0 kha of moderately and heavily eroded land into pastures.
	Progress indicators	- moderately and heavily eroded land surface transformed into pastures; - amount of fodder mass for animals produced on the eroded land converted into pastures; - amount of CO_2 removed.
Methods		- identification of new areas with eroded soils for improvement / rehabilitation; - integrated planning on a national and local scale, providing planting and technical material, methodological and technological inputs, design, on-the- field implementation, etc.; - special technologies were developed and tested in UNDP projects "Clima-East: Sustainable Management of Pastures and Forests in the First National Park of the Republic of Moldova (Orhei National Park) to demonstrate the benefits of climate change mitigation and adaptation measures for local communities" and "Integrating Biodiversity Conservation Priorities into Territorial Planning Policies and Land Use Practices in Moldova".
Assumptions		- country specific emission factors were used to assess annual biomass increases on the newly created pastures; - for improvement works (sowing) the grass species will be selected based on soils matching criteria, climate and the adaptability characteristics; - the conversion of eroded (degraded) lands will improve the condition of eroded soils.
Goals		- increasing the share of grassland to 22% rate of the country's territory, which is currently about 12%; - quantitative and qualitative increase of the feed mass for cattle; - the re-inclusion of 40.0 kha of eroded and poorly productive lands in the general productive circuit; - increase CO_2 removal capacity.
Undertaken steps		The following were approved: - the Low-Emission Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation; - Regulation on grazing and mowing, GD no. 667/2010; - the Environmental Strategy of the Republic of Moldova for 2014-2023 and the Action Plan for its implementation, GD No. 301/2014; - the Strategy on Biological Diversity of the Republic of Moldova for 2015-2020 and the Action Plan for its implementation, GD No. 274/2015; - the National Strategy for Sustainable Development of the Agribusiness in the Republic of Moldova (2008-2015), GD No. 282/2008.

Planned steps		- primary assessment of eroded land plots for improvement by conversion to pastures; - development of improvement projects for eroded and poorly productive lands by creating pastures; - selection of LPAs in the central and southern areas of the country, regarded as more vulnerable to climate change; - ensuring appropriate management for newly created pastures.
Implementation progress	Environmental achievements	The actions described are part of a new climate change adaptation project.
	CO_2 emissions removals	Circa 555 kt CO_2 by 2030

Mitigation action 21: Management of degraded agricultural lands by implementing erosion control measures and eroded soils cultivation methods

Description	The nature of the action	Sustainable management of eroded agricultural land
	Sector	LULUCF
	GHG	CO_2
	Quantitative goals	- remediate the eroded arable soils on slopes, increase fertility, and sequestrate carbon in soils. - minimize fertile soil losses up to the maximum allowable limit - 5 t/ha; - stable crops yields on arable lands on slopes; - stop the liquid and solid leakage intensity on the slopes and prevent compaction; - implement anti-erosion measures on 865 kha of eroded agricultural lands; - stop degradation (compaction) on the eroded soils, by restoration.
	Progress indicators	- the area of eroded agricultural lands improved by anti-erosion measures; - the area of eroded agricultural land with restored fertility; - the amount of C_{O2} removed.
Methods		Anti-erosion protection measures for arable land include measures aimed at surface runoff regulation, agricultural techniques retaining water in the soil, optimizing soil compaction, crop rotation and crop rotation. For lands with ^{2o} gradient: 1) hoeing crops - 60%, cereal crops - 20%; legumes - 15%, fodder crops - 5%; 2) straw crops - 50%, hoe crops - 50%; 3) hoeing crops - 50%; other - 50%, annual cereals and leguminous cereals planted in strips with a maximum width of 200 m; For lands with 2-^{5o} gradient the crops are planted in 100-150 m width strips, which including 50% hoeing crops, 25% - cereal crops, 5% - perennial grasses; 20% - legumes and fodder crops; For lands with 5-$^{8°}$ gradient - 30% hoeing crops, 40% cereal crops, 20% legumes and fodder crops, 10% perennial grasses. The crops are planted in strips up to 100 m wide and grassed buffer strips 4-5 m wide. Slopes with a more than ^{8}0 gradient should not be included in the category of arable land, these slopes are used for perennial plantations (orchards and vineyards) and pastures. On sloping lands, where it is not possible to permanently sow herbaceous species (herbing), crops are alternated with protective plants and grassy strips along the length of the curves. For lands consolidation and protection, earth waves, agricultural terraces, smooth banks or level fencing are built. In order to calculate C_O2 emission reductions, two methodologies will be used: - Tier 1 methodology available in the IPCC Guidelines 2006 (Vol. 4 - Chapter 2) - Tier 3 methodology to determine the carbon balance in agricultural soils to estimate C_O2 emissions (Banaru, 2000) [690]
Assumptions		- develop the sloping arable land distribution schemes, taking into account the geomorphological, pedoclimatic and erosion risk factors; - implement "no-till" and "mini-till" soil conservation systems on at least 160 kha, with incorporation of green manure into the soil according to pre-set periodicity[691];
Goals		- stop erosion and compaction of eroded soils on 865 kha; - achieving carbon and humus balance in the soil by 2030; - increasing soil productivity avoiding its degradation and compaction; - reduction of GHG emissions.
Undertaken steps		The following documents were approved: - The Soil Conservation and Fertility Enhancement Program for 2011-2020 and the Action Plan for its implementation (2017-2020); - The list of sites and necessary financial means for 2018 to implement the Action Plan on implementation of the Soil Conservation and Fertility Enhancement Program for 2017-2020. - Technical Regulations "Soil Protection Measures in Agricultural Practices" [692], HG no. 1157/2008; - National Strategy for Agricultural and Rural Development for the years 2014-2020; - Environmental Strategy for 2014-2023 and Action Plan for its implementation.
Planned steps		- develop and approve Action Plans and Agricultural Practices Guidelines for eroded soil management.
Implementation progress	Environmental achievements	- anti-erosion sustainable management (including "no-till" and "mini-till" practices) is already used on 35,000 ha of agricultural land;
	CO_2 emission reductions / removals	By 2030, humus content in eroded soils will increase, and entail the following GHG emissions reduction (indirect calculations): - by 50%, 149 kt CO_2 equivalent – in poorly eroded soils (humus - 2.97%); - by 30%, 114 kt CO_2 equivalent - in moderately eroded soils (humus - 2.28%); - by 15%, 91 kt CO_2 equivalent - in heavily eroded soils (humus - 1.82%).

[690] Banaru, Anatol (2000), Method for determining greenhouse emissions from arable soils. In works collection "Climate change. Research, studies, solutions." Ministry of Environment and Spatial planning / UNDP Moldova. "Bons Offices" S.R.L. Chisinau, 2000, p. 115-123.
[691] Government Decision no. 1470 of 30.12.2016 on the approval of the Low Emission Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation. Published: 24.03.2017 in the Official Gazette no. 85-91, art. no.: 222.
[692] Technical regulations "Soil protection measures in agricultural practices". GD no. 1157 of 13.10.2008. Official Gazette 2008, nr.193-194, art. 1195.

Mitigation action 22: Planting Forest Energy Crops

Description	The nature of the action	Planting energy forest crops
	Sector	LULUCF
	GHG	CO_2
	Quantitative targets	- planting of fast-growing forest crops on 5,000 hectares
	Progress indicators	- forested areas; - the volume of the harvested wood mass.
Methods		- identification of new areas for afforestation; - integrated planning on a national and local scale, providing planting and technical material, methodological and technological inputs, design, on-the- field implementation, etc.; - creation of highly productive and ecologically stable stands; - the GHG removal potential was calculated according to the approved CDM methodology AR-AM0002 "Re-afforestation of degraded lands by afforestation/re-afforestation" (UNFCCC, 2009); - media coverage and training on fast-growing species management, managed in small production cycles (10-15 years); - MRV of expanding wooded areas.
Assumptions		- to estimate annual growths and losses of biomass in forests, the country specific emission factors have been calculated/developed; - fast-growing species, managed in small production cycles (10-15 years) will be selected for planting;
Goals		- reducing the pressure on existing forests; - increase CO_2 removals.
Undertaken steps		The following were approved: - the State Program for Forest Regeneration and Afforestation for 2003-2020, the Climate Change Adaptation Strategy of the Republic of Moldova until 2020 and the Action Plan for its implementation, National Strategy for Agricultural and Rural Development for 2014-2020; Environmental Strategy for 2014-2023 and Action Plan for its implementation; The Low-Emission Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation.
Planned steps		Extension and implementation of the Climate Change Adaptation Strategy of the Republic of Moldova until 2020 and of the Action Plan for its implementation.
Implementation progress	Environmental achievements	So far, in the Republic of Moldova there are only a few energy willow plantations, which occupy an area of up to 50 ha.
	CO_2 emission removals	By 2030: about 210 kt

Mitigation action 23: Rehabilitation of forest belts for protection of agricultural fields in the central and northern areas of the Republic of Moldova

Description	The nature of the action	Rehabilitation of forest belts for protection of agricultural fields
	Sector	LULUCF
	GHG	CO_2
	Quantitative targets	Rehabilitation of forest belts for protection of agricultural fields on 2,242 hectares.
	Progress indicators	- area of the rehabilitated forest protection belts; - area of the protected adjacent agricultural lands; - the volume of the harvested wood mass; - the amount of GHG emissions reductions achieved and certified.
Methods		- integrated planning on a national and local scale, providing planting and technical material, methodological and technological inputs, design, on-the- field implementation, etc.; - creation of highly productive and ecologically stable stands; - the GHG removal potential was calculated according to the approved CDM methodology AR-AM0002 "Re-afforestation of degraded lands by afforestation / re-afforestation" (UNFCCC, 2009); - media coverage and training on sustainable management of natural resources, including forest belts for protection of agricultural fields (104 events); - MRV on the process of rehabilitation and maintenance of forest belts.
Assumptions		- to estimate annual growths and losses of biomass in rehabilitated forest protection belts a sample of markets (43 PP) will be placed; - the species for planting are selected according to the criteria of matching with the soil, climate and adaptability characteristics; - rehabilitation of forest protection belts will ensure protection of the neighboring agricultural lands; - increasing access to timber resources and non-timber wood products.
Goals		- attaining the appropriate degree of farmland protection by forest protection belts of 4%, which is currently 1.7% or 30.7 thousand ha; - curbing the degradation processes of the adjacent agricultural lands; - employment of agroforestry practices; - increase in the amount of CO_2 removals.
Undertaken steps		The following documents were approved: -the Land Reclamation and Soil Fertility Enhancement Program for 2003-2010 and 2011-2020, the National Areas Extension Plan for 2014-2018, the National Strategy for Agricultural and Rural development for 2014-2020; the Environmental Strategy for 2014-2023 and the Action Plan for its implementation; the Low-Emission Development Strategy until 2030 and the Action Plan for its implementation.
Planned steps		- rehabilitation of forest belts for protection of agricultural fields on 2.2 kha; - monitoring 43.0 kt CO_2 emissions reductions expected during 2021-2023.
Implementation progress	CO_2 emission removals	About 430.0 kt by 2041.

Mitigation action 24: Adaptation of forest and pastoral ecosystems in the Republic of Moldova to climate change

Description	The nature of the action	Land afforestation, pastures rehabilitation, ecological reconstruction of forests
	Sector	LULUCF
	GHG	CO_2
	Quantitative targets	- creation of new forests adapted to climate change on 18,200 ha; - extension on new forest belts for protection of agricultural fields and riparian areas on 1,190 ha; - rehabilitation of forest belts for protection of agricultural fields and waters on 2,800 ha; - adapting the production of forest seed and planting material to climate change evolution; - ecological reconstruction of unsuitable and climate change vulnerable stands on 6,650 ha; - optimizing the forest roads network in the context of reducing the carbon footprint in the forestry sector; - revitalization of the fire-protection systems in forests and other types of forest vegetation; - rehabilitation of degraded pastures on 2,100 ha.
	Progress indicators	- wooded area; - the area of rehabilitated forest protection curtains; - the area of improved pastures; - length of optimized forest roads; - the area of forests with revitalized fire-protection systems; - the amount of CO_2 removals.
Methods		- identification of new territories for afforestation; - integrated planning on a national and local scale, providing planting and technical material, methodological and technological inputs, design, on-the- field implementation, etc.; - creation of highly productive and ecologically/climatically stable stands; - creation of highly productive and multifunctional pastures; - MRV.
Assumptions		- in order to establish the annual increases and losses of biomass in forests, the national emission factors were calculated / elaborated; - the species for planting will be selected according to the criteria of matching with the soils, climate and adaptability characteristics; - grass species and appropriate technologies are selected for grassland improvement; - afforestation of new lands and creation of forest protection belts will improve the soils condition.
Goals		- rehabilitation of forest protection belts and degraded pastures; - planting new forest protection belts; - attain the afforestation level of about 15% of the country's territory, appropriate for a healthy ecosystem, which is currently 11.3%; - increase in CO_2 removals.
Undertaken steps		The following documents were approved: - the State Program for Regeneration and Afforestation of the Forest Fund Lands for 2003-2020, the National Areas Extension Plan for 2014-2018, the Low Emission Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation, the Climate Change Adaptation Strategy until 2020.
Planned steps		- development of afforestation and/or rehabilitation projects; - selection of LPAs, regarded to be more vulnerable to climate change; - evaluation of plots of land for afforestation or for the creation/rehabilitation of forest protection belts.
Implementation progress	Environmental achievements	The described actions are part of the Climate Change Adaptation Project of the Republic of Moldova.
	CO_2 emission removals	About 210 kt annually.

Mitigation action 25: Prevention and mitigation of the effects caused by local flash floods and floods

Description	The nature of the action	Land afforestation, rehabilitation of forest belts, development of forest and silvo-pastoral management plans
	Sector	LULUCF
	GHG	CO_2
	Quantitative targets	- afforestation of lands within the riparian water's protection areas on 658 ha; - rehabilitation of forest belts for protection of agricultural fields and waters on 214 ha; - creation of wetlands on 72 ha; - development of forest arrangements on 3,274 ha; - development of silvo-pastoral arrangements on 10,214 ha.
	Progress indicators	- wooded area; - the area of the rehabilitated forest protection belts; - developed forestry and silvo-pastoral arrangements; - the amount of CO_2 removals.
Methods		- identification of new areas for afforestation; - integrated planning on a national and local scale, providing planting and technical material, methodological and technological inputs, design, on-the- field implementation, etc.; - creation of highly productive and ecologically/climatically stable stands; - creation of highly productive and multifunctional pastures; - MRV.
Assumptions		- to estimate annual growths and losses of biomass in forests, the country specific emission factors have been calculated/developed; - the species for planting will be selected according to the criteria of matching with the soils, climate and adaptability characteristics; - grass species and breeding technologies will be selected for silvo-pastoral arrangements; - afforestation of new lands and creation of forest protection belts will improve the soils condition.

Goals		- rehabilitation of forest protection belts and degraded pastures; - planting new forests and protective forest belts; - attain the afforestation level of about 15% of the country's territory, appropriate for a healthy ecosystem, which is currently 11.3%; - increase in CO_2 removals.
Undertaken steps		The following documents were approved: - the State Program for Regeneration and Afforestation of the Forest Fund Lands for 2003-2020, the National Areas Extension Plan for 2014-2018, the Low Emission Development Strategy of the Republic of Moldova until 2030 and the Action Plan for its implementation, the Climate Change Adaptation Strategy until 2020.
Planned steps		- development of afforestation and/or rehabilitation projects; - elaboration of forestry and silvo-pastoral arrangements; - selection of LPAs, regarded to be more vulnerable to climate change; - evaluation of plots of land for afforestation or for the creation/rehabilitation of forest protection belts.
Implementation progress	Environmental achievements	The described actions are part of the Climate Change Adaptation Project of the Republic of Moldova.
	CO_2 emission removals	About 14 kt annually

Mitigation action 26: Primary collection and storage of waste in urban and rural areas

Description	The nature of the action	Efficient management of municipal solid waste
	Sector	Waste
	GHG	CH_4
	Quantitative targets	- setting up 8 regional solid waste primary collection and storage systems; - waste management services provided in urban and rural areas; - construction of 8 regional deposits by 2035; - construction of 22 transfer stations; - construction of 23 recyclable waste sorting stations; - construction of 25 biodegradable waste composting stations; - provision of about 40,000 containers and 165 transport units with a capacity of 24 m^3 and 20 transport units with a capacity of 10 m^3 for waste collection.
	Progress indicators	- number of maintained solid waste deposit sites; - amount of recycled waste; - amount of composted waste; - amount of waste stored in each deposit site.
Methods		- design and implementation of 8 regional systems for primary collection and storage of solid waste - construction of power plants based on biogas generated by SWDs, a total of 7 units - MRV of biogas generated and used to produce electricity
Assumptions		- Starting with 2030 when the waste management infrastructure will be built at regional level, all recyclable plastic, metal, glass and paper waste will be collected and recycled at about 7-8% rate of the total waste; - the share of biodegradable composted waste will reach about 2-4% of the total weight of generated waste; - electricity produced from landfill biogas will be fed into the grid.
Goals		- ensuring a high-quality environment; - minimizing health risks; - reducing raw material for production of paper, glass, plastic and metals; - significant reduction in CH_4 emissions in the atmosphere.
Undertaken steps		The following documents were approved: - the Waste Management Strategy of the Republic of Moldova for 2013-2027, the Environmental Strategy for 2014-2023 and the Action Plan for its implementation; - The German company GIZ has completed the feasibility studies for the development of the primary waste collection and storage systems in urban and rural areas for 3 of the 8 regions of the country. For 5 regions, feasibility studies were initiated, but were not completed due to non-selection of land for the location of regional SWDs; - The draft NAMA document "Production of electricity from biogas created at the Cahul landfill, with the extension of the project for the regional waste Cahul-Cantemir-Taraclia", was developed and registered in the UNFCCC NAMA Registry.
Planned steps		- Development and approval of the Action Plan on the primary collection and storage of waste in urban and rural areas; - Identifying the sources of financing primary waste collection and storage systems in urban and rural areas; - Publicity, awareness and training on the importance of recyclable waste selection; - On October 18, 2019, a loan agreement of 100 million euro was signed between the European Investment Bank and the Government of the Republic of Moldova to improve solid waste management services in the country. The loan will be provided in several installments, with the first installment of 25 million Euro. This Agreement aims to implement the Waste Management Strategy of the Republic of Moldova for 2013-2027, involving projects aimed at upgrading and developing solid waste management systems and facilities in eight regions of our country. The projects will provide settlements with new collection systems, mechanical-biological waste treatment facilities and new regional sanitary SWDs for the whole country. The regional SWDs will be equipped with biogas recovery systems, as it will contribute to the reduction of GHG emissions and therefore to the achievement of the determined national contribution, according to the provisions of the Paris Agreement.
Implementation progress	Environmental achievements	- the SWDs locations negotiated and established in three regions of the country; - in June 2020, the Financing Agreement between the RoM and the EIB on implementation of the "Solid Waste Project in the Republic of Moldova", amounting to 25 million Euro, was ratified.
	GHG emissions reductions	About 313 kt CO_2 eq./year by 2035

Mitigation action 27: Increasing the population's access to centralized sanitation services and upgrading of wastewater treatment plants in Chisinau municipality, with sludge treatment in anaerobic conditions

Description	Nature of the action	Extension and improvement of sanitation services and recovery of methane in Chisinau municipality
	Sector	Wastewater treatment
	GHG	CH_4
	Quantitative targets	By 2030 - connecting 100% of urban population and 80% of the rural population to sanitation systems
	Progress indicators	- sanitation systems built - number of populations connected to wastewater collection and treatment systems
Methodologies		- development of feasibility studies and technical documentation for construction, repair of wastewater treatment plants and sewerage networks - development of the investment project in the water supply and sanitation sector based on the recommendations of the feasibility studies and identification, mobilization and commitment of domestic or international financing sources - improving the related legal and regulatory framework - drawing up feasibility studies and technical documentation and the investment project for construction and repair of wastewater treatment plants and sewerage networks; - MRV of biogas generated and used in electricity production at the treatment plant in Chisinau; - the methodologies for calculating CH_4 emissions, respectively CH_4 emissions projections from wastewater management are of Tier 1, available in the IPCC Guidelines 2006, Volume 5.
Assumptions		- increasing budget support for the sector, both from state budget and local budgets revenues - undertaking measures related to the legal, institutional framework, etc., which would allow to ensure enabling environment for increasing the absorption capacity of investments - setting tariffs for water and sanitation services, which take into account the ability of consumers to pay - development of new sewerage and wastewater infrastructure, as well as ensuring the possibility of connecting the population to the existing infrastructure - development of the new drinking water supply infrastructure will be accompanied by the wastewater infrastructure or by any appropriate alternative sanitation infrastructure in rural localities - construction and operation of basins for anaerobic fermentation of sludge with energy production at the wastewater treatment plant in Chisinau [693]
Goals		- increased access to sewerage and wastewater treatment services in rural and urban areas of the RoM - management of sewage sludge to recover CH_4 emissions and to produce electricity for the needs of the sewage plant in Chisinau - improving health, dignity and quality of life and the economic development of the country - low CH_4 emissions into the atmosphere
Undertaken steps		- The following have been approved: Water Supply and Sanitation Strategy (2014 – 2028)[694], National Program for the Implementation of the Protocol on Water and Health in the RoM for 2016-2025[695] - A number of projects were launched ("Strengthening the institutional framework in the water supply and sanitation sector in the Republic of Moldova", Phase III of the "Water and Sanitation Project (ApaSan) in the Republic of Moldova", "Harmonization of national legislation with Directive 91/271/EEC on urban wastewater treatment") - The Financing Agreement was signed with KfW Development Bank from Germany for the implementation of the "Water supply and sewerage in Cahul district" project and other projects relevant to Cahul district - the Acrode of Cooperation from MM, the Austrian Development Agency and Cantemir local authorities for improving sanitation conditions - Initiated the development of the Inland Waterways Strategy - German company GIZ has developed Regional Sectoral Water Supply and Sewerage Programs for all Development Regions - The project "Rehabilitation of the Wastewater Treatment Plant and the New Sludge Treatment Line" was launched by S.A. "Apa-Canal Chisinau" in early 2018
Planned steps		- Update of action plans - Updating the regulatory framework - Strengthening the capacities of the implementing institutions and enforcement of the sector secondary legislation provisions - Identifying the sources of funding for projects implementation

Implementation progress	Environmental achievements	- Amendments to the Law 303/2013 on public water supply and sewerage service
		- Amendments to the GD 950/2013 approving the Regulation on requirements for collection, treatment and discharge of wastewater into sewerage and/or emission systems in urban and rural areas [696]
		- Amendments to the GD 199/2014 approving the Water Supply and Sanitation Strategy (2014 – 2030)[697];
		- The Prut River water treatment plant in Grozesti village was built and the main aqueduct of 16.8 km length and distribution networks of 101.8 km length was put into operation under the framework of the "Rehabilitation of the water supply system in Nisporeni district" project.
		- The project "Access to water and sewerage in the settlements in the Nirnova river basin" is being implemented, providing for ensuring the access to water and sewerage services through Community Development Association;
		- During 2017 the Regional Development Agencies (RDAs) implemented water supply and sanitation projects, as follows:
		  - RDA North – "Provision of drinking water and sewerage of the inhabitants of Risipeni and Bocsa villages and of the social-cultural institutions (Falesti district)";
		  - RDA South – "Construction of the sewerage system in Valul lui Traian sector and modernization of the sewage treatment plant in Causeni town"; "Construction of the sewerage system in Rosu village, Cahul district"
		  - RDA Center "Main aqueduct for Bardar, Rusestii Noi villages (stage II) and sewerage networks in Ialoveni"; "Improving the quality of life of rural population through construction of drinking water and sewerage systems, regionalization of communal services in the villages of Lapusnita river valley, in Hincesti district"; "Construction of the district treatment station and development of the public sewerage and wastewater treatment system at inter-community level, Nisporeni district".
		- The ApaSan project carried out 2 projects: treatment plant in Truseni, Chisinau municipality and 2 toilets in the summer camp in Cahul municipality.
		- From the FEN sources, 145 km of water supply networks, 30 km of sewerage networks and 5 wastewater treatment plants were built.
		- GIZ carries out regional projects to modernize water supply and sewerage services

	GHG emissions reductions	By 2030: about 108.54 kt CO_2 equivalent compared to 1990; By 2035: about 126.54 kt CO_2 equivalent compared to 1990.

[693] Water supply and wastewater treatment program in Chisinau Municipality – Feasibility Study, Project Presentation Report, EBRD, KfW Entwicklungsbank and European Investment Bank, November 2012
[694] Government Decision no. 199 of 20.03.2014 approving the Water Supply and Sanitation Strategy (2014 – 2030), Published 28.03.2014 in the Official Gazette No. 72-77, art. No.: 222, as amended by GD 442 of 01.07.20, OG188-192/24.07.20 art.634, <https://www.legis.md/cautare/getResults?doc_id=122590&lang=ro >
[695] Government Decision no. 1063 of 16.09.2016 approving the National Program for the implementation of the Protocol on Water and Health in the Republic of Moldova for the years 2016-2025. Published: 20.09.2016 in the Official Gazette No. 314, art. No.: 1141, amended by GD 1090 of 18.12.17, OG440/20.12.17 art.1214, <http://lex.justice.md/index.php?action=view&view=doc&lang=1&id=366749>
[696] Government Decision no. 950 of 25.11.2013 approving the Regulation on the requirements of collection, treatment and discharge of wastewater into the sewerage system and/or water emissaries for urban and rural areas, published: 06.12.2013 in the Official Gazette No. 284-289, art. No.: 1061, amended by GD 90 of 19.02.20, MO75-83/13.03.20 art.219; in force on 13.04.20, <https://www.legis.md/cautare/getResults?doc_id=120783&lang=ro/>
[697] Government Decision no. 442 of 01.07.2020 for the amendment of the Government Decision no. 199/2014 on the approval of the Water Supply and Sanitation Strategy (2014-2028). Published: 24-07-2020 in the Official Gazette No. 188-192 Art. 634 <https://www.legis.md/cautare/getResults?doc_id=122313&lang=ro>