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ON CLIMATE CHANGE

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Resilient nations.

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The Second Biennial Update Report on Climate Change is a significant national contribution to fulfilling the country's commitments to the UNFCCC.

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ABBREVIATIONS & UNITS

AFOLU	Agriculture, Forestry and Other Land Use
BUR	Biennial Update Report
CC	Climate Change
CHPs	Combined Heat and Power Plants
CLC	CORINE Land Cover
CMC	Center for Management of Crises
CORINE	Coordination of Information on the Environment
CRF	Common Reporting Format
CS	Country Specific
CTA	Chief Technical Advisor
DF	Default Factor
DOC	Degradable Organic Carbon
EARM	Energy Agency of the Republic of Macedonia
EC	European Commission
EEA	European Environment Agency
EFDB	Emission Factor Database
EMI	Emission Monitoring in Industry
EnC	Energy Community
EO	Earth Observation
ERC	Energy Regulatory Commission of the Republic of Macedonia
EU	European Union
Eurostat	Statistical Office of the European Union
FAOStat	Food and Agriculture Organization of the United Nations Statistical Databases
FBUR	First Biennial Update Report
F-gas	Fluorinated gas
FNC	First National Communication
FOD	First Order Decay
FOLU	Forest and Other Land Use
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GSP	Global Support Programme
GWP	Global Warming Potential
HPP	Hydro Power Plant
ICA	International Consultation and Analysis
ICT	Information and Communication Technologies
IDT	Inventory Development Team
IE	Included elsewhere
IEA	International Energy Agency
INDC	Intended Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use

LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
LU	Land Use
LUCF	Land-Use Change and Forestry
LULUCF	Land Use, Land-Use Change and Forestry
MAFWE	Ministry of Agriculture, Forestry and Water Economy
MAKSTAT	Database of the State Statistical Office of the Republic of Macedonia
MARKAL	MARKet Allocation (numeric model for the economic analysis of energy systems)
MASA	Macedonian Academy of Sciences and Arts
MCC	Macedonian Chambers of Commerce
MKD	Macedonian Denar
MMR	Monitoring Mechanism Regulation [European Union]
MNAV	Macedonian Navigation Agency
MOE	Ministry of Economy
MOEPP	Ministry of Environment and Physical Planning
MRV	Measurement, Reporting and Verification
NA	Not Applicable
NCCC	National Communication on Climate Change
NC	National Communication
NCSP	National Communications Support Programme
NCV	Net calorific value
NE	Not estimated
NGO	Non-Governmental Organization
NIR	National Inventory Report
NO	Not Occurring
ODS	Ozone-Depleting Substances
OECD	Organization for Economic Cooperation and Development
PV	Photovoltaic
QA	Quality Assurance
QAT	Quality Assurance Team
QC	Quality Control
RCESD	Research Center for Energy and Sustainable Development
REC	Regional Environmental Centre
RES	Renewable Energy Sources
RS	Remote Sensing
SAR	Second Assessment Report
SBUR	Second Biennial Update Report
SDGs	Sustainable Development Goals
SNC	Second National Communication
SSO	State Statistical Office
STUGRES	Study on Heating in the City of Skopje: Analysis of Policies and Measures
SWDS	Solid Waste Disposal Sites
T1	Tier 1
T2	Tier 2

TNC	Third National Communication
TPP	Thermal Power Plant
TWG	Technical Working Group
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USA	United States of America
USAID	United States Agency for International Development
USD	United States Dollar
WAM	With Additional Measures
WB	World Bank
WEM	With Existing Measures
WEO	World Energy Outlook
WOM	Without Measures

GLOBAL WARMING POTENTIAL VALUES USED IN THE PREPARATION OF THE GHG INVENTORY *(100-YEAR TIME HORIZON)*

Gas	CO_2 equivalent
CO_2	1
CH_4	21
N_2O	310
HFC-125	2,800
HFC-143a	3,800
HFC-134a	1,300
HFC-32	650
HFC-227ea	2,900
CF_4	6,500
C_2F_6	9,200

Source: IPCC Second Assessment Report (SAR), 1996

CHEMICAL SYMBOLS

$CaCO_3$	Limestone
$CaMgCO_3$	Dolomite
CH_4	Methane
$CO(NH_2)_2$	Urea
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2-eq	Carbon Dioxide equivalents
$HCO3^-$	Bicarbonate
HFCs	Hydro Fluorocarbons
N	Nitrogen
N_2O	Nitrous Oxide
Na_2CO_3	Sodium carbonate
NH_3	Ammonia
NH_4^{+2}	Ammonium
NMVOC	Non-Methane Volatile Organic Compound,
NO_3^-	Nitrate
NOx	Nitrogen Oxides
OH^-	Hydroxyl ion
PFCs	Per Fluorocarbons
SF_6	Sulphur hexafluoride
SO_2	Sulphur Dioxide
SO_x	Sulphur Oxides

UNITS AND METRIC SYMBOLS

UNIT	Name	Unit for
g	*gram*	mass
W	*watt*	power
J	*joule*	energy
m	*meter*	length
Wh	*watt hour*	energy
toe	*ton of oil equivalent*	energy

Mass Unit Conversion		
1g		
1kg	= 1 000 g	
1t	= 1 000 kg	= 1 Mg
1kt	= 1 000 t	= 1 Gg
1Mt	= 1 000 000 t	= 1 Tg

Metric Symbol	Prefix	Factor
P	*peta*	10^{15}
T	*tera*	10^{12}
G	*giga*	10^{9}
M	*mega*	10^{6}
k	*kilo*	10^{3}
h	*hecto*	10^{2}
da	*deca*	10^{1}
d	*deci*	10^{-1}
c	*centi*	10^{-2}
m	*milli*	10^{-3}
µ	*micro*	10^{-6}
n	*nano*	10^{-9}
p	*pico*	10^{-12}

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Ministry of Transport and Communications

Ministry of Finance

Secretariat for European Affairs

Economic Chamber of Macedonia, Administrative Office

National Hydrometeorological Service

Crisis Management Centre

Macedonian Red Cross

ZELS - Association of Units of Local Self-Government of the Republic of Macedonia

Tehnolab

Climate Reaction Network

State Statistical Office

Ministry of Health

Institute of public health

Institute of Occupational Medicine

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Dear readers,

Although we are a relatively small country and have a relatively small share of GHG emissions at the global level, we are dedicated and are constantly striving not only to meet obligations but also to ensure the best possible national contribution to keeping the increase in the global average temperature to well below 2 °C by the end of the century.

By developing the Second Biennial Report on Climate Change we have stepped forward towards setting a transparency framework for reporting emissions, but also for assessing the potential for reducing climate change in several sectors such as energy, transport, agriculture, and waste. It is noteworthy that the data presented in this Report were obtained by scientific research and analyses made by national experts, and the findings can be applied to create good policies based on facts and not on assumptions. Namely, within the preparation of the Second Biennial Report on Climate Change, three scenarios were modelled for the period 2012-2035 that investigate the national climate change mitigation potential by analyzing specific measures and policies.

All this opens new perspectives and possibilities. It gives us an opportunity to see climate change not as a burden, but as a possibility for developing good sectoral actions, for creating new "green jobs", but even more for being recognized as climate champions by using low carbon development.

Our aim is to use this document as a basis for developing and undertaking joint #ClimateAction since this is also an obligation for our country arising as a party to the United Nations Framework Convention on Climate Change, Paris Agreement, Energy Community and also as an EU candidate country. We do not want it to remain only written on paper.

In order to be the change that we wish to see it is necessary to incorporate #ClimateAction not only in national sectoral policies and in municipal policies, but it should also become part of our everyday activities at work, at home, and as a fundamental part of our everyday behavior.

Sincerely,

Minister of Environment and Physical Planning

Sadulla Duraki

EXECUTIVE SUMMARY

- Adheres to the guidelines for the preparation of **BURs** from non-Annex I parties to the UNFCCC as adopted at COP 17 (Decision 2/CP.17 and Annex III)
- Incorporates feedback received during a 2015 Technical Analysis of the **First Biennial Update Report (FBUR)**

- Includes updated data and analysis for:
  - Greenhouse gas (GHG) emissions and sinks;
  - Climate change mitigation activities;
  - Constraints and gaps, related financial, technical, and capacity needs, and support received;
  - Domestic measurement, reporting, and verification (MRV) systems; and
  - Other relevant information.

All documents are available to the public at the national climate change website **www.klimatskipromeni.mk.**

Gender balance of experts:

51% **49%**

CHAPTER 1 EXECUTIVE SUMMARY

This Second Biennial Update Report (SBUR) on climate change provides updates of national Greenhouse Gas (GHG) inventories, including a national inventory report, and information on mitigation actions, needs and support received, and other relevant information for the Republic of Macedonia. The content of this report adheres to the guidelines for the preparation of BURs from non-Annex I parties to the UNFCCC as adopted at COP 17 (Decision 2/CP.17 and Annex III). It also incorporates feedback received during a 2015 Technical Analysis of the First Biennial Update Report (FBUR), which was conducted by the UNFCCC in 2015.[1] This SBUR includes updated data and analysis for greenhouse gas (GHG) emissions and sinks; climate change mitigation activities; constraints and gaps, related financial, technical, and capacity needs, and support received; domestic measurement, reporting, and verification (MRV) systems; and other relevant information. Information in these areas is summarized from the National Inventory Report and several other extensive background reports, which are available to the public at the national climate change website, www.klimatskipromeni.mk.

1 UNFCCC (2015).

1.1. NATIONAL CIRCUMSTANCES

Republic of Macedonia is one of the smallest countries in the Southeastern Europe region, with around 2.066 million inhabitants. Its gross domestic product (GDP) totals EUR 7.7 billion and GDP per capita is EUR 3,737. The energy sector generates by far the largest share of GHG emissions, with fossil fuels, primarily coal, accounting for over 80% of total energy demand. In the past several years, the share of fossil fuels has decreased, primarily due to an increase in electricity imports, which have in turn increased import dependence (approximately 50% of electricity consumption). Gross domestic energy consumption in 2014 (2,628 ktoe) is almost 13% lower than it was during the peak consumption year of 2008. The share of renewable energy in total energy demand has increased from 10% in 2012 to 15% in 2015. Total energy required per unit of GDP in the country is around four times higher than the average of European developed countries. Because of the significant use of fossil fuels in the country and the dominant use of domestic lignite for electricity production, there is significant potential for GHG emissions reductions. The level of greenhouse gas emissions per capita in the country is approximately 30% lower than the EU-28 average.

Agriculture is an important sector due to its contribution to GDP (nearly 10% in 2016) and the percentage of the labor force that it employs (more than 17% in 2015). It is also relatively vulnerable to climate change impacts, particularly flooding. Out of a total area of about 2.5 million hectares in the country, agricultural land covers approximately 1.13 million hectares. Forests and forest lands are the main sinks of CO_2 emissions; they cover approximately 1.3 million hectares and are characterized by great species diversity, but also by low quality and small annual growth. Total wood reserves are estimated at approximately 70 million m^3, and total annual growth is around 1.7 million m^3. Total forest area has increased by more than 100,000 hectares from 2010 to 2015, total pasture area has increased by more than 150,000 hectares since 2009.

The waste sector is the second largest source of GHG emissions in the country. Solid waste is mostly disposed of in landfills. In 2014, approximately 370 kg per capita of communal waste was generated, and 75% of that waste was taken to landfills. The Drisla Landfill in Skopje is the only permitted landfill in the country, and there is a need to improve waste management practices at approximately 54 authorized municipal landfills and to close approximately 320 illegal dumpsites. Only 1.945 t of biological waste was composted in 2014. Mining and processing industries that have closed down operations have abandoned their on-site hazardous waste dumps, and little or no information is available on the composition or condition of these sites.

The Republic of Macedonia is a party of the United Nation Framework Convention on Climate Change (UNFCCC) (Official Gazette of RM – 61/97), has ratified the Kyoto Protocol (Official Gazette of Republic of Macedonia - 49/04) and has associated itself with the Copenhagen Accord (2009). The country has also signed (in 2015) and ratified (in 2017) the Paris Agreement. Under the Paris Agreement, the country became the twenty-third in the world to submit its Intended Nationally Determined Contributions for Climate Change (INDC) as per the Decision of the Government No. 42-17/91 of 28 July 2015. The Ministry of Environment and Physical Planning (MOEPP) has been designated as the National Focal Point to the UNFCCC and as a Designated National Authority (DNA) for the implementation of the Kyoto Protocol. Other ministries that have responsibilities related to climate change aspects are the Ministry of Agriculture, Forestry and Water Economy, the Ministry of Economy, the Ministry of Transport and Communication, the Ministry of Health and the Ministry of Finance. The Office of the Deputy Prime Minister for Economic Affairs is responsible for the achievement of the Sustainable Development Goals (SDGs), and it is also a National Designated Entity for the Green Climate Fund. The Office of the Prime Minister for Economic Affairs also supports the implementation of climate and energy-related projects in the country.

Although the Republic of Macedonia is a non-Annex I country to the UNFCCC, it is also a candidate country for European Union (EU) membership, and thus must adhere to EU Climate and Energy Policy, which actually assumes the commitments of Annex I countries. Furthermore, Republic of Macedonia is a Contracting Party of the Energy Community, which is movingly quickly to implement EU

regulations on MRV for GHG inventories and steps taken to address climate change. Finally, Republic of Macedonia has adopted targets for the Sustainable Development Goals (SDGs), and as such addresses SDG 13, "Take urgent action to combat climate change and its impacts." The legal framework on climate change currently falls under the Law on Environment, including the details for the development of national GHG inventories. In the past decade, a number of other laws, regulations and strategies that incorporate mitigation considerations have been adopted. The most relevant include the Strategy for Energy Development in the Republic of Macedonia for the Period 2008-2020 with a Vision to 2030 (2010), the Renewable Energy Strategy of Macedonia until 2020 (2010), the National Strategy for Energy Efficiency in Republic of Macedonia until 2020 (2010), and the Third Energy Efficiency Action Plan (EEAP) of the Republic of Macedonia (2016-2018). A Law and Strategy on Climate Change project has been programmed under the EU Instrument for Pre-Accession Assistance (IPA II) funding mechanism to be informed by the European Union's 2030 Climate and Energy Framework.

The process for producing National Communications and Biennial Reports for the UNFCCC is led by MOEPP, which is the institution responsible for climate change policies and national point of contact for UNFCCC. The National Climate Change Committee (NCCC) and the Technical Group at the National Sustainable Development Council also participate in this this process as well as other key stakeholders in government and in civil society. International institutions and donors, specifically the Global Environmental Facility (GEF) and the United Nations Development Program (UNDP), have provided financial and technical support for this reporting process.

1.2 NATIONAL GHG INVENTORY

As a Non-Annex I Party to the UNFCCC, Republic of Macedonia has been compiling an inventory of anthropogenic emissions by sources and removals by sinks of greenhouse gases (GHGs) since the year 2000. The following GHGs are included in the inventory: CO_2, CH_4, N_2O, PFCs, and HFCs, as well as precursors[2] and indirect emissions of CO, NO_x, NMVOC and SO_2. In the 2015 FBUR, the inventory was updated to consider the period 2010 – 2012, and the entire previous data series from 1990 to 2009 was revised according to IPCC Inventory Software requirements. In this report, the data for 2012 have been revised and updated as necessary, and the inventory has been expanded to cover 2013 and 2014 using IPCC Inventory Software (Version 2.17 – Rev 1). Emission factors, which are provided in Annex 4, were calculated by using either Tier 1 or Tier 2. Most activity data used were taken from official national documents and international databases. Information on QA / QC procedures is provided in Section 3.9 of this SBUR, and in the National Inventory Report.[3] Section 3.10.3 provides responses to findings from the 2015 UNFCCC Technical Analysis of the FBUR.

1.2.1 EMISSIONS AND REMOVALS BY SECTOR AND BY GAS

The key category analysis utilized Approach 1 from the IPCC Guidelines. The **level assessment** found that the five most significant categories with the highest absolute values of Gg CO_2-eq (including both emissions sources and removals) identified in the country for 2014 were Forest Land Remaining Forest Land (35.1%); Energy Industries – Solid Fuels (22.8%); Solid Waste Disposal (11.4%); Road Transportation (8.2%); and Manufacturing Industries and Construction – Liquid Fuels (3.4%). The **trend assessment** for 1990 and 2014 found a different order of top 5 key categories: Solid Waste disposal (23.5%); Road Transportation (19.7%); Energy Industries (7.5%); Other Sectors – Liquid Fuels (5.7%); and Energy Industries - Liquid Fuels (3.6%). Table 1 and Figure 1 present sectoral GHG emissions and removals over time. The greatest share of emissions comes from the Energy sector, accounting for 65.2% of emissions in 2014, followed by the Waste sector (19%), Agriculture excluding FOLU (8.2%), and the IPPU sector with 7.6%. The dominant share of Energy sector emissions is evident throughout the entire period of study.

2 Carbon monoxide (CO), Nitrogen oxides (NOx) and NMVOC in the presence of sunlight contribute to the formation of the greenhouse gas ozone (O3) in the troposphere and are therefore often called 'ozone precursors'. Sulphur Dioxide emissions lead to formation of sulphate particles, which also play a role in climate change.

3 Kanevce, G., et al (2017). National Inventory Report: Republic of Macedonia.

Table 1: *GHG emissions and removals by sector (in Gg CO_2-eq)*

Sector	1990	2003	2008	2012	2013	2014
Energy	9,415.5	8,887.7	9,026.7	9,450.6	8,419.4	7,957.5
Industrial Processes and Product Use	941.8	845.2	1,132.1	776.4	923.1	921.6
Agriculture (without FOLU)	1,327.7	1,071.6	1,072.3	1,019.4	989.2	1,001.8
FOLU	-220.0	-3,757.9	1,351.0	1,914.8	-1,837.0	-3,181.1
Waste	1,391.5	1,550.7	1,765.5	2,146.8	2,226.1	2,323.4
Total (incl. FOLU) – Net emissions	**12,856.5**	**8,597.3**	**14,347.7**	**15,308.0**	**10,720.7**	**9,023.2**
Total (excl. FOLU)	**13,076.6**	**12,355.2**	**12,996.7**	**13,393.3**	**12,557.7**	**12,204.3**

When analyzing GHG emissions by gas (excluding the Forestry and Other Land Use, or FOLU, sector), CO_2 emissions clearly predominate with 8,453.8 Gg CO_2-eq in 2014. Their share of total emissions (Figure 2: Total GHG emissions by gas, excluding FOLU (in Gg CO2-eq)) accounts for 69.3% of all emissions in 2014, followed by the CH_4 emissions (25.6%), N_2O emissions (3.6%) and all F-gases (1.5%). In view of the small share of F-gases in total emissions, only HFCs and PFCs are reported in the inventory. Emissions of SF_6 are not estimated for the country due to the unavailability of activity data.

Sectoral trends in GHG emissions removals and sinks included the following:

- In the **Energy sector**, the decrease in emissions in 2013 and 2014 is due to reduced electricity production in the Energy Industries category, which has been replaced primarily by electricity imports. It is noticeable that in the two most recent reporting years, the share of the Energy Industries category in Energy sector emissions has decreased in comparison with the years 2003, 2008 and 2012, when the share of this category was 69.6%, 67.5% and 64.2%, respectively.
- In the **Industrial Processes and Product Use (IPPU) sector**, the overall level of emissions has been consistent throughout the entire 1990-2014 period. Emissions totaled 923.1 CO_2-eq (9.1% of total emissions) in 2013 and 921.6 CO_2-eq (7.6%) in 2014 (excluding FOLU). However, it should be noted that emissions from manufacturing industries have generally decreased, while emissions from products used as ODS substitutes have generally increased over the years observed. The overall

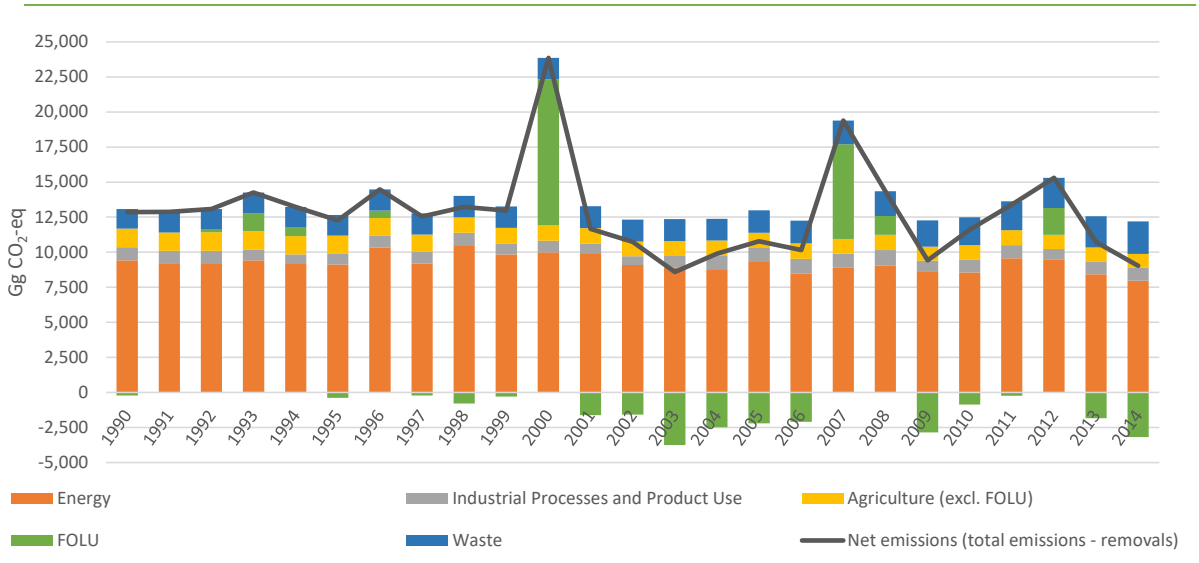


Figure 1: *GHG emissions and removals by sector (in Gg CO_2-eq)*

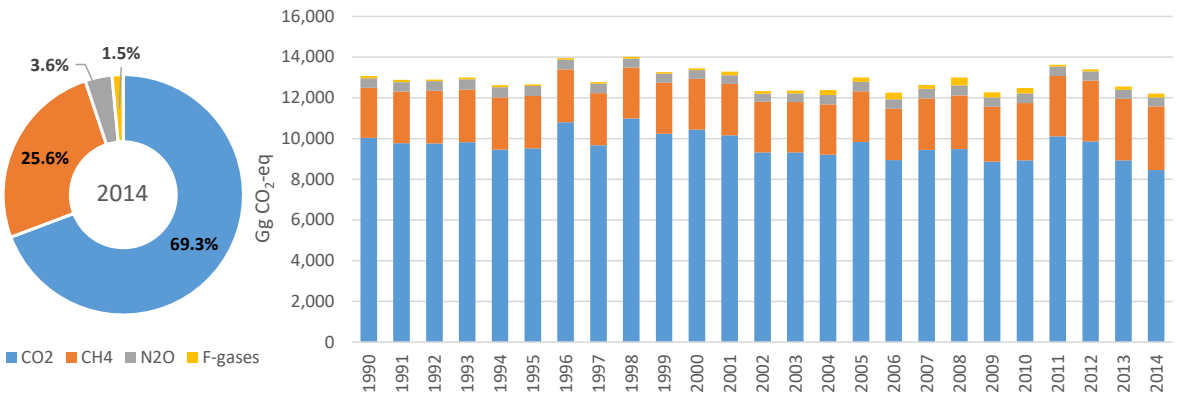


Figure 2: *Total GHG emissions by gas, excluding FOLU (in Gg CO2-eq)*

emissions from the entire IPPU sector in 2013 and 2014 are relatively stable, with a negligible decrease of -0.16% in 2014.

- In the **Agriculture, Forestry, and Other Land Use (AFOLU)** sector, the share of GHG emissions (as CO_2-eq) in categories other than Forest land is almost identical in 2013 and 2014. Livestock production activities generated 52.1% of emissions, followed by Aggregate sources and non-CO_2 emissions sources (over 25.4%), while grassland and cropland contributed with 10.4% and 9.6%, respectively. Emissions from Livestock have decreased slowly over time, and emissions related to Cropland and Grassland activities have decreased rapidly, primarily due to lower production volumes. The Forestry sector is the major contributor of GHG sinks in the country, with the exception of several years (2000, 2007, 2008 and 2012) when the severity of forest fires and resulting burned areas were significantly above the annual average.
- In the **Waste sector**, emissions account for 17.7% and 19% of the total emissions in the country for 2013 and 2014, respectively. Solid Waste Disposal emissions are most significant, accounting for 94.4% of total waste emissions in 2014. CH_4 emissions constitute 97.6% of the total emissions (in CO2-eq) from the Waste sector in 2014. Moreover, the Solid Waste Disposal category is the single biggest contributor to these emissions (96.8%). Emissions from Incineration and Open Burning of Waste represent 1.4% of total Waste emissions. The remaining 4.2% of Waste emissions come from Wastewater Treatment and Discharge (domestic and industrial).

Precursors and indirect emissions have been estimated in line with the EMEP/CORINAIR Emission Inventory Guidebook (referenced in the IPCC 2006 Guidelines) in a consistent, complete and comparable manner for the entire inventory period of 1990 – 2014. Emissions of SO_2 form the dominant share with 48.2% in 2014, followed by CO emissions (31.1%), NO_x emissions (11.3%), and NMVOC emissions (9.4%).

1.2.2 UNCERTAINTY AND QA/QC

For the first time, the inventory uses both methods for uncertainty analysis: Approach 1, the Error Propagation method; and Approach 2, which utilizes the Monte Carlo method. Using the Error Propagation method, the results indicated that the AFOLU sector had the highest uncertainty, followed closely by the Waste sector. Using the Monte Carlo method, the highest level of uncertainty by far occurred in the Waste sector, which exceeded 27% in all three analyzed years. This sector was followed by the AFOLU sector, where the greatest uncertainty occurred in the Livestock subcategories (approximately 16%). On the other hand, sectors with the lowest levels of uncertainty remained the same: the Energy sector had the lowest uncertainty, followed by the IPPU sector.

The Macedonian approach to **QA/QC activities** in the national GHG inventory process is based on the in-depth analyses of current practices in its inventory compilation and the relevant international best practices; it is discussed in Section 3.9 of this SBUR. Sectoral experts have documented improvements in the current inventory and made recommendations for subsequent inventories, and these are summarized in Sections 3.10.1 and 3.10.2, respectively.

1.3. CLIMATE CHANGE MITIGATION AND ACTION PLAN

The climate change mitigation analysis conducted in the Second Biennial Update Report (SBUR) builds upon and continues the analyses in the Third National Communication (TNC), First Biennial Update Report (FBUR) and the Intended Nationally Determined Contributions (INDC).[4] All sectors recognized by the IPCC methodology (Energy, IPPU, AFOLU, and Waste) have been modelled in order to assess the mitigation potential of certain measures and policies. Modelling and analysis are based on three scenarios: 1) A reference scenario, the **Scenario without Measures** (**WOM**); 2) a mitigation scenario, the **Scenario with Existing Measures** (**WEM**); and 3) a more ambitious mitigation scenario, the **Scenario with Additional Measures** (**WAM**). Modelling covers the period from 2012 to 2035. In outreach materials, the WOM, WEM, and WAM scenarios are also referred to as the **Survival**, **Safe Way**, and **Climate Champion** scenarios, respectively, in order to make them more accessible to a broad audience. A total of 46 measures (35 in the Energy sector, 8 in the AFOLU sector, and 3 in the Waste sector) were selected from national strategic and planning documents and prioritized by assessing their specific cost (expressed in EUR/t CO_2-eq) and their mitigation potential (expressed in t CO_2-eq). The modeling outputs are depicted in Figure 3: Comparison of total GHG emissions from all sectors in WOM, WEM and WAM scenarios, 2030 (in Gg CO_2-eq).

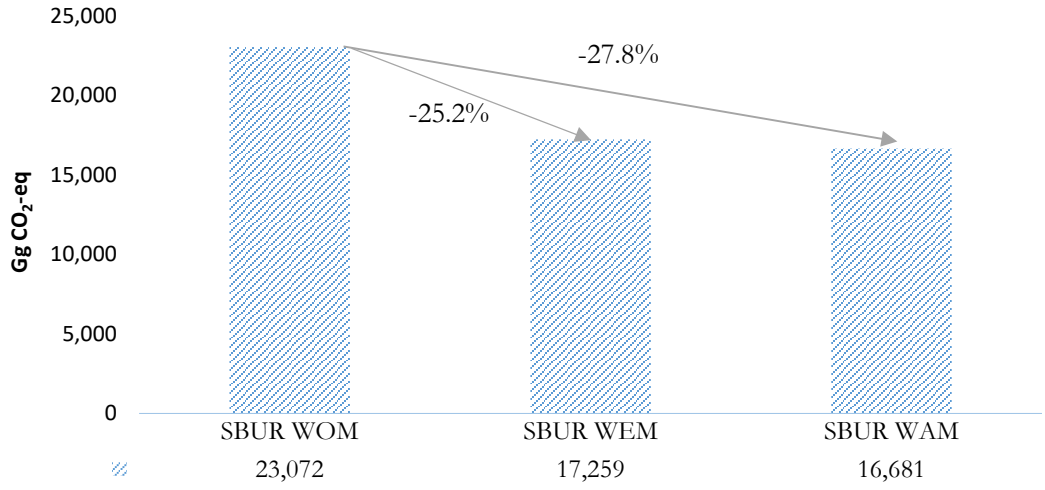


Figure 3: *Comparison of total GHG emissions from all sectors in WOM, WEM and WAM scenarios, 2030 (in Gg CO_2-eq)*

Key findings include the following:

- In the WOM scenario, there is a gradual increase in emissions from 2012 until 2035. Emissions in 2035 amount to 25,585 Gg CO_2-eq, which is a 49% increase compared to the emissions in 2012. While the Energy sector has the largest share of total emissions through the time period (68% in 2035), the Waste sector shows the biggest growth in emissions with an increase of approximately 130%.

4 All documents are available at the following link: http://klimatskipromeni.mk/Default.aspx?LCID=213

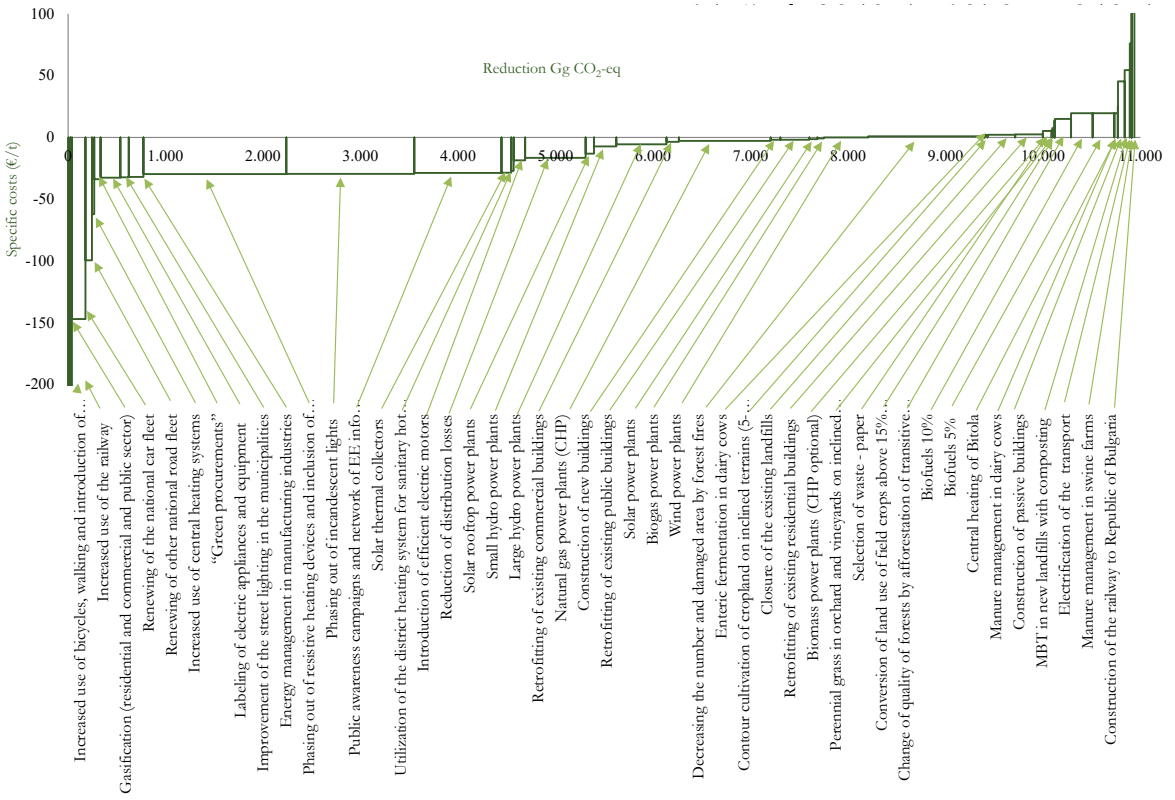


Figure 4: *Marginal abatement cost curve for 2030*

- In the WEM and WAM Scenarios, total GHG emissions in 2035 drop by 25.2% and 27.8% respectively, when compared to the WOM scenario. The GHG emissions occurring in WEM in 2035 are only 2.6% higher than in 2012, while the 2035 emissions in WAM decrease by 14% when compared to 2012.
- The peak year for emissions in both the WEM and the WAM scenarios is 2032, when the emissions reach 18,130 CO_2-eq in the WEM scenario and 17,510 CO2-eq in the WAM scenario.
- The Energy sector still predominates in both mitigation scenarios, with a share of total emissions in 2035 of 60.9% (WEM) and 53.8% (WAM). However, compared to the reference scenario, emissions in the WEM scenario are 25% lower, and the emissions in the WAM scenario are 29% lower in 2030. For this reason, the majority of the suggested mitigation measures and policies are related to the Energy sector.

Cross-referencing the specific costs of policies and measures with potential reductions identified multiple win-win options: Renewing of the national car fleet, Labeling electric appliances and equipment, Improvement of street lighting in municipalities, increased use of heat pumps, Energy management in manufacturing industries, Phasing out of incandescent lights, Public awareness campaigns/ EE info centers, Solar thermal collectors, Efficient electric motors, Reduction of distribution losses, and Solar rooftop power plants. Several policies and measures with reasonably small costs (Wind power plants, Retro-fitting existing residential buildings, Introduction of biofuels, Enteric fermentation in dairy cows, Change of quality of forests by afforestation, and Conversion of land use of field crops above a 15% inclination) should also be considered for possible realization. The marginal abatement costs for measures are provided in Figure 4: Marginal abatement cost curve for 2030, and an **Action Plan** consisting of measures from the WEM scenario is included as Annex 5 of this report.

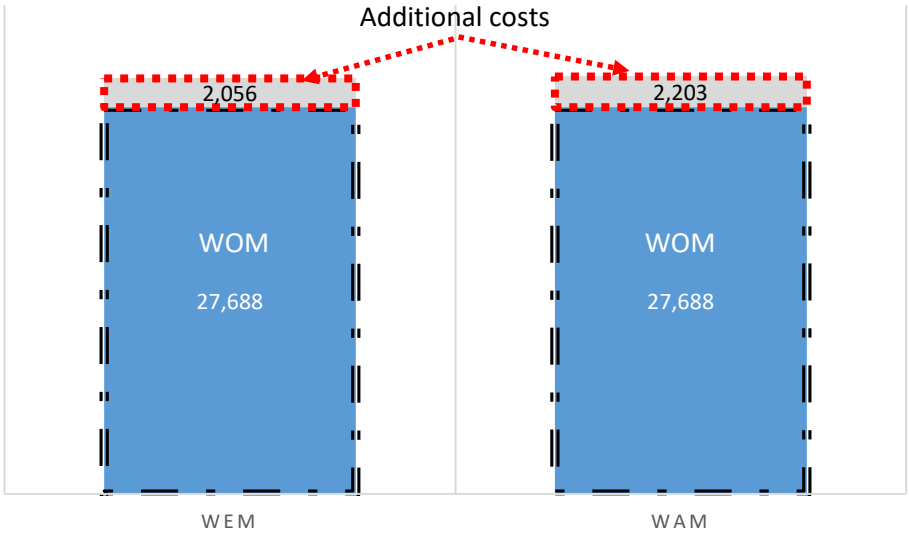


Figure 5: *Total investment costs in the WOM, WEM and WAM scenarios (in million EUR)*

Figure 5: Total investment costs in the WOM, WEM and WAM scenarios (in million EUR) shows the additional investment costs of the two mitigation scenarios for the **Energy sector**. While investment costs in the WOM reference scenario for the energy sector in the period 2017-2035 totaled EUR 27,688 million, the WEM scenario is EUR 2,056 million costlier at EUR 29,744 million. Total investment costs in the WAM scenario are EUR 2,203 million higher than in the reference scenario, totaling EUR 29,891 million. In terms of costs for implementing the mitigation measures in the WEM scenario, investments of EUR 17,056.8 million are needed in the Energy sector for the period 2017-2035. Similarly, investments in the Energy sector in the WAM scenario total EUR 22,638.0 million. In the WEM scenario, average annual investments would total approximately 6.75% of average annual GDP (EUR 13,000 million), while in the WAM scenario they would total 8.96%. If investments from the private sector are disregarded, investments for the period 2017-2035 total EUR 2,604.2 million in the WEM scenario and EUR 5,220.4 million in the WAM scenario (i.e. the amount that is to be provided by the national budget, municipalities, the City of Skopje, and AD-ELEM, a government-owned utility).

It is important to emphasize that investments under the WEM scenario contribute to reducing total system costs (EUR 37,803 million discounted in 2012) compared to the reference scenario costs (EUR 39,415 million), which is a reduction of 4.1%. Furthermore, the investments under the WAM scenario also contribute to the reduction of total system costs (EUR 37,045 mil. discounted in 2012), compared to the WOM reference scenario (EUR 39,415 million), which is a reduction of 6%.

Policies and measures were analyzed in light of their **potential for green job creation**. It is estimated that over 6,200 green jobs[5] will be created by 2035 as the result of energy efficiency measures in buildings and the low-carbon energy market (renewable energy and gas). The green jobs analysis is discussed in greater detail in Section 4.4.2. Finally, the Mitigation team for the SBUR launched **two studies on reducing energy consumption and GHG emissions in different energy end use sectors.** The first study[6] examined what would happen if **more stringent mitigation measures in the transport sector** were implemented in addition to those in the two mitigation scenarios. The second study analyzed **ways to reduce GHG emissions from household heating and at the same time reduce local pollution in the city of Skopje**.[7] The studies should be completed by the end of 2017, and their findings will be presented in the next BUR.

5 Additionally, around 14,000 green jobs outside of Republic of Macedonia.

6 Study for the Transport Sector – Analyses of Policies and Measures, or STUTRA.

7 Study on the Heating in the City of Skopje Analysis of Policies and Measures, or STUGRES.

1.4 CONSTRAINTS AND GAPS, AND RELATED FINANCIAL, TECHNICAL AND CAPACITY NEEDS, INCLUDING A DESCRIPTION OF SUPPORT NEEDED AND RECEIVED

1.4.1 INFORMATION ON CONSTRAINTS AND GAPS

1.4.1.1 Technical Needs and Capacity-Building Needs

At the **national level**, capacity needs are primarily due to a **lack of capacity within the key institutions responsible for climate change policy**. In Republic of Macedonia, the present institutional capacity to implement climate change policies and to monitor and evaluate them is weak. As a result, climate change-related work is often dependent on project-specific activities and donor support. At the organizational level, constraints include the **limited number of personnel** in MOEPP and the Ministry of Economy (Department of Energy within the Ministry of Economy), coupled with limited staff at the Energy Agency and relevant sectoral Ministries. Furthermore, the **legal framework on climate change** is still located within the Law on Environment, which does not provide a comprehensive foundation for long-term policy and strategic planning. Section 5.2.1 identifies specific capacity needs, including cost estimates for MOEPP, the Ministry of Economy, and the Energy Agency. At the **local level**, municipalities have several common needs: support for integrated implementation of environmental legislation, sufficient numbers of qualified staff, and training for employees. Section 5.2.2 provides cost estimates for specific needs in climate change and environmental management for municipalities in the country. In the area of **research and systematic observation**, there is a need for a systematic approach to fostering climate change research, continuous funding for research activities and research centers, and cross-sectoral peer-reviewed research by Macedonian authors.

1.4.1.2 Financial Needs

Financial needs were estimated two ways. First, the mitigation team analyzed **planned measures for mitigation** for the period from 2017-2035 (Chapter 4). Second, a comprehensive analysis considered **cost estimates for planned projects under key national strategies** in renewable energy, energy sector development, energy efficiency, and waste. At the sub-national level, financial needs for *Resilient Skopje*, the Climate Change Strategy for the capital, were also assessed. At the local level, municipalities around the country have financial needs for capacity building for staffing, resources and facilities, and training and networking. It is important to emphasize that approximately 80% of all emission reductions assessed under the planned measures for the country can be achieved through policies and measures with negative specific costs, known as **win-win measures**. The implementation of these measures not only reduces emissions, but creates financial savings and can lead to job creation (Section 4.4.2) and other co-benefits.

1.4.1.3 Constraints and Gaps

In spite of support received in the form of capacity building, awareness-raising, and funding for training, grants, and education, there are still significant constraints and gaps constraints regarding climate change mainstreaming. For example, the country has not been able to leverage the full potential of pre-accession funding from the EU due to limited institutional capacity in public administration and a lack of coordination and transparency in project development.[8] In the area of MRV, an analysis identified a lack of appropriate legislation to adopt necessary regulations, a gap between existing monitoring systems and shortcomings in their ability to collect the necessary data, and a lack of training for MRV personnel and others who will oversee data collection.[9] In the area of mainstreaming Sustainable Development Goals (SDGs) into national planning a 2016 study identified

8 Institute for European Politics (2013).

9 Dimovski (2017): 34-5.

gaps in integrating climate change considerations into sectoral policies, the lack of a comprehensive National Adaptation Plan and lack of an MRV scheme for adaptation measures, the lack of a pertinent education curriculum on climate change, and a gap in integrating climate change priorities into national R&D and innovation policy and programming. Financial gaps include a lack of access to capital for investments in energy efficiency, energy pricing that does not reflect its environmental and economic cost, and a lack of energy labeling.

1.4.2 INFORMATION ON FINANCIAL RESOURCES, TECHNOLOGY TRANSFER, CAPACITY BUILDING, AND TECHNICAL SUPPORT RECEIVED

Republic of Macedonia has received significant financial, capacity building, technical and technological support from international donor organizations and developed countries. This report documents support received in the period 2014 – 2017. It is also important to note that the country has funded a number of projects with direct or indirect impacts on climate change mitigation through its own national and local budgets. All projects that have been identified and captured in the summary reporting tables on support that are listed in Section 5.4.1 have been awarded as climate projects with direct impact on the climate change mitigation of the country and are part of the activities listed in the BUR. They provide summary information about the support received for climate change activities during the 2014-2017 period from multilateral institutions disaggregated by donor and by type of support (financial, technology transfer, capacity-building or technical). Similar information for the same period is provided for multilateral development banks and regional development banks. The complete list of climate-related projects funded in the country with and direct and/or indirect impacts on climate change by donor and level of support is provided in tabular format in Annex 8 of this report, as is direct support for the preparation of BURs and associated activities.

It is important to clarify criteria and methodology for support received as well as which projects to include in summary tables that must be reported in BURs, as it is uncertain whether this section relates to direct or indirect contributions; including the latter could present an ambiguous picture of the climate change investments in the country.

Republic of Macedonia has provided financial support for climate change activities through national budget allocations by the Macedonian Government, the City of Skopje budget, the budgets of municipalities within the City of Skopje, and several municipalities outside of the capital. The Government of the Republic of Macedonia is currently spending a minimum of approximately 1.97% of its budget on climate-related activities, and the City of Skopje provides 1.42% of its total budget for mitigation actions. In addition, the Fund for Innovation and Technology Development has provided nearly EUR 450,000 for five climate-related projects.

As there is no mechanism currently in place for the collection and assessment of climate change related projects, appropriate methodology should be developed/identified. Additionally, two options are proposed:

a) The simplest solution would be to issue a simple, annual questionnaire on constraints and gaps and related financial, technical and capacity needs for climate change mainstreaming. The questionnaires should be sent to all relevant institutions, including municipalities, governmental bodies, academic organizations and NGOs.

b) A more complex solution would be to develop a single IT tool to be housed at MOEPP that would integrate all climate monitoring and reporting in Republic of Macedonia. This option would require substantially more funding and effort, but it would be a long-term, sustainable solution that could for the basis for a comprehensive climate MRV framework.

1.4.3 KEY CONSIDERATIONS ON TECHNOLOGY NEEDS

In Republic of Macedonia, technology needs, constraints, and gaps are largely influenced by general capacity needs, constraints and gaps in the energy and environmental sectors. Under the work for this SBUR, the mitigation team identified and analyzed a series of important climate technologies in several sectors as part of the WEM and WAM scenarios for the country (see Chapter 4), particularly in the Energy sector (for the Energy industries and Transport sub-sectors) and the Waste sector. In addition, the country intends to analyze its technology needs in greater depth when resources become available for that activity.

1.4.4 CAPACITY BUILDING

During the reporting period of 2014 – 2017, the country has received significant **support for capacity reinforcement** by means of various **trainings, seminars, conferences and workshops.** A list of these events is provided in Annex 10. In climate change research, three programs stand out in terms of developing long-term capacity to understand and address climate change: 1) Financial support for researchers in the country that enables them to publish in international journals; 2) Government scholarships to allow outstanding students to attend masters and doctoral programs at top universities around the world; and 3) the establishment of the National Fund for Innovation and Technology Development. Additional information about research and innovation activities is provided in Chapter 8 of this report. Republic of Macedonia also plans to use resources available under the Capacity Building Initiatives for Transparency (CBIT) as soon as it ratifies the Paris Agreement. Planned capacity strengthening measures include support to national institutions in becoming more transparent, access to tools, training and assistance to meet the provisions stipulated in Article 13 in the Paris agreement, and support for an assessment of MRV systems and introduction and maintenance of tracking tools. Section 5.6.1 provides recommendations for capacity development to support climate policy, climate related institutional and individual capacity development, climate financing, strengthening climate-related research, and mainstreaming climate issues in research.

1.5 LEVEL OF SUPPORT RECEIVED FOR THE BURS

To assist the Republic of Macedonia in the preparation of its **First Biennial Update Report** to the UNFCCC, which was submitted in 2015, the GEF provided support in the form of an Enabling Activity grant in the amount of USD 321,461. For the preparation of this **Second Biennial Update Report**, the GEF provided support in the form of a grant in the amount of USD 352,000 for an Enabling Activity project that also included USD 73,900 in co-financing. Co-financing was provided in the form of a grant from UNDP (USD 43,900), a grant from MOEPP (USD 15,000), and in-kind support from MOEPP (USD 15,000). In addition, the project team utilized in-kind technical and administrative support from the Global Support Programme for National Communications and Biennial Update Reports. Chapter 6 provides an overview of activities conducted within the framework of the preparation of the SBUR.

1.6 DOMESTIC MEASUREMENT, REPORTING AND VERIFICATION SYSTEMS

The Republic of Macedonia is in a unique situation when it comes to its international obligations regarding monitoring, reporting and verification due to its concurrent status as a non-Annex 1 party to the UNFCCC, a Candidate Country for EU membership, and a Contracting Party of the Energy Community (EnC). For the SBUR, the project team conducted in-depth analyses of national capacities (financial and human) to put its proposed MRV system into operation.

The Law on Environment[10], currently regulates the issue of monitoring of anthropogenic emissions by sources and sinks of greenhouse gases. However, the Law on Environment does not yet regulate the issue of MRV on policies and measures in detail. In order to be effective, the law would require an amendment. Other sectoral laws and strategies that provide partial guidance on MRV for policies and measures include the following: the Law on Energy, the Strategy for Energy Development, the Strategy for the Use of RES, the Strategy for Energy Efficiency, the Law on the Railway System and the National Program for Railway Infrastructure, and the Law on Vehicles. A variety of electronic systems under development or testing address monitoring and reporting needs, including software to partially automate data collection for the preparation of the energy balance; a monitoring and verification web platform (MVP) to monitor the implementation of the National Energy Efficiency Action Plan; ExCITE, software for monitoring energy consumption in municipalities; a special tool to monitor the energy market in Republic of Macedonia; Emission Monitoring in Industry (EMI) software; and the Vehicle Registry. Although national legislation clearly indicates that monitoring systems should be established, and several systems are under development or testing, the responsible institutions still require ***comprehensive, fully-operational*** systems.

Section 7.4 provides a series of recommended measures for an MRV system for the country that will comply with UN and EU requirements as well as reflect the Paris Agreement and the Macedonian NDC (which serves as its primary target under SDG13). They cover GHG inventories, mitigation policies and measures and emissions projections, and adaptation measures.

1.7 OTHER RELEVANT INFORMATION

The primary information portal for climate change information in the country is the **national climate change website** (www.klimatskipromeni.mk). In addition to all national policies and reports on climate change, the website has several interactive features, including customized, interactive features for policy-makers and the public.

In December 2016, UNDP and MOEPP conducted an **online climate change survey** to assess changes since a similar survey was conducted in 2014. The survey design and approach are described in Section 8. Responses from the 583 completed surveys reflect a more optimistic spirit within the Macedonian population when it comes to tackling climate change than in 2014. Respondents felt more knowledgeable about climate change: half of the participants considered themselves informed about a variety of climate change impacts and consequences, and 78% identified the most visible climate change impacts as extreme temperatures and irregularities in seasonal shifts and precipitation patterns. Climate change was ranked as the third most serious threat to society, behind poverty and the economic situation. The majority of respondents had heard about the Paris Agreement, and nearly all (94%) considered it important to fight against climate change, while most (368) thought that this should be done by reaching a global climate change agreement.

As a part of the development and implementation of the Third National Communication on Climate Change, Republic of Macedonia developed a **communication strategy on climate change**, along with an accompanying **action plan**. The first phase of the action plan (2013-2016) focused on general communications and three target groups (cities, workplaces, and households). When evaluated in 2017, progress on the implementation of this action plan ranged from "satisfactory" (for cities and households) to "significant" (workplaces), and "almost completely implemented" (for the general communications strategy).

As an important component of ongoing support from the Global Support Programme to the preparation of National Communications and Biennial Update Reports, the country plans to have a **gender/ climate action plan** by the end of 2017 that will outline concrete steps and responsibilities related

10 ("Official Gazette of the Republic of Macedonia" 53/2005, 81/2005, 24/2007, 159/2008, 83/2009, 48/10, 124/10, 51/11, 123/12, 93/13, 42/14 and 44/2015)

to integrating gender considerations into subsequent reporting to the UNFCCC, with implementation to start in 2018.

Republic of Macedonia has also focused on **technological innovation** to address climate change challenges. In 2014, UNDP, USAID, the Swedish Embassy, the Social Innovation Hub, and MOEPP came together for the creation of a nationwide **Climate Challenge #ItDependsOnYou**. The challenge called on the public to submit innovative proposals for tackling climate change and generated 129 applications to the challenge, resulting in 10 finalists and 2 winners. The winner, the "smart sole," enables shoes to generate small amounts of energy as their wearer walks. A second Climate Challenge was launched in 2015 that focused on urban resilience to climate change and led to nine high-quality finalists and extensive media coverage. The winning idea, ReBot, was a "smart recycling" idea, and the ReBot team will conduct a nationwide recycling-awareness campaign in addition to its launch in Skopje.

NATIONAL CIRCUMSTANCES

One of the smallest countries in the Southeastern Europe region

Fossil fuels, primarily coal, account for over 80% of the country's total energy demand.

80%

- Greenhouse gas emissions per capita in 2014

CO_2 **5.9** **t CO_2-eq/capita**

CHAPTER 2 NATIONAL CIRCUMSTANCES

2.1. COUNTRY PROFILE

The Republic of Macedonia is one of the smallest countries in the Southeastern Europe region, with around 2.066 million inhabitants. Its gross domestic product (GDP) totals EUR 7.7 billion and GDP per capita is EUR 3,737. As of 2014, the unemployment rate was 27.9%.

ENERGY

The energy sector generates by far the largest share of GHG emissions in the Republic of Macedonia. This is due to the fact that fossil fuels, primarily coal, account for over 80% of total energy demand in the country. Their share in the gross domestic consumption was 86% in 2003, but decreased to 81% and 79% in 2013 and 2014, respectively. In the last few years, there has been a certain decreasing trend in the share of fossil fuels, primarily due to an increase in electricity imports. These have in turn increased the import dependence of the country, which is assessed at approximately 50% of electricity consumption. At the same time, the energy produced from renewable energy sources has remained constant at 11% of the total energy production. The rest of gross domestic consumption is covered by electricity imports, which increased from 3% in 2003 to 10% in 2014.

On the other hand, gross domestic energy consumption in 2014 (2,628 ktoe) is 3% lower compared to consumption in 2003 and 2013 (2,710 ktoe). In the years reported, the highest consumption was recorded in 2008 (3,012 ktoe); after that year, energy consumption decreased, so that in 2014 the actual level of consumption was almost 13% lower than it was in 2008. In addition, the share of renewable energy in total energy demand has increased from 10% in 2012 to 15% in 2015.

The conversion efficiency of Macedonia's energy system (expressed as conversion from total energy required into final energy) is about 68%. This value is almost at the same level as the average for member countries of the Organization for Economic Co-operation and Development (OECD) in Europe, where it is about 70%. As a result of the low GDP per capita, Republic of Macedonia falls in the category of countries with high gross domestic consumption and high final energy consumption per unit of GDP despite low per capita energy consumption. The total energy required per unit of GDP in

Republic of Macedonia is around four times higher than the average of European developed countries. Because of the significant use of fossil fuels in the country and the dominant use of domestic lignite for electricity production, there is significant potential for GHG emissions reductions.

An important indicator from the perspective of climate change is the greenhouse gas emissions intensity of energy consumption, which monitors the extent to which low-carbon fuels, such as natural gas and renewable energy sources (RES), are replacing high-carbon fuels, such as lignite and other coal, in energy production and consumption. Compared to EU countries and neighboring countries, Macedonia's greenhouse gas emissions per unit of energy consumed are low. Expressed as an index relative to the year 2000 (2000 = 100%), the value of this indicator in recent years has ranged from 80% - 90%. For EU countries, this indicator ranges from 90% -100%.

Another significant indicator of climate change is that of greenhouse gas emissions per capita. According to this indicator, an average citizen of the Republic of Macedonia emits 30% fewer emissions than an average citizen in the EU-28, or approximately the same as an average citizen in Romania or Hungary.

INDUSTRIAL PROCESSES AND PRODUCT USE

The GHG emissions from Industrial Processes and Product Use (IPPU) in the Republic of Macedonia originate from production industries or from the use of ozone depleting substances for air conditioning. The metal industry is the main contributor to the emissions of this sector with a dominant level of emissions from the production of ferroalloys. Cement production is the second largest contributing category to GHG emissions. The rest of the emissions are the result of the use of substitutes for ozone depleting substances. Only a small share of emissions come from the chemical industry sector, as there is no developed chemical industry in the country.

AGRICULTURE, FORESTRY AND OTHER LAND USE

Forests and forest lands are the main sinks of CO_2 emissions in the Republic of Macedonia. Out of a total area of about 2.5 million hectares in the country, agricultural land covers approximately 1.13 million hectares. More than 0.5 million hectares of agricultural land is arable land, while the rest—more than 0.6 million hectares—are pastures. Forests and Forest land cover approximately 1.3 million hectares. Forests are characterized by great species diversity, but also by low quality and small annual growth. More than 70% of the forests are coppices, 90% are deciduous, and almost 90% are state owned. The most common tree species is beech, followed by various species of oak. Total wood reserves are estimated at approximately 70 million m3, and total annual growth is around 1.7 million m^3. A very large part of the land that is classified as forest is a Mediterranean type of forest, which is characterized by small trees and bushes.

According to statistical data, certain categories of land use, such as pastures and forests and forest land, have exhibited significant changes during the period starting in 2009. The total area classified as pastures has increased by more than 150,000 hectares, while the total forest area in the period 2010 – 2015 has increased by more than 100,000 hectares.

Agriculture is an important sector due to its contribution to GDP (nearly 10% in 2016) and the percentage of the labor force that it employs (more than 17% in 2015). It is also relatively vulnerable to climate change impacts, particularly flooding. In the agriculture sector, activities related to livestock production emit greenhouse gases mainly as a result of enteric fermentation and manure management. On the other hand, greenhouse gas emissions from crop production are the result of several major sources: inadequate or excessive fertilization with mineral fertilizers, which in the long term causes a serious reduction in organic matter in soils and significant CO_2 emissions; infrequent and inadequate application of manure; conversion of land use from extensive agriculture to intensive agriculture; inadequate management of arable land; and improper management when fertilizing.

WASTE

The waste sector is the second largest source of greenhouse gases in the Republic of Macedonia. The following categories contribute to greenhouse gas emissions: solid waste disposal, biological treatment of solid waste, incineration and open burning of waste, and wastewater treatment and discharge. According to the National Waste Management Plan 2009 – 2015, solid waste generated in the country is mostly disposed of in landfills. The Drisla Landfill, which serves the Skopje region of approximately 590,000 habitants, is the only permitted landfill in the country and is relatively well managed. The Drisla facility also includes a two-chamber medical waste incinerator, which started operating in the year 2000. In rural areas, at municipal landfills or dumpsites, the waste is simply dumped by the communal enterprises with no operational costs except some overhead and occasional waste consumption costs for extinguishing emerging landfill fires. There are around 54 authorized municipal landfills. The need to improve their waste management practices has been recognized. Furthermore, there are around 320 illegal disposal sites which need to be closed. In accordance with national legislation, the mayors of municipalities are obliged to provide yearly reports on the municipalities' management of non-hazardous waste. In 2014, approximately 370 kg per capita of communal waste was generated, and 75% of that waste was taken to landfills. The remainder was disposed of through incineration or open burning. Composting waste is still at a very initial stage, as only 1.945 t of biological waste was composted in 2014. Finally, Macedonian mining and processing industries that generated hazardous waste faced severe problems during the transition period, and many have closed down operations with no chance of reopening. Their on-site waste dumps have been abandoned, and little or no information is available on the history of these dumpsites.

2.2 CLIMATE CHANGE-RELATED INSTITUTIONAL FRAMEWORK

The Republic of Macedonia is a party of the United Nation Framework Convention on Climate Change (UNFCCC) (Official Gazette of RM – 61/97), ratified the Kyoto Protocol (Official Gazette of Republic of Macedonia - 49/04) and has associated itself with the Copenhagen Accord (2009).

The country has signed (in 2015) and ratified (in 2017) the Paris Agreement. The Ministry of Environment and Physical Planning has recently informed the public that the Government of the Republic of Macedonia upon proposal of the MOEPP, on its session held on July 25, 2017, adopted the Information about the ratification of the Paris Agreement on Climate Change. The Government of the Republic of Macedonia has tasked the Ministry of Environment and Physical Planning with submitting the text of the Agreement to the Ministry of Foreign Affairs in order to implement the procedure for ratification of the Paris Agreement in the Parliament of the Republic of Macedonia. This confirms the commitment of the Government to join the global efforts for addressing climate change by implementing activities for reducing the GHG emissions in order to limit the rise of global temperature to maximum 2° C by the end of the century and to ensure low carbon growth and development. Under the Paris Agreement, the country became the twenty-third in the world to submit its Intended Nationally Determined Contributions for Climate Change (INDC) as per the Decision of the Government No. 42-17/91 of 28 July 2015.

The Republic of Macedonia has also submitted three National Communications to the UNFCCC (in 2003, 2008 and 2014) and in January 2015, it became the eleventh country in the world to submit its First Biennial Update Report (FBUR). Although the Republic of Macedonia is a non-Annex I country to the UNFCCC, it is also a candidate country for European Union (EU) membership, and thus must adhere to EU Climate and Energy Policy, which actually assumes the commitments of Annex I countries. For this reason, the Republic of Macedonia has made voluntary efforts to incorporate UNFCCC reporting principles that apply to Annex I parties to the greatest extent possible.

The Ministry of Environment and Physical Planning (MOEPP) has been designated as the National Focal Point to the UNFCCC and as a Designated National Authority (DNA) for the implementation of the Kyoto Protocol. Other ministries that have responsibilities related to climate change aspects are the Ministry of Agriculture, Forestry and Water Economy, the Ministry of Economy, the Ministry of Transport and Communication, the Ministry of Health and the Ministry of Finance. The Office of the Deputy Prime Minister for Economic Affairs is responsible for the achievement of the Sustainable Development Goals, and it is also a National Designated Entity for the Green Climate Fund. Furthermore, as one of the strongest national institution in the country, the Office of the Deputy Prime Minister for Economic Affairs is strongly supporting the implementation of climate and energy-related projects in the country.

The National Council for Sustainable Development is responsible for mainstreaming of the sustainable development aspects in the national economic policies. The National Climate Change Committee (NCCC) provides high-level support and guidance for the overall climate change policies in the country. The NCCC is an intergovernmental body that consists of representatives from all relevant governmental institutions and academia.

Finally, Republic of Macedonia is a member of the Open Government Partnership (OGP) and a participant in its Open Climate Working Group, which involves 10 countries and many civil society organizations. As a working group member, the country is expected to develop clear, concrete and ambitious commitments to addressing climate change in consultation with civil society. Furthermore, Macedonia is one of the seven countries in the world that have already incorporated climate commitments in their respective OGP National Action Plan (NAP) 2016–2018. The country has committed to develop national climate policies in a transparent, participatory manner. It has also provided: open access to national databases that show the amounts and sources of greenhouse gas emissions, including: information and data on climate change effects, relevant climate scenarios and climate change mitigation. It also commits to establish appropriate legal and regulatory frameworks for the private sector to deliver data relevant to climate change.

2.3 CLIMATE CHANGE-RELATED POLICY AND LEGAL FRAMEWORKS

The legal framework on climate change is incorporated into the Law on Environment, including the details for the development of national GHG inventories. The Law also includes an action plan on measures and activities to abate the increase of the GHG emissions and to mitigate the adverse impacts of climate change. The Law on Environment stipulates that a National Plan for Climate Change (now embodied in Macedonia's INDCs) is to be adopted for the purpose of stabilizing GHG concentrations at a level that would prevent any dangerous anthropogenic impact on the climate system within a timeframe sufficient to allow ecosystems to naturally adapt to climate change, in accordance with the principle of international cooperation and the goals of the national social and economic development.

In the past decade, a number of other laws, regulations and strategies that incorporate mitigation considerations have been adopted. The most relevant include the Strategy for Energy Development in the Republic of Macedonia for the Period 2008-2020 with a Vision to 2030 (2010), the Renewable Energy Strategy of Macedonia until 2020 (2010), the National Strategy for Energy Efficiency in Republic of Macedonia until 2020 (2010), and the Third Energy Efficiency Action Plan (EEAP) of the Republic of Macedonia (2016-2018). In the Strategy for Energy Development in the Republic of Macedonia, the chapter analyzing the energy sector in the country with a focus on sustainable development recognizes the strong linkages between energy production and climate change. At a strategic level, energy policies and plans have been taken into consideration when drafting Macedonia's INDC.

A law on climate will serve as a key milestone on the path towards sustainable development in general, and in particularly towards a sustainable energy transition. The Law and Strategy on Climate Change project has been programmed under the EU Instrument for Pre-Accession Assistance (IPA II) funding mechanism, but the implementation of the project is still pending. The planned Law and Strategy on Climate Action will be informed by the European Union's 2030 Climate and Energy Framework.

Republic of Macedonia has also adopted targets for the Sustainable Development Goals (SDGs), and as such has targets for SDG 13, "Take urgent action to combat climate change and its impacts." Its National Sustainable Development Strategy is entitled "Climate Change and Clean Energy." SDG 13 has been adequately covered in national strategic documents in the areas of mitigation, vulnerability assessments, awareness and dissemination. Gaps have been identified with regards to adaptation and resilience sectoral planning, an appropriate monitoring framework, and quantifiable and measurable indicators of achievements in both mitigation and adaptation.[1]

2.4 INSTITUTIONAL PROCESS FOR NATIONAL COMMUNICATIONS

The process for producing National Communications and Biennial Reports for the UNFCCC is led by MOEPP, which is the institution responsible for climate change policies and national point of contact for UNFCCC. The National Climate Change Committee (NCCC) and the Technical Group at the National Sustainable Development Council also participate in this this process as well as other key stakeholders in government and in civil society. International institutions and donors, specifically the Global Environmental Facility (GEF) and the United Nations Development Program (UNDP), have provided financial and technical support for this reporting process. In fact, UNDP has provided support for the majority of climate change policy documents in the country, including its three National Communications, the FBUR, this SBUR, its INDCs, a Climate Change Strategy for the City of Skopje, and others. It should be noted that the Global Support Programme for National Communications and Biennial Update Reports, which is implemented for the GEF by UNDP and UNEP, has facilitated peer review of communications and reports, technical support for GHG inventories and other aspects of reporting, and technical support for initiatives designed to support gender mainstreaming in climate change reporting and programming.

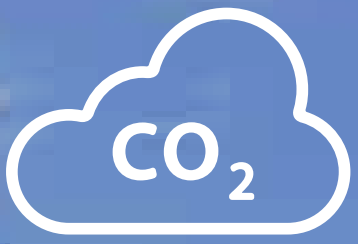
It is anticipated that the development of a continuous process for reporting will be undertaken as part of the development of the new Law and Strategy on Climate Action, although it could also be done by the introduction of new regulatory guidelines on climate reporting. Republic of Macedonia currently submits GHG inventory reports to Eionet, the central data repository of the European Environment Agency, when new data become available through National Communications or BURs.[2] In 2016, the Ministerial Council of the Energy Community, of which the Republic of Macedonia is a Contracting Party, adopted a non-binding recommendation to implement EU Regulation 525/2013 on monitoring, reporting, and assessment of GHG inventories and steps taken to address climate change. The recommendation involves providing an annual report to the Energy Community on anthropogenic GHG emissions (to be submitted by 15 January each year starting in 2019). Information provided to the Energy Community by the country will simultaneously be provided to the UNFCCC.

All National Communications, the FBUR, background reports contributing to this SBUR, and other key climate-related documents are available publicly at the national Climate Change website www.klimatskipromeni.mk.

1 Gap Analysis... (2016): 122-128.

2 Data are available at the following link: http://cdr.eionet.europa.eu/mk/un/unfccc/

NATIONAL GHG INVENTORY



- Comprises emissions from 5 greenhouse gases: CO_2, CH_4, N_2O, PFCs and HFCs
- Also includes 4 precursors/sources of indirect emissions: CO, NOx, NMVOC and SO_2

- Covers 4 sectors, with approximately 60 categories/subcategories
- 6 country-specific emission factors have been calculated

THE PROCESS IN A NUTSHELL

- Prepared by a highly qualified team of 17 national experts (41% women)
- Used a wide participatory approach, involving 30 institutions (12 governmental Institutions, 5 international organizations, 6 NGOs, 5 academic institutions and 2 private companies) and 80 persons (57% women)
- Sustainability ensured: 2 new persons trained in the development of GHG inventories
- 4-stage quality verification process implemented
  - 2 at the national level (inventory team and national UNFCCC-certified reviewer)
  - 2 at the international level (Global Support Programme and UNFCCC)

CHAPTER 3 NATIONAL GHG INVENTORY

3.1. OVERVIEW

The Republic of Macedonia, as a Non-Annex I Party to the UNFCCC, has been developing an inventory of anthropogenic emissions by sources and removals by sinks of **greenhouse gases** (GHGs) since the year 2000 as a part of its National Communications and Biennial Update Reports. The following GHGs are included in the inventory: CO_2, CH_4, N_2O, PFCs, and HFCs, as well as **precursors**[1] **and indirect emissions** of CO, NO_x, NMVOC and SO_2. These GHG emissions and removals are divided into the following sectors: Energy, Industrial Processes and Product Use (IPPU), Agriculture, Forestry and Other Land Use (AFOLU) and Waste. Each sector is comprised of categories and subcategories, so that the inventory is compiled at the subcategory level.

The Republic of Macedonia has previously submitted three National Communications (2003, 2008 and 2014) and a First Biennial Update Report (2015) to the UNFCCC. In the First Biennial Update Report (FBUR) the inventory was updated to consider the period 2010 – 2012, and the entire previous data series from 1990 to 2009 was revised according to IPCC Inventory Software requirements. In this report, the data for 2012 have been revised and updated as necessary, and the emission trend has been expanded by developing an inventory for 2013 and 2014 using **IPCC Inventory Software (Version 2.17 – Rev 1,** available at the time of preparation of the Inventory**)**.

The **emission factors** used to estimate the GHG emissions were calculated by using either the Tier 1 or Tier 2 approach depending on data availability.

- In the Energy sector, the Tier 2 method was applied for CO_2 emission factors for lignite, residual fuel oil, and natural gas for the Fuel Combustion category in the Energy sector of the inventory.
- In the IPPU sector, Tier 2 was used for emission factors in the Mineral Industry category (for cement production) and in the Metal Industry category (for Iron and Steel Production and Ferroalloys Production).

1 Carbon monoxide (CO), Nitrogen oxides (NOx) and NMVOC in the presence of sunlight contribute to the formation of the greenhouse gas ozone (O3) in the troposphere and are therefore often called 'ozone precursors'. Sulphur Dioxide emissions lead to formation of sulphate particles, which also play a role in climate change.

- In the Waste sector, the Tier 2 method was used through the IPCC First Order Decay (FOD) method and through country-specific activity data on waste disposal at solid waste disposal sites (SWDS) and historical data on GDP and population.
- For other calculations, Tier 1 (the default method) was used. Using a higher tier method of estimating emissions of precursors and indirect GHG in the Energy sector would require detailed characteristics of the fuels used in combination with onsite measurements or other detailed parameters, which were not available during the preparation of the SBUR. However, the Report on National CO_2 and non-CO_2 emission factors for Key Sectors under IPCC and CORINAIR methodology[2] could be used for developing higher tier estimations in future submissions.

Most of the **activity data** used for preparation of national inventory were taken from official national documents such as: statistical yearbooks, energy balances, sectoral reports and the MAKSTAT database from the State Statistical Office (SSO); various strategies and reports from relevant institutions, including MOEPP and the Ministry of Agriculture, Forestry and Water Economy (MAFWE); and various international databases, such as UN projections for population and GDP and FAOstat.

The preparation of the national GHG inventory is project based and is supported by the GEF and UNDP. The estimated emissions in the inventory are available publically at the following link: http://www.unfccc.org.mk/Default.aspx?LCID=244. The national inventory process includes the following **key players**:

- **MOEPP**, which is responsible for supervising the national inventory process and reporting emissions to UNFCCC and also for other international reporting;
- The **GHG Inventory Development Team**, composed of the MASA team and external sectoral experts responsible for preparing the GHG inventory in four different sectors (Energy, IPPU, AFOLU and Waste) and for calculating Precursors and indirect emissions;
- **Data Suppliers**, with the SSO being the most important data source;
- The **Verification Team**, which includes experts working on Quality Control and experts working on Quality Assurance. The latter area uses a multilayer structure involving a Chief Technical Advisor (CTA), the National Committee on Climate Change (NCCC), and the Global Support Programme (GSP).

For the first time, the inventory uses both methods for **uncertainty analysis**: Approach 1, the Error Propagation method; and Approach 2, which utilizes the Monte Carlo method. This expanded analysis is applied to all sectors of the inventory for 2012, 2013 and 2014. Approach 1 is already embedded in the IPCC Inventory Software, and a separate model was developed using MATLAB computational software for Approach 2 that directly used the IPCC Inventory Software database.

The preparation of the GHG inventory included a set of standardized procedures for **Quality Assurance and Quality Control (QA/QC).** In addition to the work of the QA/QC experts on the Verification Team, QA/QC procedures were strengthened by revising and updating the national training materials prepared for each sector within the framework of the FBUR. These training materials contain a step-by-step process for completing inventory tables, explanations of good practice and sources of data, and emission factors. It should be noted that these materials are specific to Macedonia, and they provide clear information on the in-country location of the different input data needed for the IPCC software. In this way, the materials increase the sustainability of the inventory process over different project cycles, because project-based teams can then locate the data and documentation that they need. Additional information on QA / QC procedures is provided in Section 3.9 below and in the National Inventory Report.[3]

The quality of the inventory is also supported by strong individual capacity in the area of GHG inventory preparation in the country. Although government agencies lack organizational capacity in GHG

2 Tehnolab (2013).

3 Kanevce, G., et al (2017). National Inventory Report: Republic of Macedonia.

inventories, this SBUR includes the work of all national experts in the field, and it was reviewed by a national UNFCCC-certified reviewer (one of three in the country). In addition, the inventory report was reviewed by the Global Support Programme for National Communications and Biennial Update Reports. A table that documents the incorporation of feedback from the review is available in the National Inventory Report.[4] Finally, the SBUR incorporates recommendations that resulted from a Technical Analysis conducted by the UNFCCC that was concluded in September 2015.[5] The recommendations from this review and a description of how they were incorporated into the SBUR are included in Section 3.10 below and in the National Inventory Report.

3.2 SUMMARY

3.2.1 KEY CATEGORIES

The inventories team conducted a **key category analysis** that identified categories that contributed the most to the absolute level of national emissions and removals (level assessment) and to the trend of emissions and removals (trend assessment). This analysis utilized Approach 1 from the IPCC Guidelines, whereby key categories are those that add up to 95% of the total level/trend when summed together in descending order of magnitude.

The **level assessment** (see Figure 6: Level assessment of key categories and their contribution in 2014) found that the five most significant categories with the highest absolute values of Gg CO_2-eq (including both emissions sources and removals) identified in the country for 2014 were:

- Forest Land Remaining Forest Land (35.1%),
- Energy Industries – Solid Fuels (22.8%),
- Solid Waste Disposal (11.4%),
- Road Transportation (8.2%), and
- Manufacturing Industries and Construction – Liquid Fuels (3.4%).

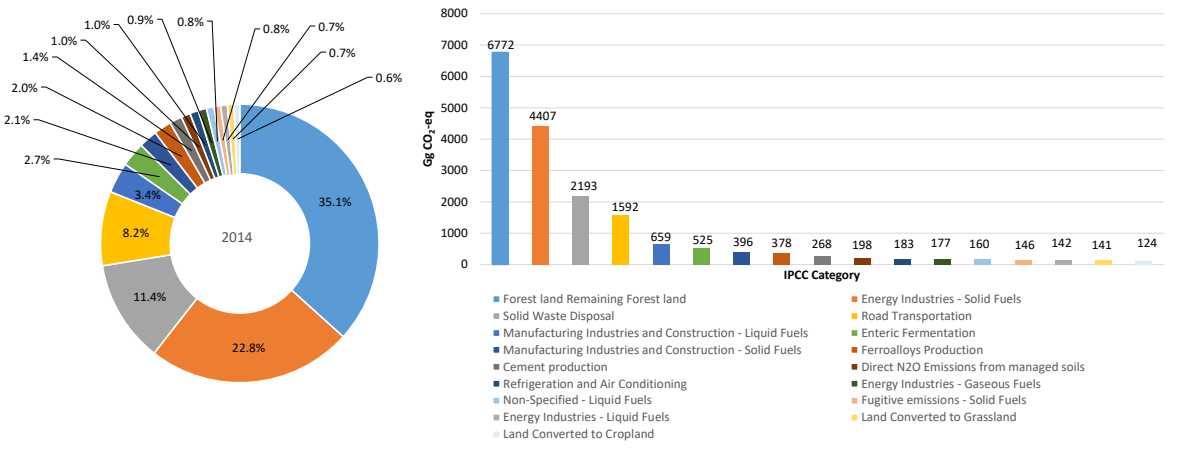


Figure 6: *Level assessment of key categories and their contribution in 2014*

The trend assessment used 1990 as the base year and 2014 as the latest inventory year. The purpose of this trend assessment was to emphasize the categories with trends that were significantly

4 Ibid.

5 "Summary Report on the Technical Analysis of the first biennial update report of the Former Yugoslav Republic of Macedonia submitted on 26 February 2015." FCCC/SBI/ICA/2015/TASR.1/MDK (29 September 2015). UNFCCC.

different from the trend of the overall inventory, regardless of whether the category trend was increasing or decreasing, or was a sink or source.

Unlike the key categories level assessment for 2014, the **trend assessment** for 1990 and 2014 found a different order of top 5 key categories, as follows:

- Solid Waste disposal (23.5%)
- Road Transportation (19.7%)
- Energy Industries (7.5%),
- Other Sectors – Liquid Fuels (5.7%), and
- Energy Industries - Liquid Fuels (3.6%).

3.2.2 AGGREGATE GHG EMISSIONS AND REMOVALS

Aggregate GHG emissions and removals (net emissions) are calculated at 10,720.7 Gg CO_2-eq in 2013 and 9,023 Gg CO_2-eq in 2014 (including the FOLU sector). Table 2: GHG emissions and removals by sector (in Gg CO2-eq) and Figure 7 show the estimates of emissions and removals over time, including net emissions (in CO_2-eq), from 1990 to 2014. Significant fluctuations in net emissions can be seen in 2000, 2007, 2008 and 2012, when increased CO_2 emissions can be observed in the FOLU sector (instead of removals) as the result of forest fires/wildfires.

Table 2: *GHG emissions and removals by sector (in Gg CO_2-eq)*

Sector	1990	2003	2008	2012	2013	2014
Energy	9,415.5	8,887.7	9,026.7	9,450.6	8,419.4	7,957.5
Industrial Processes and Product Use	941.8	845.2	1,132.1	776.4	923.1	921.6
Agriculture (without FOLU)	1,327.7	1,071.6	1,072.3	1,019.4	989.2	1,001.8
FOLU	-220.0	-3,757.9	1,351.0	1,914.8	-1,837.0	-3,181.1
Waste	1,391.5	1,550.7	1,765.5	2,146.8	2,226.1	2,323.4
Total (incl. FOLU) – Net emissions	12,856.5	8,597.3	14,347.7	15,308.0	10,720.7	9,023.2
Total (excl. FOLU)	13,076.6	12,355.2	12,996.7	13,393.3	12,557.7	12,204.3

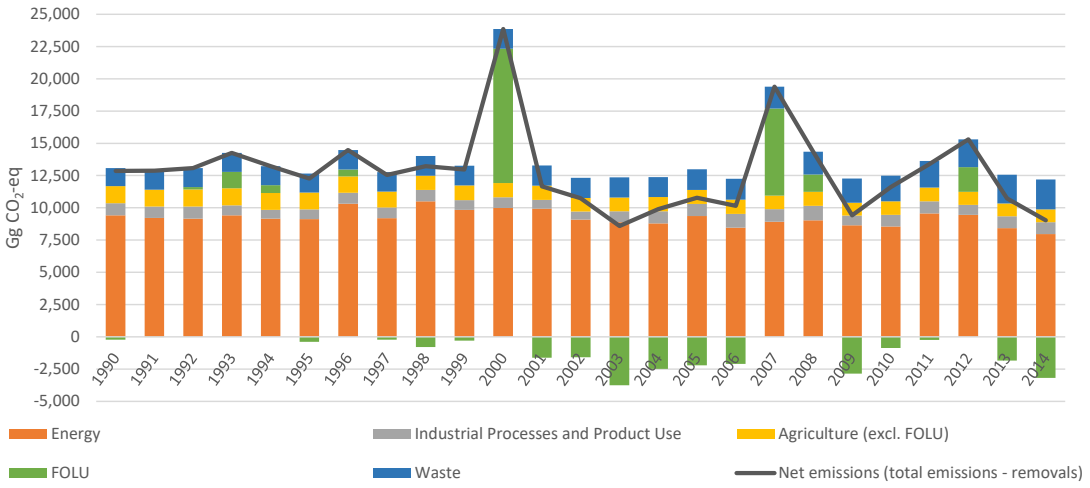


Figure 7: *GHG emissions and removals by sector (in Gg CO_2-eq)*

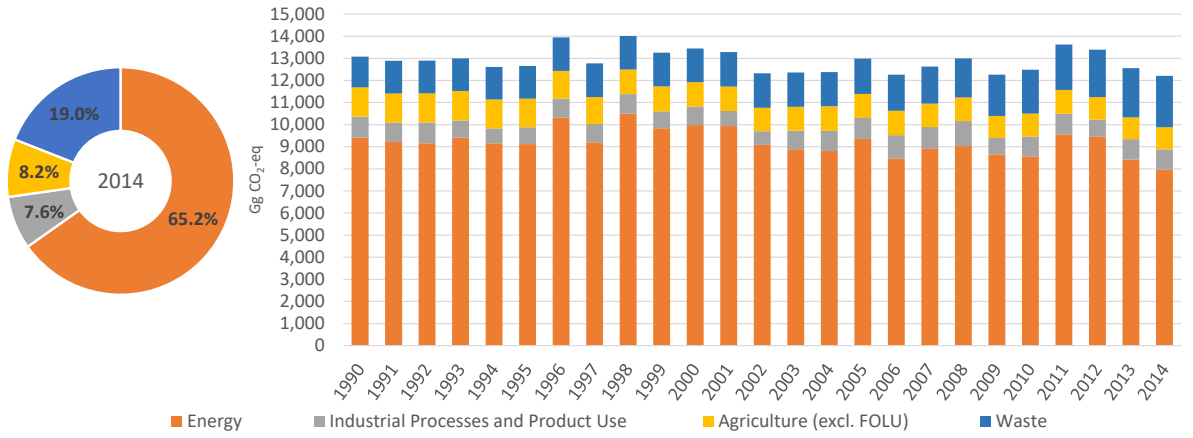


Figure 8: *Total GHG emissions by sector, excluding the FOLU sector (in Gg CO_2-eq)*

If removals from the FOLU sector are not accounted for (Figure 8: Total GHG emissions by sector, excluding the FOLU sector (in Gg CO2-eq)), then total GHG emissions in 2014 are 12,204 Gg CO_2-eq. The greatest share of emissions comes from the Energy sector, accounting for 65.2% of emissions in 2014, followed by the Waste sector (19%), Agriculture excluding FOLU (8.2%), and the IPPU sector with 7.6%. The dominant share of Energy sector emissions is evident throughout the entire period of study.

When analyzing GHG emissions by gas (excluding the FOLU sector), CO_2 emissions clearly predominate (Table 3: GHG emissions by gas (in Gg CO2-eq) and Figure 9). Their share accounts for 69.3% of all emissions in 2014, followed by the CH_4 emissions (25.6%), N_2O emissions (3.6%) and all F-gases (1.5%). In view of the small share of F-gases in total emissions, only HFCs and PFCs are reported in the inventory (Table 3 and Figure 4). Emissions of SF_6 are not estimated for the country due to the unavailability of activity data.

Table 3: *GHG emissions by gas (in Gg CO2-eq)*

Gas	1990	2003	2008	2012	2013	2014
CO_2 (incl. FOLU)	9,814.7	5,554.5	10,832.4	11,766.2	7,097.0	5,272.7
CO_2 (excl. FOLU)	10,034.7	9,312.4	9,481.4	9,851.4	8,934.0	8,453.8
CH_4	2,456.9	2,475.0	2,640.3	2,989.9	3,018.0	3,125.6
N_2O	470.5	424.6	484.7	449.2	439.0	441.5
HFCs	0.0	89.8	390.1	96.7	165.2	183.5
PFCs	114.5	53.4	0.2	6.0	1.4	0.0
SF_6	0.0	0.0	0.0	0.0	0.0	0.0
Total (incl. FOLU) - Net emissions	**12,856.5**	**8,597.3**	**14,347.7**	**15,308.0**	**10,720.7**	**9,023.2**
Total (excl. FOLU)	**13,076.6**	**12,355.2**	**12,996.7**	**13,393.3**	**12,557.7**	**12,204.3**

Figure 10: Emissions of F-gases (in Gg CO2-eq) illustrates how HFC emissions first appear in the year 2000, with some fluctuations over time, depending on the activities in the IPPU sector, while PFC emissions decrease considerably after 2003.

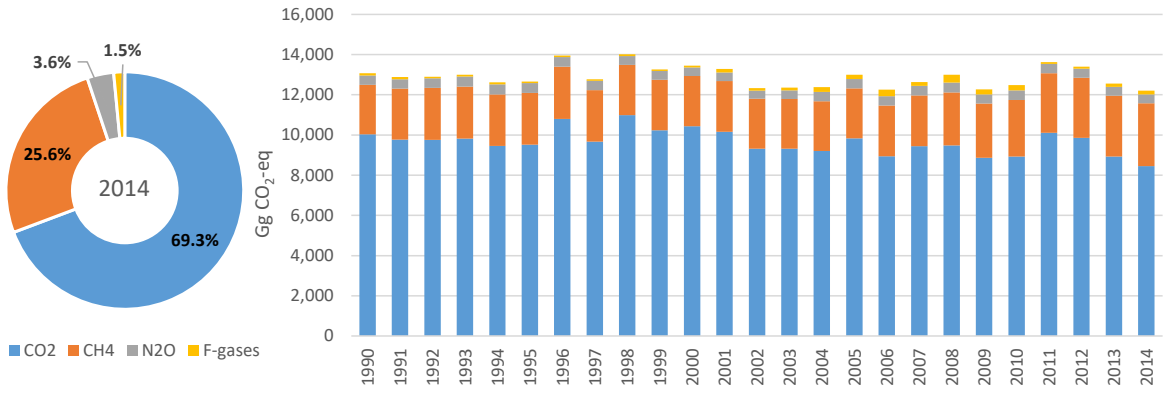


Figure 9: *Total GHG emissions by gas, excluding FOLU (in Gg CO_2-eq)*

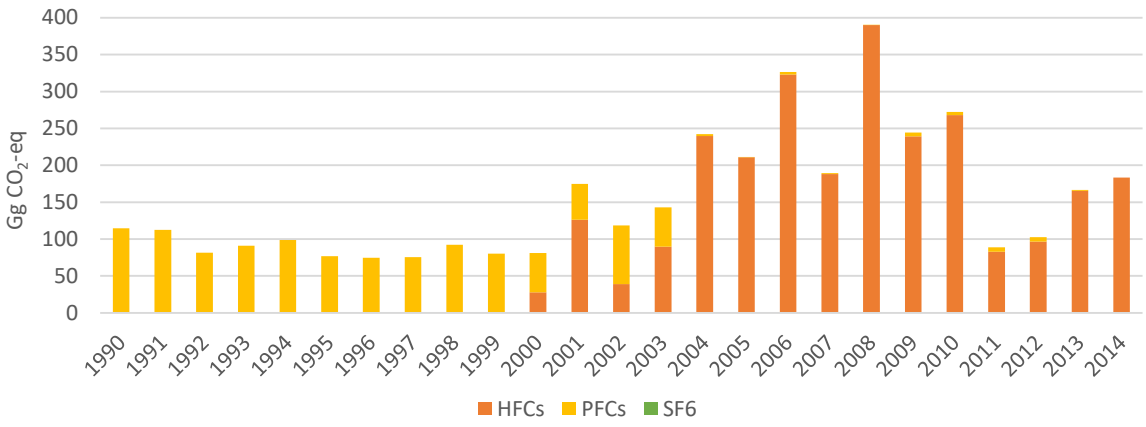


Figure 10: *Emissions of F-gases (in Gg CO_2-eq)*

3.3. ENERGY

The GHG inventory in the Energy sector accounts for the emissions released as a result of fuel combustion activities, as well as the fugitive emissions from extraction of solid and transmission and distribution of liquid and gaseous fuels. Emissions in this report have been calculated by using two methods: 1) the Reference approach (top-down), which uses the apparent fuel consumption to account for the carbon flows into and out of the country; and 2) the Sectoral approach, which accounts for fuel consumption by sector. The summary tables for GHG emissions in the Energy sector have been estimated using the Sectoral approach. Reported Total Energy sector emissions by category are shown in Figure 11: GHG emissions in Energy sector, by category (in Gg CO_2-eq), and Table 4: GHG emissions in Energy sector, by category (in Gg CO_2-eq) provides estimates of GHG emissions in Energy sector by category (in Gg CO_2-eq). The decrease in emissions in 2013 and 2014 is due to reduced electricity production in the Energy Industries category, which has been replaced primarily by electricity imports. It is noticeable that in the two most recent reporting years, the share of the Energy Industries category in Energy sector emissions has decreased in comparison with the years 2003, 2008 and 2012, when the share of this category was 69.6%, 67.5% and 64.2%, respectively.

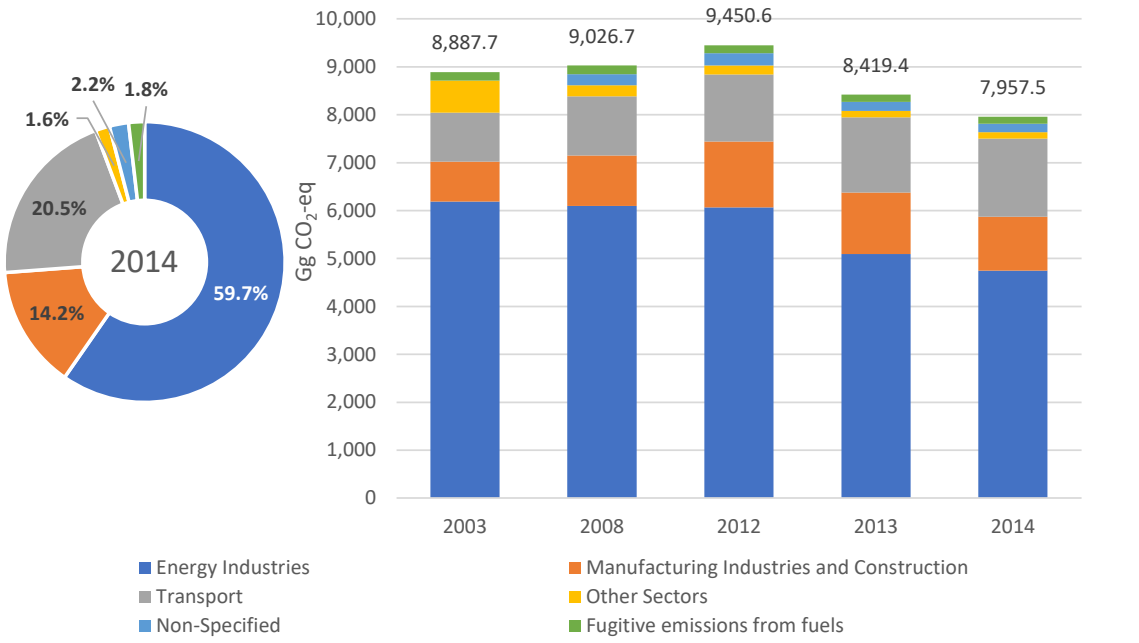


Figure 11: *GHG emissions in Energy sector, by category (in Gg CO_2-eq)*

Table 4: *GHG emissions in Energy sector, by category (in Gg CO_2-eq)*

Categories	2003	2008	2012	2013	2014
Energy	**8,887.7**	**9,026.7**	**9,450.6**	**8,419.4**	**7,957.5**
Fuel Combustion Activities	**8,712.8**	**8,845.8**	**9,285.9**	**8,268.8**	**7,811.6**
▪ Energy Industries	6,187.2	6,095.1	6,065.8	5,096.5	4,746.9
▪ Manufacturing Industries and Construction	836.8	1,053.2	1,373.9	1,277.9	1,126.1
▪ Transport	1,019.5	1,236.0	1,402.4	1,575.0	1,631.9
▪ Other Sectors	669.4	234.1	187.9	128.3	131.2
▪ Non-Specified	0.0	227.4	255.9	191.1	175.6
Fugitive emissions from fuels	**174.9**	**180.9**	**164.7**	**150.6**	**145.9**
▪ Solid Fuels	174.5	180.4	164.6	150.5	145.9
▪ Oil and Natural Gas	0.4	0.5	0.1	0.0	0.0

For comparison, estimated CO_2 emissions using the Reference approach were 8,159.8 Gg CO_2 in 2013 and 7,700.9 Gg CO_2 in 2014.

Figure 12: GHG emissions in Energy sector, by gas (in Gg of CO_2-eq) provides information on overall GHG emissions in the Energy sector by type of greenhouse gas (in Gg of CO_2-eq) for the reporting years, as well as on their share in 2014. On the left side of the chart, one can easily notice that almost all of the Energy sector GHG emissions in 2014 are CO_2 emissions (96.8%), while CH_4 and N_2O emissions amount to only 2.5% and 0.7%, respectively.

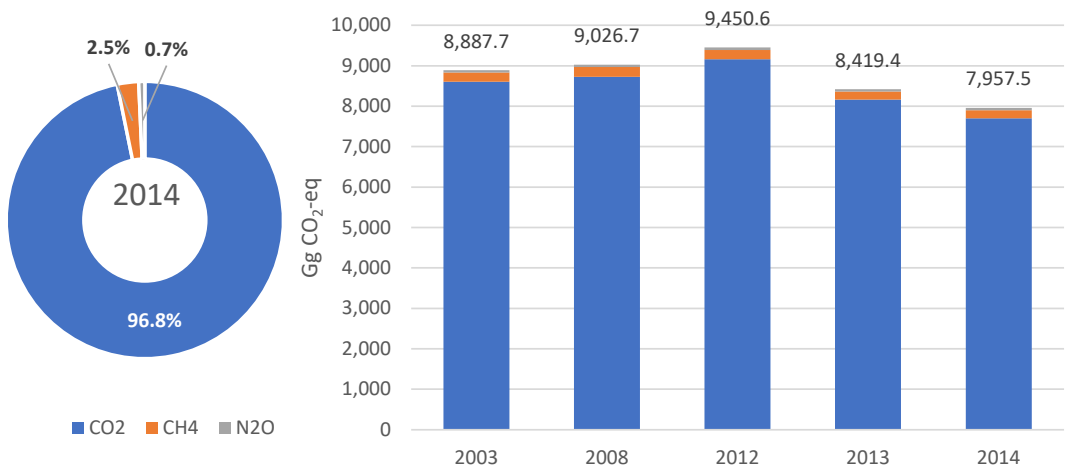


Figure 12: *GHG emissions in Energy sector, by gas (in Gg of CO_2-eq)*

3.3.1 COMMENTS ON ENERGY SECTOR INPUTS

The emission factor for lignite was calculated as a weighted sum of the emission factors for the two main lignite-fired thermal power plants in the country (REK Bitola and REK Oslomej), where the weighting coefficients were taken to be the shares of the total lignite consumption. The calculations were based on the carbon content of the lignite (results obtained from laboratory test). Due to lack of data on the carbon content of lignite for 2013 and 2014, the country-specific emission factor of lignite calculated for 2012 was also used to estimate the CO_2 emissions in 2013 and 2014.

Because the country imports natural gas of Russian origin, the FBUR calculated the carbon emission factor of natural gas used in the country by using the carbon content and the net calorific value (NCV) from the Russian Natural Gas specification. This same emission factor is used in this report. A country specific emission factor has also been calculated for residual fuel oil, using the same data on carbon content as in the FBUR. It uses data obtained from the OKTA refinery and the NCV of residual fuel oil for each year, which is based on Energy Balances provided by the SSO. These Energy Balances, which contain information on fuel consumption both in natural units and in kilotonnes of oil equivalent (ktoe), were used to calculate the NCV of each fuel in a certain year. It should be noted that the variations of a certain fuel's NCV from one sector to another were taken into account.

Compared to the FBUR, the Energy Balances used for the SBUR provide a more disaggregated data set: similar fuels, which were grouped together in the older energy balances, are given separately. This indicates a higher resolution approach on the part of the State Statistical Office, but it also indicates that certain fuels have become significant enough to be reported independently. For instance, the Energy balances issued until 2011 contained a category named Diesel and Heating Oil, which is now separated into the categories "Road Diesel" and "Heating & Other Fuel Oil." Although both of the above-mentioned categories are reported as "Gas/Diesel Oil" in the IPCC Inventory Software, different NCVs are used. The same concept applies to biomass. In the energy balances issued since 2012, biomass has been reported in two categories: "Biomass" and "Wood Wastes, Wood Briquettes and Pellets." In order to take advantage of the disaggregated data in this report, the category "Biomass" is reported in TJ under "Wood/Wood Wastes" in the IPCC Inventory Software. Additionally, "Wood Wastes, Wood Briquettes and Pellets" are also reported as "Wood/Wood Wastes," and the amount of fuel is entered in Gg.

3.4. INDUSTRIAL PROCESSES AND PRODUCT USE (IPPU)

Emissions in the country from the IPPU sector come either from manufacturing industries or the use of ODS substitutes for refrigeration and air-conditioning. The metal industry is the main contributor, with emissions from the production of ferroalloys predominating. This category is followed by the mineral industry, where most emissions come from cement production. The remainder of emissions result from ODS substitutes usage in the country. Only a small portion of emissions comes from the chemical industry sector, as there are no significant factories that produce chemicals.

The overall level of greenhouse emissions from this sector has been consistent throughout the entire 1990-2014 period. Emissions totaled 923.1 CO_2-eq (9.1% of total emissions) in 2013 and 921.6 CO_2-eq (7.6%) in 2014 (excluding FOLU). However, it should be noted that emissions from manufacturing industries have generally decreased, while emissions from products used as ODS substitutes have generally increased over the years observed. The overall emissions from the entire IPPU sector in 2013 and 2014 are relatively stable, with a negligible decrease of -0.16% in 2014.

Figure 13: GHG emissions from the IPPU sector (in Gg CO2-eq) shows that greenhouse emissions from the IPPU sector have experienced several fluctuations that result from various economic factors that affect production volumes in different industries. A major spike in emissions occurred in 2008 right before the global economic crisis spread in Europe during 2009, as markets were still optimistic and spending was encouraged. Emissions from the use of ODS substitutes increased until 2008, when they reached their peak, followed by a sharp decline and stabilization by the end of the time series.

The following trends were observed in the **Metal Industry** under the IPPU category:

- CO_2 emissions from steel production decreased sharply due to the global financial crisis that in turn affected global steel production all around the world, including Republic of Macedonia. However, emissions from this category eventually increased as outputs increased along with economic stabilization. In 2013, greenhouse gas emissions totaled 70.0 Gg CO_2-eq, or 7.6% of the entire IPPU sector, and in 2014 emissions totaled 73.0 Gg CO_2-eq or 7.9% of the all emissions in the sector.
- Emissions from ferroalloy production have also fluctuated due to shifts in economic activity. In 2013, these emissions totaled 384.3 Gg CO_2-eq, or 41.6% of the entire IPPU sector, and in 2014 emissions totaled 379.5 Gg CO_2-eq, or 41.2% of all emissions in the sector. The emissions between these two years decreased by 1.2% due to the decline in the production volume of ferroalloys in the country

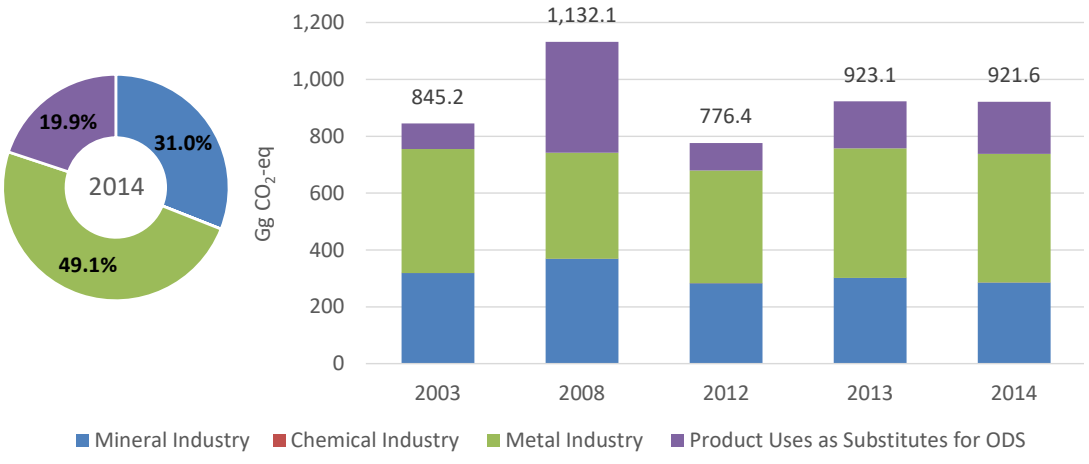


Figure 13: *GHG emissions from the IPPU sector (in Gg CO_2-eq)*

- Emissions from aluminum production decreased over the period 1990-2003. Due to the closure of the only industrial plant that produced aluminum, emissions in 2013 were negligible, and there is no evidence of aluminum production in 2014.

The category of Product Uses as Substitutes for ODS refers primarily to HFCs, which are mainly used for refrigeration and air conditioning in the country. These products require an import license, which allows MOEPP to track actual imports. HFC emissions from this sector increased until 2008, following a decline the following year and stabilization of emission levels at approximately 165.3 CO_2-eq in 2013 and 182.5 CO_2-eq in 2014.

In terms of **emissions by type of GHG**, CO_2 emissions accounted for 79.88% of the overall greenhouse emissions from IPPU in 2014. HFCs were the second highest contributor and accounted for 19.91% of total emissions. CH_4 emissions were negligible and accounted for only 0.21% of the greenhouse emissions from this sector.

3.4.1 COMMENTS ON IPPU INPUTS

Data for the IPPU sector were generally collected from three main sources: the State Statistical Office, MOEPP, or directly from industrial plants. In addition to the data provided by these main sources, other international databases were used to crosscheck the data or to fill in the gaps in the time series, such as UN industrial production statistics, the World Steel Association Statistics archive and the Eurostat PRODCOM database.

3.5 AGRICULTURE, FORESTRY AND OTHER LAND USE (AFOLU)

The GHG emissions from the AFOLU sector include emissions associated with Livestock, Forestry and Land Use. The national **livestock** population in the country has been decreasing in all species relative to the base year, mainly as a result of socio-economic changes in recent decades. However, livestock emit approximately 50% of total GHG emissions (in CO_2-eq.) in the AFOLU sector (excluding Forest land). Dairy cows and other cattle emit the majority of GHGs in livestock production. Emissions due to livestock activity in 2013 were 666.4 Gg CO_2-eq, while in 2014 they increased for the first time to 673.7 Gg CO_2-eq. This increase of about 1% was due to an increase in the number of cattle by over 3,000 heads.

Emissions and removals in the **Land** category of the inventory are mainly the result of activities and changes in Forest Land (fuel wood, afforestation and forest fires, etc.) and conversion from one land use type of agricultural land to another. The **Forestry** sector is the major contributor of GHG sinks in the country, with the exception of several years (2000, 2007, 2008 and 2012) when the severity of forest fires (burned areas) were significantly above the annual average. Species composition (conifers, broadleaf, mixed), and the annual increment and removals from the forests are relatively stable. The average GHG sink in this sector for 2014 is estimated at 3,471.2 Gg CO_2-eq. According to statistical data, there is an increase in area under forests of more than 20,000 hectares for the period 2013-2014 compared to 2010. However, there are significant inconsistencies in data related to afforested land, depending on the source. Soil is another significant sink of GHG emissions, and it is closely related to soil management and fertilization practices.

GHG emissions in the Land category are mainly from Cropland (466.7 Gg CO_2-eq in 2003), followed by Grassland (344.1 Gg CO_2-eq), with a total of 906.0 Gg CO_2-eq for all categories of land except Forest land. However, there has been a significant decrease of more than 60% in GHG emissions in all categories of land use (excluding Forest land) in the last decade. Cropland is has become a moderate contributor of GHG emissions, accounting for 120.6 Gg CO_2-eq and 123.8 Gg CO_2-eq in the years 2013 and 2014, respectively. It is followed by Grassland with 130.0 Gg CO_2-eq in 2013 and 134.9 Gg CO_2-eq

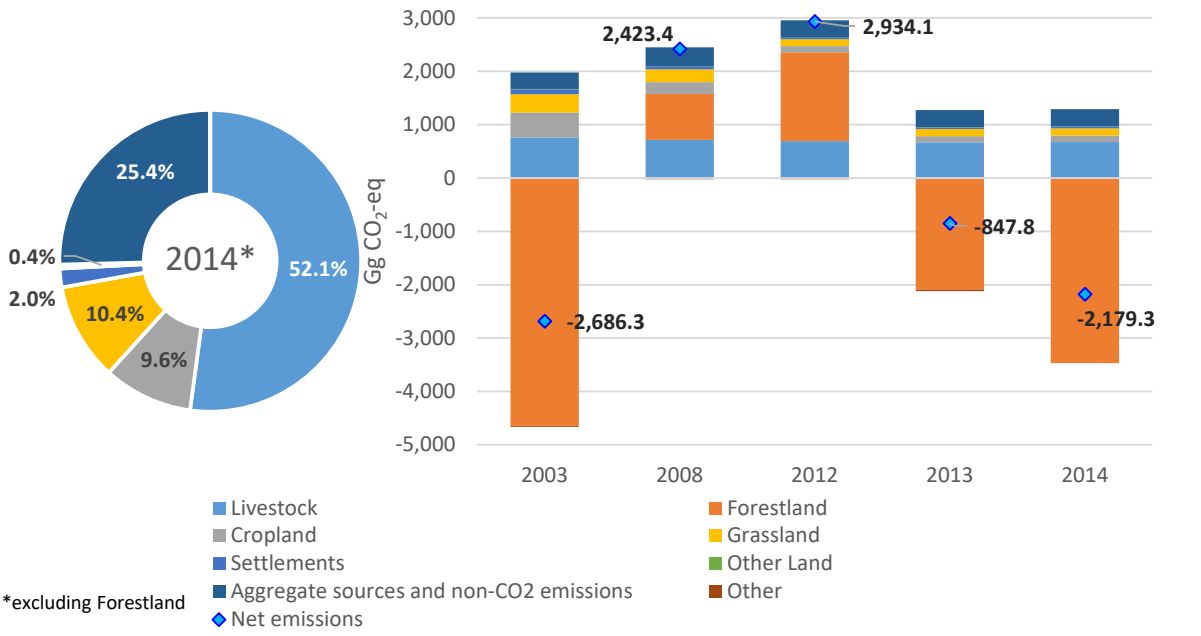


Figure 14: *GHG emissions (and removals) from AFOLU sector (in Gg CO_2-eq)*

in 2014. The GHG emissions from Settlements are estimated at 25.0 Gg CO_2-eq and 25.9 Gg CO_2-eq in 2013 and 2014, respectively. Even though the total area classified as other land was significant, this category is a very small contributor of GHG emissions in the country, estimated at 6.6 Gg CO_2-eq in 2013 and 5.5 Gg CO_2-eq in 2014.

In terms of **other sources**, urea application on land in the category of aggregate sources and non-CO_2 sources is very small contributor of GHG emissions in the country, with estimated emissions of 5.7 Gg CO_2-eq for 2013 and 2014. Direct N_2O emissions from managed soils are correlated with direct CO_2 emissions from cropland or grassland, and this category is a moderate contributor of GHG emissions in the country. Emissions from direct N_2O emissions from managed soils were estimated at 196.0 Gg CO_2-eq in 2013 and 197.7 Gg CO_2-eq in 2014. Indirect N_2O emissions from managed soils were small: in 2013 and 2014, these emissions were approximately 71.3 Gg CO_2-eq and 72.0 Gg CO_2-eq, respectively. Indirect N_2O emissions from manure management were also stable at approximately 27 Gg CO_2-eq in both years. Finally, methane emissions from rice cultivation were a small contributor of GHG emissions in Republic of Macedonia. The GHG emissions from rice cultivation were estimated at 22.9 Gg CO_2-eq in 2013 and 25.4 Gg CO_2-eq in 2014.

Figure 14: GHG emissions (and removals) from AFOLU sector (in Gg CO2-eq) depicts emissions and removals in the AFOLU sector. The share of GHG emissions (as CO_2-eq) in categories other than Forest land is almost identical in 2013 and 2014. Livestock production activities generated 52.1% of emissions, followed by Aggregate sources and non-CO_2 emissions sources (over 25.4%), while Grassland and Cropland contributed with 10.4% and 9.6%, respectively. Settlements account for 2% of emissions and Other land less than 0.4%. While emissions from Livestock have decreased slowly over time, emissions related to Cropland and Grassland activities have decreased rapidly. These reductions were primarily due to a lower volume of productive activities.

3.5.1 COMMENTS ON AFOLU INPUTS

In **livestock** emissions estimates, emissions per unit of animal product vary greatly between production units, even within similar production systems. This variability is due to different farming practices and supply chain management. In order to be able to distinguish different systems and practice

levels, a deep descriptive data set is needed. Statistical yearbooks still do not provide this type of data. Therefore, Tier 1 methodology was used for this category. In order to apply Tier 2 methodology in the future, it will be necessary to conduct an assessment that models typical farm size, systems, and technologies. It is of particular importance to do an assessment in Cattle, where the majority of farms are small and use different production systems.

Forest land estimates used Tier 1 methodology due to a lack of accurate annual data. The estimates have been improved by using CORINE Land Cover maps to establish annual land use changes. In addition, the annual increment of different types of forests, were changed and used national averages for different categories of forests, provided by experts from Saints Cyril and Methodius University in the Faculty of Forestry (Department of Forest Management). Default emission factors were used from the IPCC Inventory Software (in accordance with 2006 IPCC Guidelines).

Emissions from **land use** were evaluated across forest land, cropland, grassland, wetland, settlements and other land. In order to determine changes from one land use type to another, temporal analyses of the available CORINE Land Cover maps (CLC) for Republic of Macedonia were conducted. The CLC is a computerized inventory on the land cover of the 28 EU member states and other European countries. The CLC maps were sourced from European Environmental Agency for the year 2000, year 2006 and year 2012 (these years were the only 3 periods that CLC maps were available for the territory of Republic of Macedonia). The analyses provided three points for land use change: the years 2000, 2006, and 2012. In order to convert these points in annual land use changes, the inventory team conducted a regression analysis and estimated annual land use changes for the period 2000-2014. The use of the same regression model for the period 1990 to 1999 did not provide a good base, so it was not possible to present even a rough estimation of annual land use changes for that period. It therefore remains the same as in the FBUR. In order to achieve a more accurate overview of areas under certain categories of land use, it is highly recommended to establish a sustainable system for performing of continuous, long-term inventory of the Forest sector and all other sectors within the Land category.

3.6. WASTE

Estimates show that the **Waste** sector is a significant source of GHG emissions, as it accounts for 17.7% and 19% of the total emissions in the country for 2013 and 2014, respectively. The categories used for reporting are Solid Waste Disposal, Biological Treatment of Solid Waste, Incineration and Open Burning of Waste, and Waste Water Treatment and Discharge. The data categorization format is consistent with previous years in order to preserve the existing time series, except in sectors where data were introduced for the first time.

The overall emissions from this sector are estimated at 2,226.1 Gg CO_2-eq in 2013 and 2,323.5 Gg CO_2-eq in 2014. Solid Waste Disposal emissions are most significant, accounting for 94.4% of total waste emissions in 2014. Emissions from Biological Treatment of Solid Waste have been, for the first time, introduced for the period from 2012 to 2014 as a result of data availability. Emissions from Incineration and Open Burning of Waste represent 1.4% of total Waste emissions. The remaining 4.2% of Waste emissions come from Wastewater Treatment and Discharge (domestic and industrial).

Figure 15: GHG emissions from Waste sector, by category (in Gg CO2-eq) contains the emissions of each sub-sector of the Waste sector in Gg CO_2-eq. It also depicts the emissions of gases in the Waste sector in CO_2-eq. An upward emissions trend is evident, as is the predominance of emissions from solid waste disposal.

Waste greenhouse gas emissions follow an increasing trend throughout the years included in this report. Their value in 2014 is 8.2% higher when compared to 2012 and 49.8% higher when compared to 2003. Out of all the sectors, the Solid Waste Disposal emissions are most significant, accounting for 94.4% of total waste emissions on average. The CH_4 and N_2O emissions from this category however, do not contribute largely to the overall emissions due to the small amount of reported composted

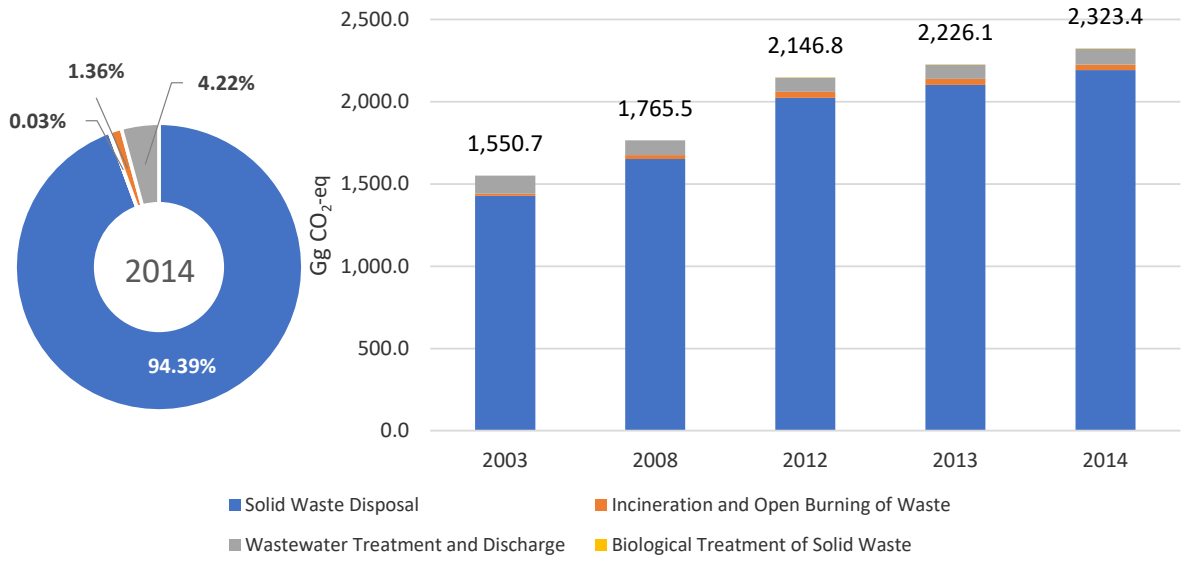


Figure 15: *GHG emissions from Waste sector, by category (in Gg CO_2-eq)*

waste. Since waste incineration hasn't been reported, the emissions reported under Incineration and Open Burning represent the greenhouse gases emitted only by open burning of waste. The decrease of these emissions in 2014 ends the previously established upward trend. Nevertheless, emissions from incineration and open burning of waste represent less than 2% of the total waste emissions. The gasses which are emitted from the Wastewater Treatment and Discharge category are methane and nitrous oxide. They are the result of domestic and wastewater treatment and discharge. Because domestic wastewater treatment and discharge emissions depend on the population size, methane emissions gradually increase. On the other hand, nitrous oxide emissions are constant from 2012 to 2014, but show no particular long-term trend. Industrial wastewater treatment and discharge emission constantly increases from 2012 to 2014. However, when the time series 1990 – 2014 is taken into account, the variations disrupt any consistent pattern.

CH_4 emissions constitute 97.6% of the total emissions (in CO_2-eq) from the Waste sector in 2014 (Figure 16: GHG emissions from Waste sector, by gas (in Gg CO2-eq)). Moreover, the Solid Waste Disposal category is the single biggest contributor to these emissions with a share of 96.8%. Emissions of CO_2

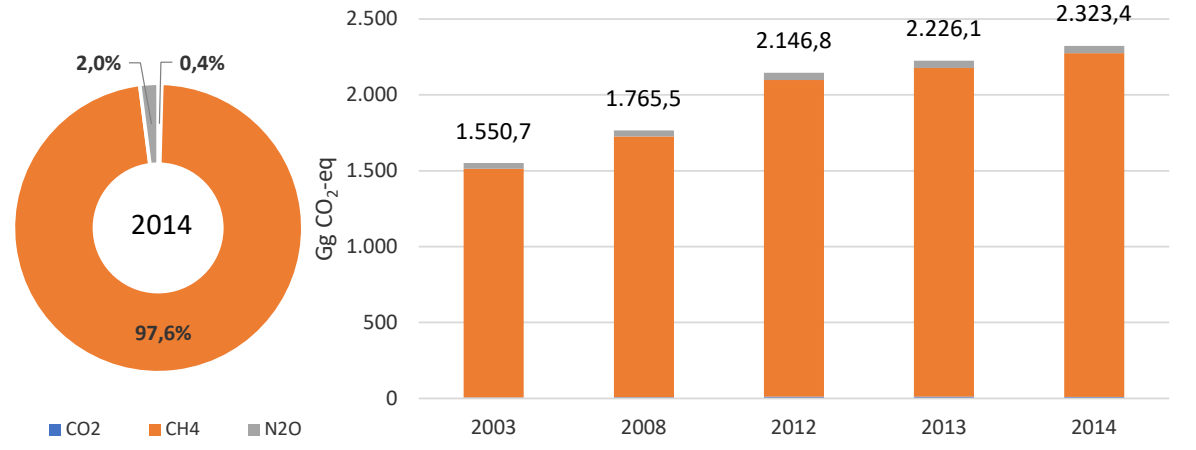


Figure 16: *GHG emissions from Waste sector, by gas (in Gg CO_2-eq)*

gases from the Waste sector in the country occur only as a result of Open burning of waste and account for 0.4% of the sectoral emissions. Nitrous oxide emissions display no variations with time and average approximately 47.7 Gg CO_2-eq for 2012 to 2014, or 2% of total Waste emissions.

3.6.1 COMMENTS ON WASTE SECTOR INPUTS

The Ministry of Environment and Physical Planning releases annual Quality of the Environment reports, which include amounts of composted waste. In the past, a number of facilities for the biological treatment of organic wastes, including biogas and composting installations, have been installed in the country. These vary in capacity and operation time. Only data on amounts of composted waste were available and used in the inventory. The industry product used as input in the category Industrial Wastewater Treatment and Discharge was obtained from the SSO Yearbook. All other data was used from the IPCC 2006 Guidelines.

In the Solid Waste Disposal sector, all of the population data from 1990 until 2014 has been revised. The revised data were also used for the categories Incineration and Open Burning of Waste and Domestic Wastewater Treatments and Discharge. All of the data for the years when population size had been estimated with a census are included. However, as no census has been conducted since 2002, the population size has been estimated by using information from reports from the SSO and the UN. Furthermore, the calculation of the national GDP was completed with data from UN and national reports.

Data on incinerated amounts of waste are available, but the emissions caused by this activity were not reported in the FBUR, and they are not included in this inventory, either. Nonetheless, these emissions should be provided in future reports, which should also include a revision of other components of the Waste sector. It should also be noted that in the FBUR, it was assumed that the nitrous oxide emission factor used in the FBUR was equal to the default value divided by 1000. This has been corrected in the SBUR, and the default emission factor has been used.

3.7 PRECURSORS AND INDIRECT EMISSIONS

Precursors and indirect emissions have been estimated in line with the EMEP/CORINAIR Emission Inventory Guidebook (referenced in the IPCC 2006 Guidelines) in a consistent, complete and comparable manner for the entire inventory period of 1990 – 2014. Trends in Indirect GHG emissions and SO_2 emissions in the country are presented in Figure 17: Emissions of NOx, CO, NMVOC and SO2 in the period 1990 – 2014 (in Gg). Emissions of SO_2 have a dominant share with 48.2% in 2014, followed by CO emissions (31.1%), NO_x emissions (11.3%), and NMVOC emissions (9.4%).

The assessment of the overall emissions (including AFOLU sector emissions) shows that the Energy sector is the most significant contributor of precursors and indirect GHG emissions: in 2014, 89.2% of total NO_x emissions originated in the Energy sector, followed by the IPPU sector (5.8%), the AFOLU sector (3.0%), and the Waste sector (2%). In addition, the Energy sector is responsible for 67.1% of CO emissions, while 15.6% are from the IPPU sector, 12.7% from the Waste sector and 4.6% from the AFOLU sector. When it comes to the emissions of NMVOC, the Energy sector is again most dominant, with 67.2%, while the sector AFOLU contributes a significant share of 27.9%, followed by the IPPU sector with 4.0% and the Waste sector with 0.9%. For SO_2 emissions, the major share (89.4%), again originates from the Energy sector, while the IPPU sector contributes 10.6%.

Detailed methodologies for estimating the emissions of precursors are provided in the EMEP/CORINAIR Emission Inventory Guidebook 2016. This guidebook has been developed for emission inventories of substances regulated under the UNECE Convention on Long-Range Transboundary Air Pollution (CLRTAP) and covers all source sectors and should therefore be considered as the primary source of information for the estimation of these emissions.

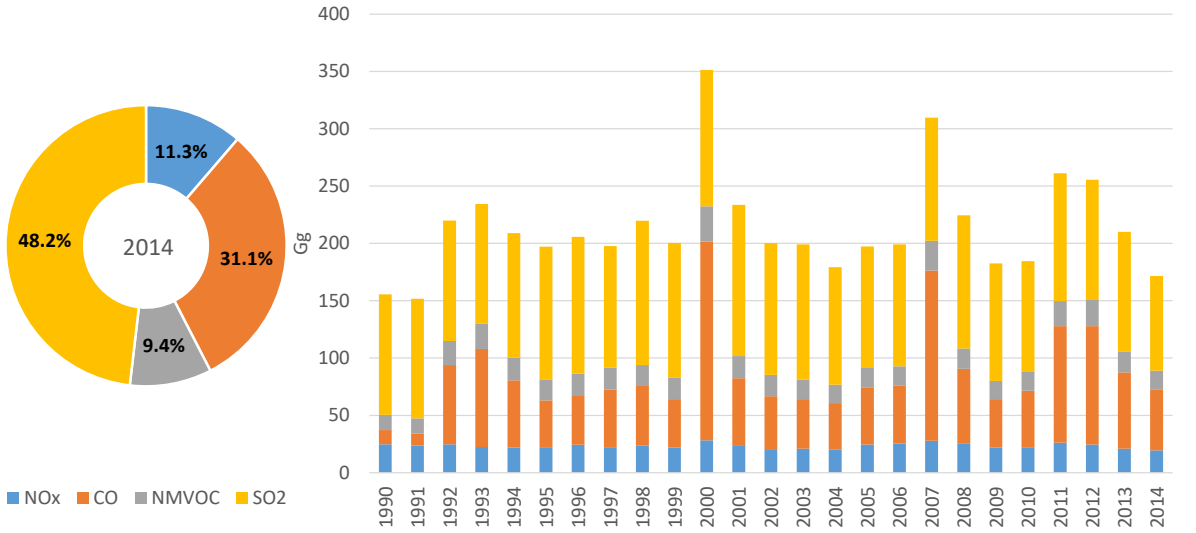


Figure 17: *Emissions of NOx, CO, NMVOC and SO2 in the period 1990 – 2014 (in Gg)*

3.8 UNCERTAINTY ANALYSIS

For this report, uncertainty analysis was conducted for the first time using both Approach 1 (the Error Propagation method) and Approach 2, which utilizes the Monte Carlo method, for all sectors of the inventory for 2012, 2013 and 2014. Figure 18: Comparison of Monte Carlo and IPCC Inventory Software method by subcategory for 2012 provides uncertainty levels for both methods.

Using the **Error Propagation method**, the results indicated that the AFOLU sector had the highest uncertainty, followed closely by the Waste sector. In both sectors, uncertainty in certain subcategories exceeded 40%. On the other hand, the sector with the lowest level of uncertainty was the Energy sector, with approximately 4%. This sector was followed by the IPPU sector, where the Metal Industry has a maximum uncertainty of approximately 9.8%. Using the **Monte Carlo method** the highest level of uncertainty by far occurred in the Waste sector, which exceeded 27% in all three analyzed years. This sector was followed by the AFOLU sector, where the greatest uncertainty occurred in the Live-

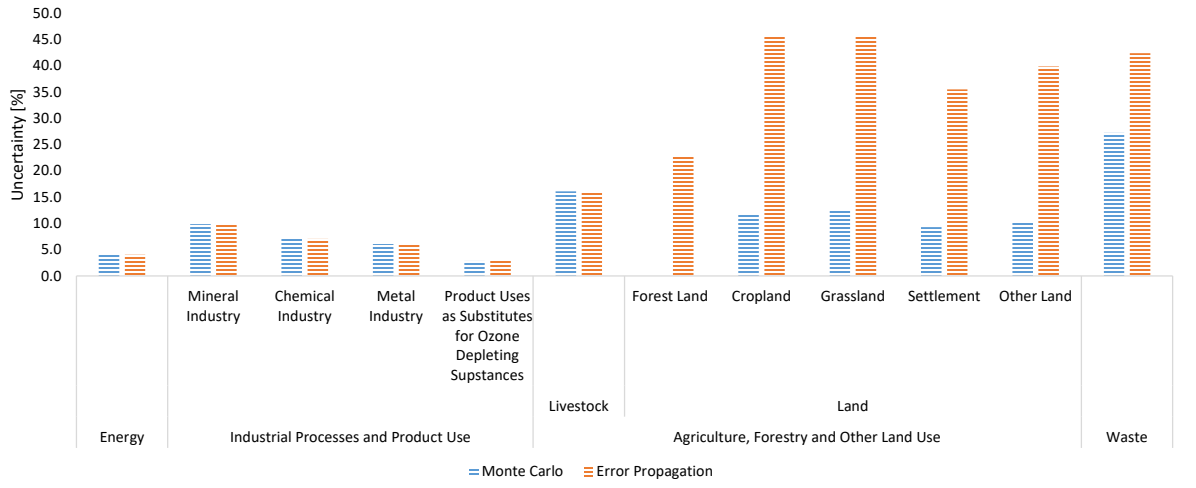


Figure 18: *Comparison of Monte Carlo and IPCC Inventory Software method by subcategory for 2012*

stock subcategories (approximately 16%). On the other hand, sectors with the lowest levels of uncertainty remained the same: the Energy sector had the lowest uncertainty, followed by the IPPU sector.

Figure 18: Comparison of Monte Carlo and IPCC Inventory Software method by subcategory for 2012 also compares the Monte Carlo and the Error Propagation method by subcategory. There are no significant differences in the results obtained for the Energy and IPPU sectors. There are no significant differences in the results obtained for the Energy and IPPU sectors. However, there are major differences in the other two sectors due to the inability to accurately assign uncertainty to all variables in the IPCC Inventory Software. This limitation stems from the fact that all uncertainty must be reduced to only two values (one for the activity data and one for the emission factor).

Obviously, these differences in the emissions by subcategory when using the two approaches leads to different uncertainty in the total annual emissions. However, the trend of uncertainty over time in both methods is the same; i.e., it increases with the growth of the share of sectors with higher uncertainty. Because the average emissions from all iterations in the Monte Carlo method is nearly equal to the actual estimates of the emissions, and because individual uncertainty for each variable may be used, it can be concluded that the results obtained from Approach 2 are much more relevant.

As it is presented, the highest uncertainty is in the Waste sector. This is primarily due to the large number of variables that have uncertainty, such as the total amount of municipal waste, the fraction of that amount sent to SWDS percentage wear landfill, methane correction factor, GPD and waste generation rate. Currently, regional waste management plans are in the process of preparation that can significantly contribute to uncertainty reduction in this sector. The data from these regional plans will be included in the preparation of the next GHG inventory.

Furthermore, there is great uncertainty in the Livestock subcategory. In this subcategory default emission factors are used, which according to the Guidelines have great uncertainty associated with them. If, in the future, national emission factors can be calculated, with lower uncertainty, it would significantly reduce the uncertainty in the sector. The Livestock category is followed by the remaining subcategories from the AFOLU sector, where the main source of uncertainty are the areas of each type of land, as well as the areas that have been converted to other area type. As stated in the Section 6, due to the inconsistencies in the data related to these subcategories, it is recommended to establish system for continuous monitoring and inventory for each type of land that will also contribute to uncertainty reduction. However, according to the Guidelines there is also high uncertainty in the values for annual biomass carbon growth and annual loss of biomass carbon.

3.9 QUALITY ASSURANCE / QUALITY CONTROL (QA / QC)

The Macedonian approach towards **QA/QC activities** in the national GHG inventory process is based on the in-depth analyses of the current practices of the inventory compilation in the country and the relevant international best practices. The resulting **QA/QC plan** was presented within the FBUR. It is applied in the same manner over the Inventory process of the SBUR, with an extension of QA activities within the energy sector. This QA/QC plan has proved effective in achieving QA/QC objectives, and as such is planned to be implemented for the inventory processes under forthcoming National Communications on Climate Change and Biennial Update Reports.

The Macedonian inventory process meets the necessary technical conditions for ensuring sustainability, since:

- A strong focus is put on documenting essential information in a concise format;
- Activities and tasks are standardized, and clear procedures are stipulated;
- Roles and responsibilities of all players are clearly defined.

The GHG inventory team has developed training materials on GHG inventory preparation developed by the GHG inventory team. These materials are country-specific, and they are based on personal

experience gathered and lessons learned during the GHG inventory preparation in Macedonian conditions, which can provide clear guidance for newcomers in the inventory process.

Finally, the National Inventory Report compiled in support of this SBUR included recommendations for further inventory improvements by sector for the Energy sector, the IPPU sector, the AFOLU sector, and the Waste sector. These recommendations address data collection, disaggregation of activity data, data from additional sub-categories, and the use of additional data sources, such as satellite imagery in the land-use sector. These recommendations are provided in Section 3.10.

The GHG inventory quality is assured introducing external expert review conducted by QA team members. They check, and if needed, propose corrective actions and verify the following:

- Adequacy of the selected activity data and emission factors,
- Adequacy of the applied methodologies,
- Accuracy and consistency of the calculated emissions,
- Adequacy of the data documentation,
- Correctness of the conducted Key Sources analysis and Uncertainty Management.

As a final step, the Chief Technical Adviser checks the National Inventory Report, proposes corrective actions if necessary, and verifies the National Inventory Report once the proposed corrective actions are implemented by the Inventory Development team members.

According to the IPCC Good Practice Guidance and Uncertainty Management in National GHG Inventories, priority in the QA process should be given to key source categories, as well as to source categories where there are significant changes in methods or data. Because the Energy and the Waste sectors are the most significant contributors to the Macedonian GHG inventory, an expert peer review was conducted for QA of the national GHG estimates of those sectors.

3.10 GOOD PRACTICES, IMPROVEMENTS, RECOMMENDATIONS

As a part of the preparation of the National Inventory Report, sectoral experts identified improvements in the current inventory and made recommendations for subsequent inventories.

3.10.1 IMPROVEMENTS

Improvements made in the GHG inventory for the SBUR in relation to the FBUR include the following:

- In the **Energy sector**, data were disaggregated in the Diesel and heating oil and Biomass categories. In addition, country-specific emission factors were used for lignite, residual fuel oil and natural gas in Energy sector, and Fuel combustion activities
- In the **IPPU sector**, the 1990-2012 estimates were revised in order to assure consistency throughout the time series, and estimates of F-gas emissions from refrigeration and air-conditioning were added.
- In the **AFOLU sector**, data for Dairy cows and other cattle have been corrected, and data have been disaggregated into different classes for sheep, swine, and poultry instead of using a single emission factor for each type of livestock.
- In the **Forestry sector**, two new categories of Forest land were introduced; growing stock level factors were modified for new and existing categories, improved satellite images for land use change were obtained for 2000, 2006, 2012; improved data for commercial and firewood removals were used; and improved and updated data from three different sources were used for burned forest area.

- In the **Waste sector**, supporting population data from 1990 to 2014 were revised; emissions from waste composting activities were calculated for 2012-2014 based on MOEPP data; the delay time for waste composition is now assumed to be 6 months; the nitrous oxide emission factor has been corrected; the percentage of waste deposited in disposal sites is now calculated based on data from the SSO rather than on a default value; and the estimation of the share of the population burning waste has been updated.

3.10.2 RECOMMENDATIONS

The inventory team made the following recommendations for improving future GHG inventories.

In the **Energy sector**:

- Establish a process for secure, continuous data collection with relevant institutions regarding the composition and carbon content of fuels. These arrangements could be formalized through a Memorandum of Understanding, and they would support the estimation of country-specific emission factors.
- Update activity data in compliance with the revised national Energy Balances for the period 2005 – 2014 that were published by the SSO in October 2016.
- Disaggregate activity data before 2005 for the Manufacturing industries and Construction category in the IPCC Inventory Software database in accordance with the SSO Energy balances.

In the **IPPU sector**:

- Include more detailed data regarding the carbon content of the feedstock in the cement production, lime production, and steel production sectors. These data can be gathered directly from industrial plants.
- Segregate data for F-gas emissions from refrigeration and air-conditioning by the specific part of the equipment life-cycle. These data should be collected by MOEPP.
- Include F-gas emissions from fire protection, aerosols and solvents, or reiterate that emissions from these categories are not occurring in the country.
- Include N_2O emissions from medical appliances.
- Include SF_6 emissions from use and disposal of electrical equipment.

In the **AFOLU sector**:

- Model typical farm size, systems and technology in order to support the use of Tier 2 methods, particularly in the Cattle sector and small pig farms (which are responsible for half of all swine production).
- Develop remote sensing (RS) and Earth Observation (EO) capacities in the country in order to calculate Land use changes, particularly through analysis of aerial photographs and satellite imagery.
- Assess Land Use and Land use changes annually, and maintain the geo-data collected in a publicly-accessible database.
- Lay the groundwork for higher Tier assessment of sectoral emissions/removals by conducting supporting measurements in areas such as field measurement of GHG emissions, land productivity dynamics (soil organic carbon), annual bio-productivity for perennial crops, and waste biomass management practices.
- Invest in capacity building for forest inventories, LULUC software, annual growth tables for species in the country, and monitoring systems for natural disturbances.

In the **Waste sector**:

- Include data from regional waste management plans, which are currently under preparation, in the calculation of the share of waste.
- Revise the percentage of waste deposited in disposal sites for the years prior to 2012 in the manner that it has been revised for 2012, 2013 and 2014.
- Estimate emissions from incineration the entire time series for which activity data are available.
- Consider changing the data source and categorization for certain data on industry production, due to inconsistency of data series (particularly in the Meat & Poultry category).
- Revise the share of waste not disposed in disposal sites for all years prior to 2012 for which data are available.

3.10.3 INCORPORATION OF UNFCCC TECHNICAL ANALYSIS RECOMMENDATIONS

Table 5: Response to FBUR Technical Analysis provides an overview of issues identified in the FBUR and a description of how they have been addressed in the SBUR.

Table 5: *Response to FBUR Technical Analysis*[6]

Decision	Reporting requirements	Yes/ Partly/No	Comments on the extent of the information provided	Response to the comments
Decision 2/CP.17, paragraph 41(g)	The first BUR shall cover, at a minimum, the inventory for the calendar year no more than four years prior to the date of the submission, or more recent years if information is available	Yes	The inventory covers the period 1990–2012	
Decision 2/CP.17, annex III, paragraph 5	The updates of the sections on the national inventories of anthropogenic emissions by sources and removals by sinks of all GHGs not controlled by the Montreal Protocol should contain updated data on activity levels based on the best information available using the Revised 1996 IPCC Guidelines for National GHG Inventories, the IPCC good practice guidance and Uncertainty Management in National GHG Inventories, and the IPCC good practice guidance for LULUCF; any change to the emission factor may be made in the subsequent full national communication	Partly	The Party reports in the BUR that the activity data were updated and the 2006 IPCC Guidelines were used for the period 1990–2012. However, neither the updated activity data nor the emission factors used are provided in the BUR	AFOLU sector: Activity data is provided in Annex 2, and all emission factors are specified in Annex 4.
Decision 2/CP.17, annex III, paragraph 9	The inventory section of the BUR should consist of a national inventory report as a summary or as an update of the information contained in decision 17/CP.8, annex I, chapter III (National greenhouse gas inventories), including:	Partly	The BUR provides an update of the inventory section in the third national communication submitted in 2014, in which 2003–2009 is the inventory time frame. However, some information in tables 1 and 2 is missing	Summary inventory tables are provided in Annex 1 for the years 1990, 1994, 2000, 2003, 2008, 2012, 2013 and 2014.
	Table 1 (National greenhouse gas inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol and greenhouse gas precursors)	Partly	Provided for 1990 and 2012. Macedonia includes table 1 in annex 2 to the BUR, but the table does not provide the disaggregated information for LULUCF	The LULCF activity data are provided for general categories; a further breakdown is not provided
	Table 2 (National greenhouse gas inventory of anthropogenic emissions of HFCs, PFCs and SF_6)	Partly	A table containing F-gases is provided in annex 2 to the BUR, but only PFCs from the metal industry are estimated	PFC emissions from aluminum production are estimated and included in the inventory. HFC emissions from refrigeration and air-conditioning are estimated and included in the inventory.

6 Source of Comments: "Summary Report on the Technical Analysis of the first biennial update report of the Former Yugoslav Republic of Macedonia submitted on 26 February 2015." FCCC/SBI/ICA/2015/TASR.1/MDK (29 September 2015). UNFCCC.

Decision	Reporting requirements	Yes/ Partly/No	Comments on the extent of the information provided	Response to the comments
Decision 2/CP.17, annex III, paragraph 6	Non-Annex I Parties are encouraged to include, as appropriate and to the extent that capacities permit, in the inventory section of the BUR:			
	Tables included in annex 3A.2 to chapter 3 of the IPCC good practice guidance for LULUCF	No	The tables are not reported in the BUR	Tables are not provided, but in due time can be generated
	The sectoral report tables annexed to the Revised 1996 IPCC Guidelines	No	The tables are not reported in the BUR	Tables are not provided, but in due time can be generated
Decision 2/CP.17, annex III, paragraph 7	Each non-Annex I Party is encouraged to provide a consistent time series back to the years reported in the previous national communications	Yes	Provided in table 3-1 of the BUR	
Decision 2/CP.17, annex III, paragraph 8	Non-Annex I Parties that have previously reported on their national GHG inventories contained in their national communications are encouraged to submit summary information tables of inventories for previous submission years (e.g. for 1994 and 2000)	Partly	Annex 2 to the BUR contains this information; however, it includes it only for the years 1990 and 2012. The previously submitted national communications cover the periods 1990–1998, 1999–2002 and 2003–2009	Summary inventory tables are provided in Annex 1 for the years 1990, 2003, 2008, 2012, 2013 and 2014
Decision 2/CP.17, annex III, paragraph 10	Additional or supporting information, including sector-specific information, may be supplied in a technical annex	Yes	Sector-specific information is provided in sections 3.3–3.6 of the BUR	
Decision 17/CP.8, annex, paragraph 13	Non-Annex I Parties are encouraged to describe procedures and arrangements undertaken to collect and archive data for the preparation of national GHG inventories, as well as efforts to make this a continuous process, including information on the role of the institutions involved	Yes	The information is provided in section 3.1 of the BUR	

Decision	Reporting requirements	Yes/ Partly/No	Comments on the extent of the information provided	Response to the comments
Decision 17/CP.8, annex, paragraph 14	Each non-Annex I Party shall, as appropriate and to the extent possible, provide in its national inventory, on a gas-by-gas basis and in units of mass, estimates of anthropogenic emissions of the following gases by sources and removals by sinks:			Summary inventory tables are provided in Annex 1for the years 1990, 2003, 2008, 2012, 2013 and 2014
	▪ CO_2	Yes	Provided for 1990 and 2012 in table 1 of annex 2 to the BUR	/
	▪ CH_4	Yes	Provided for 1990 and 2012 in table 1 of annex 2 to the BUR	/
	▪ N_2O	Yes	Provided for 1990 and 2012 in table 1 of annex 2 to the BUR	/
Decision 17/CP.8, annex, paragraph 15	Non-Annex I Parties are encouraged, as appropriate, to provide information on anthropogenic emissions by sources of HFCs, PFCs and SF_6	Partly	A table containing F-gases is provided in annex 2 to the BUR, but only PFCs from the metal industry are estimated	PFC emissions from aluminum production are estimated and included in the national GHG inventory. HFC emissions from refrigeration and air-conditioning are estimated and included in the national GHG inventory.
Decision 17/CP.8, annex, paragraph 19	Non-Annex I Parties should, to the extent possible, and if disaggregated data are available, report emissions from international aviation and marine bunker fuels separately in their inventories:			
	▪ International aviation	Yes	Provided for 1990 and 2012	/
	▪ Marine bunker fuels	Yes	Provided for 1990 and 2012	NA
Decision 17/CP.8, annex, paragraph 16	Non-Annex I Parties are encouraged, as appropriate, to report on anthropogenic emissions by sources of other GHGs such as:			
	▪ CO	No	Although the BUR indicates that CO is included in the inventory database	Included in summary inventory tables in Annex 1
	▪ NO_x	No	Although the BUR indicates that NO_x is included in the inventory database	Included in summary inventory tables in Annex 1
	▪ NMVOCs	No	Although the BUR indicates that NMVOCs are included in the inventory database	Included in summary inventory tables in Annex 1

Decision	Reporting requirements	Yes/ Partly/No	Comments on the extent of the information provided	Response to the comments
Decision 17/CP.8, annex, paragraph 17	Other gases not controlled by the Montreal Protocol, such as SO_x, included in the Revised 1996 IPCC Guidelines, may be included at the discretion of the Parties	No	Although the BUR indicates that SO_2 is included in the inventory database	Emissions of SO_2 are included in the inventory
Decision 17/CP.8, annex, paragraph 21	Non-Annex I Parties are encouraged to provide information on methodologies used in the estimation of anthropogenic emissions by sources and removals by sinks of GHGs not controlled by the Montreal Protocol, including a brief explanation of the sources of emission factors and activity data. If non-Annex I Parties estimate anthropogenic emissions and removals from country-specific sources and/or sinks that are not part of the Revised 1996 IPCC Guidelines, they should explicitly describe the source and/or sink categories, methodologies, emission factors and activity data used in their estimation of emissions, as appropriate. Parties are encouraged to identify areas where data may be further improved in future communications through capacity-building:			
	▪ Information on methodologies used in the estimation of anthropogenic emissions by sources and removals by sinks of GHGs not controlled by the Montreal Protocol	Partly	The methodological tier used (1 or 2) for most sources and sinks is indicated in the BUR. However, this information is missing for some sources (e.g. managed soils), and the calculation equations are not provided	The methodologies applied in the inventory are summarized in A II.2, Table 72. All emissions are generated by IPCC InventorySoftware. Explanation for the software background equations is needed.
	▪ Explanation of the sources of emission factors	Yes		
	▪ Explanation of the sources of activity data	Yes		
	▪ If non-Annex I Parties estimate anthropogenic emissions and removals from country-specific sources and/or sinks that are not part of the Revised 1996 IPCC Guidelines, they should explicitly describe:	NA	The Party did not report on any country-specific sources or sinks	NA
	▪ Source and/or sink categories	o		
	▪ Methodologies	o		

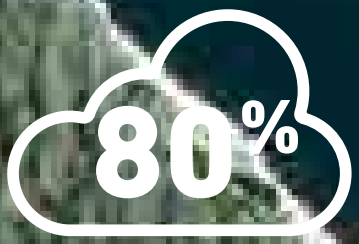
Decision	Reporting requirements	Yes/ Partly/No	Comments on the extent of the information provided	Response to the comments
	▪ Emission factors	o		
	▪ Activity data	o		
	▪ Parties are encouraged to identify areas where data may be further improved in future communications through capacity-building	Yes	An improvement plan is presented	
Decision 17/CP.8, annex, paragraph 24	Non-Annex I Parties are encouraged to provide information on the level of uncertainty associated with inventory data and their underlying assumptions, and to describe the methodologies used, if any, for estimating these uncertainties:			
	Level of uncertainty associated with inventory data	Yes	Although very general, a summary is provided on the level of uncertainty for the inventory and also the trend of uncertainties. Uncertainties at the sector or subsector levels are not provided	
	Underlying assumptions	No	No information is provided on assumptions applied, such as the use of IPCC default values	Detailed tables with assumptions applied are provided in the chapter for Uncertainty analysis
	Methodologies used, if any, for estimating these uncertainties	Yes	The use of the IPCC Inventory Software to apply a Monte Carlo algorithm is indicated, but additional details are not provided	

Abbreviations: BUR = biennial update report, F-gas = fluorinated gas, GHG = greenhouse gas, IPCC = Intergovernmental Panel on Climate Change, IPCC good practice guidance = ***Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories***, IPCC good practice guidance for LULUCF = ***Good Practice Guidance for Land Use, Land-Use Change and Forestry***, LULUCF = land use, land-use change and forestry, NA = not applicable, NMVOC = non-methane volatile organic compound, Revised 1996 IPCC Guidelines = ***Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories***, 2006 IPCC Guidelines = *2006 IPCC Guidelines for National Greenhouse Gas Inventories.*

CLIMATE CHANGE MITIGATION AND ACTION PLAN

Modelling and analysis of the mitigation potential in Macedonia is based on three scenarios for the period 2012 to 2035:

- a reference scenario, called **SURVIVAL**
- a mitigation scenario, called **SAFEWAY**
- a more ambitious scenario, called **CLIMATE CHAMPION**



Approximately 80% of all emission reductions can be achieved through the implementation of 'win-win' measures, i.e. policies and measures that will not only reduce emissions but also create financial savings.

Over 6,200 green jobs could be created by 2035 as a result of energy efficiency measures in buildings and the low-carbon energy market. This makes the measures 'win-win-win' measures, since they generate economic, environmental and other additional benefits.

THE PROCESS IN A NUTSHELL

- Scenarios prepared by a highly qualified team of NATIONAL EXPERTS (17 persons; i.e., 40% women) and 1 international expert
- Used a wide participatory approach, involving:
  - 30 institutions (13 governmental Institutions, 5 international organizations, 6 NGOs, 5 academic institutions and 2 private companies)
  - 124 persons (56% women)
- Relevant data has been provided from 12 institutions, with the State Statistical Office being the most important source of data
- Sustainability enhanced: 2 new persons trained in developing the assessment of national mitigation potential.

CHAPTER 4 CLIMATE CHANGE MITIGATION AND ACTION PLAN

4.1 OVERVIEW

The climate change mitigation analysis conducted in the Second Biennial Update Report (SBUR) builds upon and continues the analyses of previous studies: Third National Communication (TNC), First Biennial Update Report (FBUR) and the Intended Nationally Determined Contributions (INDC).[1]

All sectors recognized by the IPCC methodology (Energy, Industrial Processes and Product Use, Agriculture, Forestry and Other Land Use and Waste) have been modelled in the SBUR in order to assess the mitigation potential of certain measures and policies.

Modelling and analysis are based on three scenarios: 1) A reference scenario, the **Scenario without Measures** (WOM); 2) a mitigation scenario, the **Scenario with Existing Measures** (WEM); and 3) a more ambitious mitigation scenario, the **Scenario with Additional Measures** (WAM). Modelling has been conducted for the period from 2012 to 2035. In outreach materials, the WOM, WEM, and WAM scenarios are also referred to as the Survival, Safe Way, and Climate Champion scenarios, respectively, in order to make them more accessible to a broad audience.

The mitigation measures in the WEM and WAM scenarios were selected from national strategic and planning documents. A total of 46 measures (35 in the Energy sector, 8 in the AFOLU sector, and 3 in the Waste sector) were prioritized by assessing their economic effectiveness, or specific cost (expressed in EUR/t CO_2-eq), as well as their environmental effectiveness, or mitigation potential (expressed in t CO_2-eq). Key findings include the following:

- In the WOM scenario, there is a gradual increase in emissions from 2012 until 2035. Emissions in 2035 amount to 25,585 Gg CO_2-eq, which is a 49% increase compared to the emissions in 2012. While the Energy sector has the largest share of total emissions through the time period (68% in 2035), the Waste sector shows the biggest growth in emissions with an increase of approximately 130%.

1 All documents are available at the following link: http://klimatskipromeni.mk/Default.aspx?LCID=213

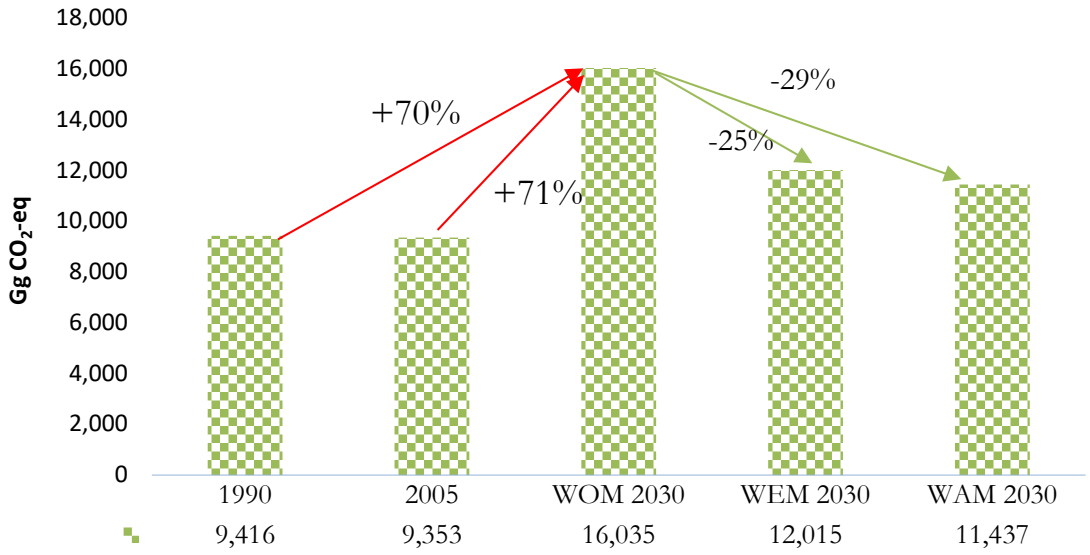


Figure 19: *Comparison of GHG emissions from the Energy sector in 1990 and 2005 with emissions in 2030 in the WOM, WEM and WAM scenarios (Gg CO2-eq)*

- In the WEM and WAM Scenarios, total GHG emissions in 2035 drop by 25.2% and 27.8% respectively, when compared to the WOM scenario. The GHG emissions occurring in WEM in 2035 are only 2.6% higher than in 2012, while the 2035 emissions in WAM decrease by 14% when compared to 2012.
- The peak year for emissions in both the WEM and the WAM scenarios is 2032, when the emissions reach 18,130 CO2-eq in the WEM scenario and 17,510 CO2-eq in the WAM scenario.
- The Energy sector still predominates in both mitigation scenarios, with a share of total emissions in 2035 of 60.9% (WEM) and 53.8% (WAM). However, compared to the reference scenario, emissions in the WEM scenario are 25% lower, and the emissions in the WAM scenario are 29% lower in 2030 (Figure 19: Comparison of GHG emissions from the Energy sector in 1990 and 2005 with emissions in 2030 in the WOM, WEM and WAM scenarios (Gg CO2-eq)). For this reason, the majority of the suggested mitigation measures and policies are related to the Energy sector.

Figure 19: Comparison of GHG emissions from the Energy sector in 1990 and 2005 with emissions in 2030 in the WOM, WEM and WAM scenarios (Gg CO2-eq) compares the level of GHG emissions in the Energy sector in 2035 for all three scenarios compared to the base year of 1990 and the year 2005.

It is important to note that approximately 80% of all emission reductions can be achieved through policies and measures with negative specific costs, known as **win-win measures**. The implementation of these measures not only reduces emissions, but creates financial savings as well. Furthermore, these policies and measures were analyzed in light of their **potential for green job creation**. It is estimated that over 6,200 green jobs will be created by 2035 as the result of energy efficiency measures in buildings and the low-carbon energy market (renewable energy and gas). That makes the measures "win-win-win" measures, because they generate economic, environmental, and additional benefits.

Furthermore, the mitigation team compared findings from the mitigation scenarios in the FBUR and this SBUR with Macedonia's Intended Nationally Determined Contributions (INDC). It was not possible to compare the scenarios directly with the INDC due to the absence of CH_4 and N_2O in the INDCs, the different way in which electricity imports are handled, and different reference cases.

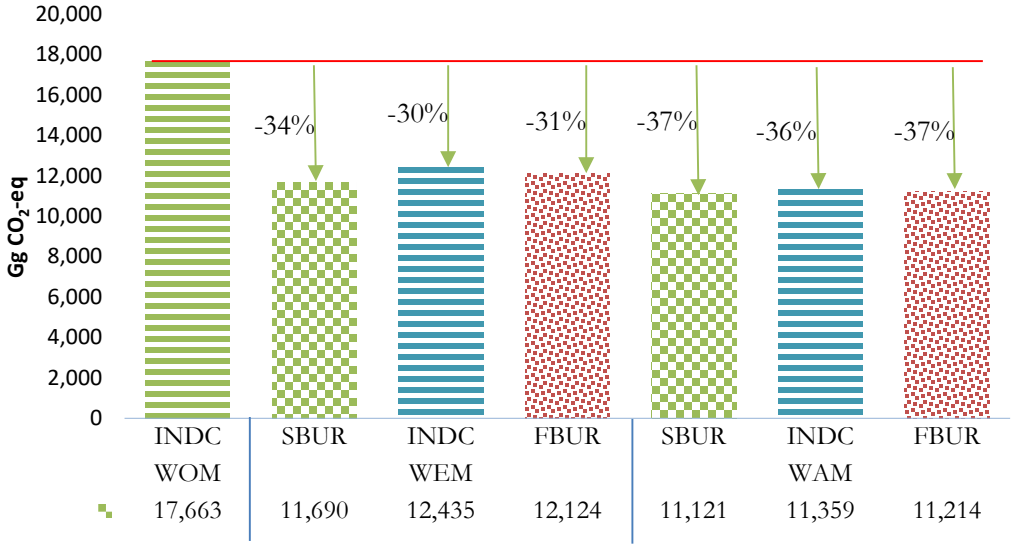


Figure 20: *Comparison of the SBUR, INDC and FBUR, Mitigation and the WAM scenario for the Energy sector with the INDC Reference scenario, 2030 (in Gg CO_2-eq)*

However, the mitigation team developed a comparison that addressed these issues by including only CO_2 emissions and disregarding electricity imports. The results from the comparison are displayed in Figure 20: Comparison of the SBUR, INDC and FBUR, Mitigation and the WAM scenario for the Energy sector with the INDC Reference scenario, 2030 (in Gg CO2-eq).

Finally, the Mitigation team for the SBUR launched **two studies on reducing energy consumption and GHG emissions in different energy end use sectors.** The first study[2] examined what would happen if **more stringent mitigation measures in the transport sector** were implemented in addition to those in the two mitigation scenarios. The second study analyzed **ways to reduce GHG emissions from household heating and at the same time reduce local pollution in the city of Skopje**.[3] The studies should be completed by the end of 2017, and their findings will be presented in the next BUR.

4.1.1 ECONOMIC IMPLICATIONS OF SCENARIOS

Figure 21: Total investment costs in WOM, WEM and WAM scenarios (in mill. EUR) shows the additional investment costs of the two mitigation scenarios for the **Energy sector**. While investment costs in the WOM reference scenario for the energy sector in the period 2017-2035 totaled EUR 27,688 million, the WEM scenario is EUR 2,056 million costlier at EUR 29,744 million. Total investment costs in the WAM scenario are EUR 2,203 million higher than in the reference scenario, totaling EUR 29,891 million. In terms of costs for implementing the mitigation measures in the WEM scenario, investments of EUR 17,056.8 million are needed in the Energy sector for the period 2017-2035. Similarly, investments in the Energy sector in the WAM scenario total EUR 22,638.0 million. In the WEM scenario, average annual investments would total approximately 6.75% of average annual GDP (EUR 13,000 million), while in the WAM scenario they would total 8.96%. If investments from the private sector are disregarded, investments for the period 2017-2035 total EUR 2,604.2 million in the WEM scenario and EUR 5,220.4 million in the WAM scenario (i.e. the amount that is to be provided by the national budget, municipalities, the City of Skopje, and AD-ELEM, a government-owned utility).

In the **AFOLU sector**, two proposed mitigation measures in the **Forestry** category were analyzed. These measures pertain to better forest management to promote sustainability: 1) afforestation of

2 Study for the Transport Sector – Analyses of Policies and Measures, or STUTRA.

3 Study on the Heating in the City of Skopje Analysis of Policies and Measures, or STUGRES.

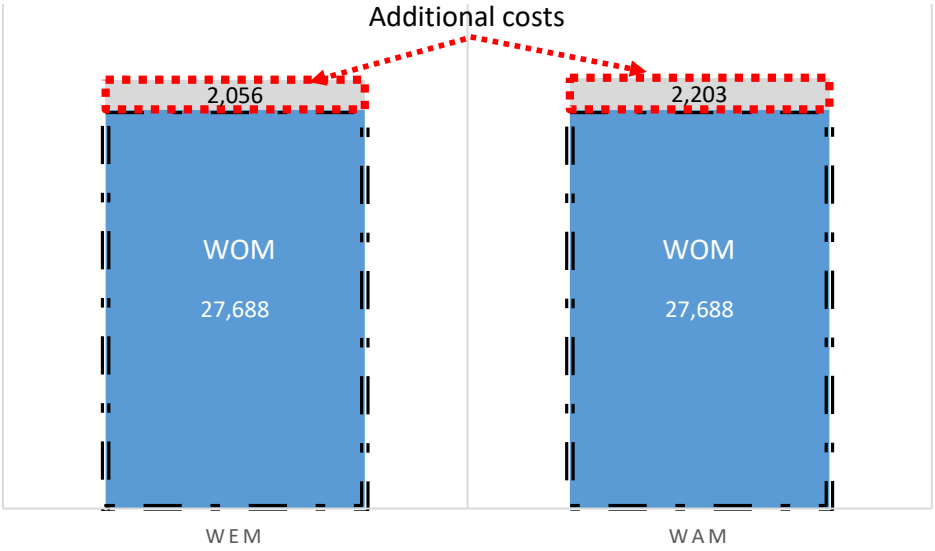


Figure 21: *Total investment costs in WOM, WEM and WAM scenarios (in mill. EUR)*

transitional forest surfaces; and 2) reduction of the area damaged by forest fires. For the realization of these two forestry measures during the period from 2017 to 2035, investments of EUR 56 million are needed. In the Livestock category, three measures for GHG mitigation were analyzed that were related livestock production. When defining these measures, it was important that they be easy to implement and that they not be based on specific strategies and policies or long-term subsidies. As a result of the implementation of these measures, total GHG emissions in 2035 would be 590.52 Gg CO_2-eq. For their realization, investments of EUR 2.2 million are needed. In the Land category, three mitigation measures were envisaged aimed at reducing land erosion and increasing organic matter in the soil. Their proper implementation could reduce emissions in this area by 20% by 2035 (410.05 Gg CO_2-eq). For the realization of these measures, investments of EUR 3.5 million are needed.

In the **Waste sector**, total GHG emissions are projected to increase by 97% in 2035 (4.944 Gg CO_2-eq) compared to 2012, where emissions from the sub-category Solid Waste Disposal remained the largest, with a share of 97.4% in 2035 (94.3% in 2012). To reduce the emissions in this sector, three measures have been proposed: opening new regional landfills, closure of existing landfills and use of methane combustion; and waste sorting. It is predicted that through these measures the greenhouse gas emissions in 2035 will decrease by 7% compared to the emissions in the WOM scenario. For the realization of these three measures, investments worth EUR 93 million are needed.

4.1.2 COMMENTS ON THE MITIGATION ANALYSIS

Modeling and analysis in this SBUR feature significant improvements and upgrades, such as the following: the harmonization of all sectors and categories with IPCC methodology (the sectors are now identical to the GHG inventory, making it easier to follow trends); use of a single IPCC methodology for GHG emission calculations in all sectors; integration of separate sectoral models[4] by introducing inter-sectoral connections on the basis of key drivers common to all sectors (Figure 22: Cross-sectoral binding); and the use of a unified methodology when creating mitigation policies/measures, which allows an integrated preview of the results from the WAM and WEM scenarios.

4 In previous national reports on climate change, the analysis of some sectors was conducted with MARKAL, some with GACMO, and others according to other methodologies; all of them used different input data.

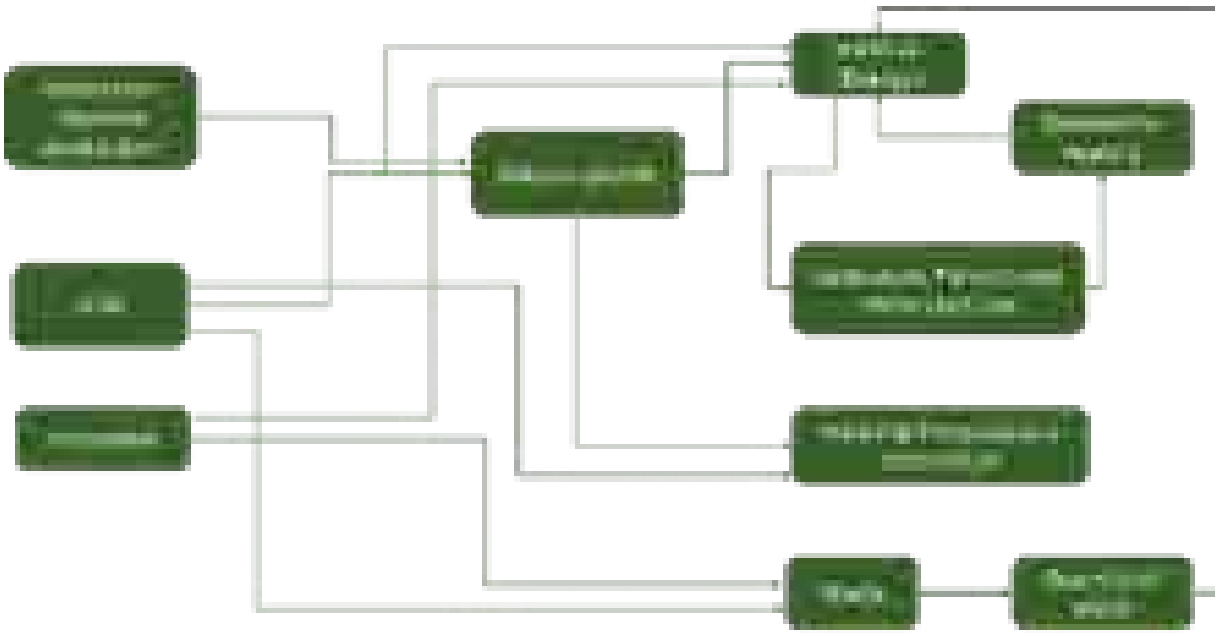


Figure 22: *Cross-sectoral binding*

In addition to these improvements and upgrades in the modelling, the private sector and the government were actively included in the process of preparing and selecting policies and measures. In that regard, a series of meetings was organized in order to ensure familiarity with and alignment of the attitudes of different actors towards the proposed policies and measures.

4.2 SCENARIO WITHOUT MEASURES (WOM SCENARIO)

The WOM scenario is a reference case that has been substantially updated from the FBUR. It should be noted that this scenario has no likelihood of occurrence because it implies, for example, that the efficiencies of household appliances in 2035 will be same as appliances used in 2012. Nevertheless, this scenario is of crucial importance, because it allows all measures to be compared to one reference option, and it allows for the various effects (financial, environmental, energy-related) of a certain measure or policy to be compared.

4.2.1 ASSUMPTIONS

The WOM reference scenario contains several **key assumptions**:

- Average annual GDP growth is 4.3%
- Domestic fuel prices correspond to the prices from the Energy Regulatory Commission for 2012-2015 and foreign fuel prices correspond to estimates in the 2015 and 2016 editions of *World Energy Outlook*[5]
- Electricity prices are 35-45 EUR/MWh in the near term (4-5 years) with a subsequent increase to 70 EUR/MWh in 2035
- There is an emissions factor for imported electricity (this has been done in order to avoid treating electricity imports as a mitigation measure).
- In the Mineral Industry, Metal Industry, and Chemical Industry categories, emissions are primarily dependent on the increase in added value in those industries.

5 OECD/IEA 2015, 2016.

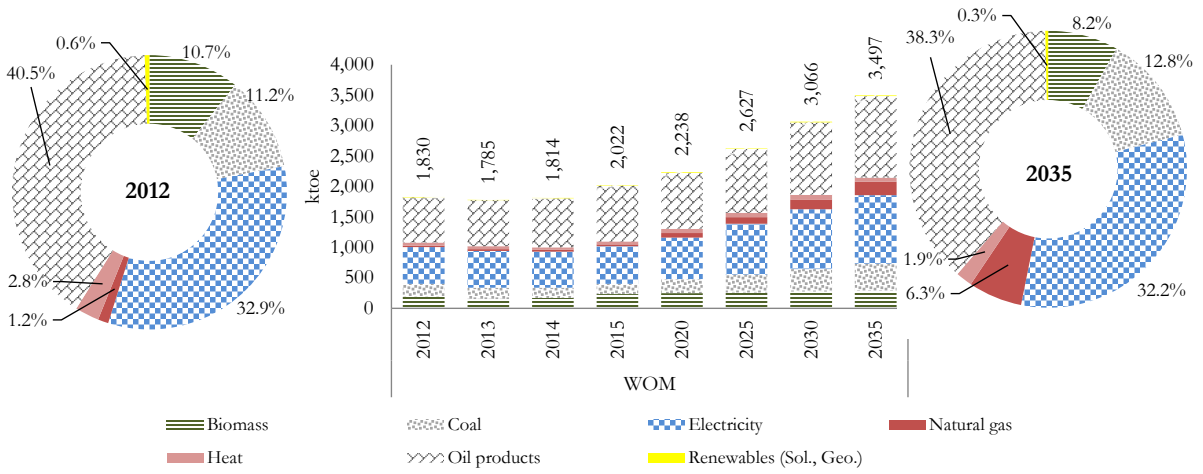


Figure 23: *Final energy consumption by fuels (in ktoe)*

- In the Product Uses as Substitutes for ODS category, all imported appliances are assumed to emit 100% of their emissions in the first year of operation.
- In the Livestock sector, GHG emissions will decrease by 10% over 20 years due to increases in productivity and a reduction in the number of livestock.
- There will be very little or no change in the amount of forested land, and annual losses from forest fires will be equal to the average annual loss over the past 15 years. Annual harvests in forests will also be equal to the average annual harvest over the past 15 years.
- In the Waste sector, the average amount of waste per capita in the country will increase over 20 years, while the average amount of waste per capita in the EU-28 will decrease until, in 2035, Republic of Macedonia will converge with the EU-28 average.

4.2.2 RESULTS

Based on the projections of useful energy and taking into account the available technologies in 2012 in the country in all sectors on the demand side, the MARKAL model, based on least-cost criteria, determines the final energy consumption by 2035. The results obtained for **final energy consumption by fuel** (Figure 23: Final energy consumption by fuels (in ktoe)) indicate the following:

- Final energy consumption under the WOM scenario increases by 91% from 2012 to 2035.
- Annual growth in energy consumption averages 2.9%
- The share of natural gas increases from 1.2% in 2012 to 6.3% in 2035
- The share of biomass decreases by 2.5%, oil products by 2.2%, and heat by 0.9%.

4.2.3 GREENHOUSE GAS EMISSIONS IN THE WOM SCENARIO

Overall results in the WOM scenario (Figure 24: Total GHG emissions by sectors - WOM scenario (in Gg CO2-eq)) were as follows:

- GHG emissions increased continually from 2015 to 2032
- GHG emissions increased by 49% in 2035 compared to 2012
- Annual emissions in 2035 totaled 25,585 Gg CO_2-eq

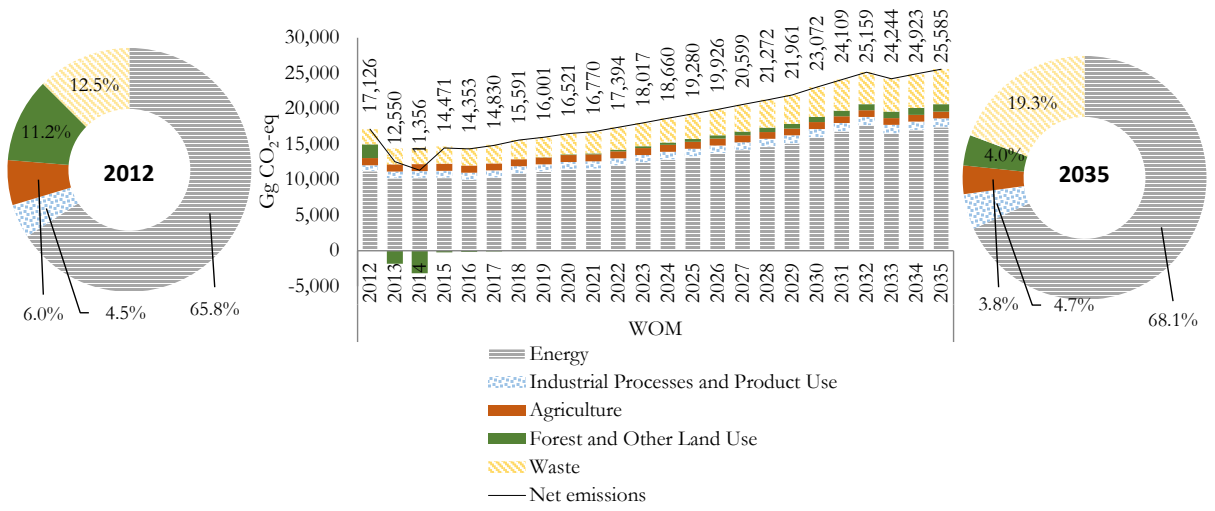


Figure 24: *Total GHG emissions by sectors - WOM scenario (in Gg CO_2-eq)*

- The Energy sector was the source of the largest share of GHGs (68%) in 2035 (compared to 66% in 2012)
- The Waste sector experienced the highest increases in GHGs (130%) in the period 2012-2035
- Instead of sequestering CO_2 emissions, the Forestry category became a source of net emissions as of 2019, which indicated that the use of biomass in the country would be unsustainable.

In individual sectors, the WOM results identified the following:

- In the Energy sector, growth in emissions was uninterrupted throughout the entire period, leading to a 56% increase in sectoral GHG emissions in 2035 compared to 2012
- In the IPPU sector, emissions in 2035 increased by approximately 55% compared to 2012.
- In the AFOLU sector, methane emissions decreased by about 6.3%, primarily due to the reduction of population in ruminant animals. N_2O emissions from manure management decrease by 11.3%. Finally, emissions from the AFOLU sector as a whole in the WOM scenario in 2035 were 32% lower than emissions in 2012 (this last result is due to the fact that the year 2012 experienced unusually large forest fires, resulting in GHG emissions, rather than carbon sequestration in forests).
- In the Waste sector, the largest emissions remained in the Solid Waste Disposal subcategory, with a 97.4% share of emissions in 2035.

4.3 POSSIBLE MITIGATION MEASURES

While the FBUR analyzed 18 measures in its scenarios, the SBUR has expanded the number of measures considered to 46. Table 6: Overview of mitigation measures selected for inclusion in the WAM and/or WEM scenarios provides an overview of these mitigation measures by sector and scenario, and it includes a description of the policies / measures involved. Annexes 5 and 6 contain more detailed information on the scope of the measures, their estimated impacts, the methodologies used for these estimates, and—for existing measures—the status of implementation.

Table 6: *Overview of mitigation measures selected for inclusion in the WAM and/or WEM scenarios*

IPCC SECTOR	ACTION AND SCENARIO	DESCRIPTION
Energy — Energy Industries	Reduction of distribution losses (WEM and WAM)	Operating and constructive measures necessary for losses reduction, implemented by distribution networks operators. Energy suppliers and distribution companies are required to achieve a certain amount of annual energy savings at the end-user level.
Energy — Energy Industries	Large hydro power plants (WEM and WAM)	Construction of new large hydro power plants
Energy — Energy Industries	Small hydro power plants. (WEM and WAM)	Construction of new small hydro power plants and introduction of flexible feed-in premium tariffs to stimulate the construction
Energy — Energy Industries	Solar power plants (WEM and WAM)	Construction of solar power plants (larger than 10 kW) and introduction of flexible feed-in premium tariffs to stimulate the construction
Energy — Energy Industries	Solar rooftop power plants (WEM and WAM)	Construction of solar rooftop power plant and introduction of "net metering"
Energy — Energy Industries	Wind power plants (WEM and WAM)	Construction of wind power plants and introduction of flexible feed-in premium tariffs to stimulate the construction
Energy — Energy Industries	Biogas power plants (WEM and WAM)	Construction of biogas power plants and introduction of flexible feed-in premium tariffs to stimulate the construction
Energy — Energy Industries	Biomass power plants (CHP optional) (WEM and WAM)	Construction of biomass power plants (CHP optional) and introduction of flexible feed-in premium tariffs to stimulate the construction
Energy — Energy Industries	Bitola district heating (WEM and WAM)	Construction of district heating system in Bitola and utilization of the waste heat from TPP Bitola
Energy — Energy Industries	Natural gas power plants (CHP) (WAM only)	Construction of natural gas power plants (CHP)
Energy — Residential and Non-Specified	Solar thermal collectors (WEM and WAM)	Installation of solar thermal collectors for hot water
Energy — Residential and Non-Specified	Labeling of electric appliances and equipment (WEM and WAM)	Labeling of electric appliances and equipment to provide relevant information on the energy consumption of the products. The application of the labeling and eco-design of the products is necessary to ensure that the products sold in the country are in compliance with the EU regulations.
Energy — Residential and Non-Specified	Phasing out of resistive heating devices and introduction of more heat pumps (WAM only)	Phasing out heating devices with resistive heaters and their replacement with heat pumps in compliance with EU Climate and Energy Policy
Energy — Residential and Non-Specified	Public awareness campaigns and network of EE Info Centers (WEM and WAM)	Establishment of EE info centers in municipalities or regional centers, in which energy advisors will operate, will share free advice to the interested citizens about the possibilities of saving energy and saving money in their homes

IPCC SECTOR	ACTION AND SCENARIO	DESCRIPTION
Energy — Residential	Retrofitting existing residential buildings (WEM and WAM)	Reconstruction of residential buildings including windows replacement, initiated by the owners and/ or supported by commercial banks and funds which exist in the Republic of Macedonia This measure will provide issuing of certificates for energy performance of buildings, as a prerequisite for commissioning the reconstructed buildings.
Energy — Residential and Non-Specified	Retrofitting existing public buildings (WEM and WAM)	Reconstruction including windows replacement of existing public buildings under jurisdiction of the central government or municipal government. This measure will provide issuing of certificates for energy performance of buildings, as a prerequisite for commissioning the reconstructed buildings.
Energy — Non-Specified	Retrofitting existing commercial buildings (WEM and WAM)	Reconstructions of existing commercial buildings including windows replacement, initiated by the owners and/or supported by commercial banks and funds which exist in the Republic of Macedonia This measure will provide issuing of certificates for energy performance of buildings as a prerequisite for commissioning the reconstructed buildings.
Energy — Residential	Construction of new buildings (WEM and WAM)	Construction of new buildings in compliance with the Directive on energy performance in buildings. This measure will provide issuing of certificates for energy performance of buildings, as a prerequisite for putting the building into operation
Energy — Residential	Construction of passive buildings (WAM only)	Construction of new passive residential buildings in compliance with the EU Directive 2010/31/EU. This measure will provide issuing of certificates for energy performance of buildings, as a prerequisite for putting the building into operation
Energy — Residential and Non-Specified	Phasing out incandescent lights (WAM only)	Replacing incandescent light bulbs with halogen ones (at the beginning) and later with compact fluorescent (CFL) and LED
Energy — Non-Specified	Improvement of municipal street lighting (WEM and WAM)	Replacement of the existing lamps with sodium and LED lamps
Energy — Non-Specified	Green procurement (WAM only)	Intensified activities to ensure legal and technical knowledge and skills of public sector entities for inclusion and evaluation of requirements for energy efficiency in public procurement procedures by applying the criteria of most economically advantageous tender.
Energy — Residential and Non-Specified	Gasification (residential, commercial, and public sector) (WAM only)	Gasification of residential and commercial and public sector through construction of a gasification network
Energy — Residential and Non-Specified	Increased use of district heating systems (WAM only)	Increased use of the existing central heating systems through implementation of information campaigns for connecting new consumers, including those who have been disconnected from the system in the past.
Energy — Residential and Non-Specified	Utilization of district heating systems in combination with solar collectors for hot water in the buildings sector. (WAM only)	Obtaining sanitary hot water by combining district heating with solar collectors

IPCC SECTOR	ACTION AND SCENARIO	DESCRIPTION
Energy — Manufacturing and Construction	Energy management in manufacturing industries (WEM and WAM)	Implementation of obligatory energy audits of manufacturing industries and implementation of ISO 50001 standard
Energy — Manufacturing and Construction	Introduction of efficient electric motors (WEM and WAM)	Introduction of efficient electric motors in manufacturing industries
Energy — Transport	Biofuels 5% (WEM only)	5% share of biofuels by 2020
Energy — Transport	Biofuels 10% (WAM only)	10% share of biofuels by 2020
Energy — Transport	Increased use of railways (WAM only)	Increased use of the railway though awareness rising to use the railway for long-distance traveling and by improving the conditions of the companies
Energy — Transport	Renewing the national passenger car fleet (WEM and WAM)	This measure consists of successively organized and well-planned steps for faster renewal of the vehicle fleet of passenger cars.
Energy — Transport	Renewing of other national road fleet (light duty and heavy goods vehicles and buses) (WEM and WAM)	This measure involves introduction of a regulation that will enable renewal of the vehicle fleet of light-duty trucks, freight vehicles, and buses
Energy — Transport	Increased use of bicycles, walking and introduction of parking policy (WEM and WAM)	Conducting campaigns/providing subsidies and systems for use of new or rented bicycles, walking, and introduction of parking policies that would reduce the use of cars in the city area
Energy — Transport	Construction of the railway to the Republic of Bulgaria (WAM only)[6]	Construction of the railway to the Republic of Bulgaria
Energy — Transport	Electrification of Transport (WAM only)	This measure consists of successively organized and well-planned steps for faster renewal of the vehicle fleet through introduction of electric vehicles
AFOLU — Livestock	Enteric fermentation in dairy cows (WEM and WAM)	This measure involves modifying the feed composition and nutrition practice for dairy cows in order to reduce CH_4 emissions due to enteric fermentation through practical training and demonstrations for farmers.
AFOLU — Livestock	Manure management in dairy cows (WEM and WAM)	This measure involves modifying the manure management of dairy cows in order to reduce NO_2 emissions through subsidies for adopting new practices and incentives for modified farm design and construction.
AFOLU — Livestock	Manure management at swine farms (WEM and WAM)	This measure involves modifying manure management at swine farms to reduce NO_2 emissions through subsidies for adopting new practices and incentives for modified farm design and construction.
AFOLU — Forestry	Decreasing the number and extent of forest fires (WEM and WAM)	This measure would protect forested areas by preventing forest fires and the resulting damages
AFOLU — Forestry	Change of quality of forests through the afforestation of transitive forest land (WEM and WAM)	This measure would improve forest quality through the afforestation of transitive forest land with higher quality tree species: coniferous, deciduous and mixed forests

6 It should be noted that funding for this railway line has already been allocated, unlike other WAM measures.

IPCC SECTOR	ACTION AND SCENARIO	DESCRIPTION
AFOLU — Land	Conversion of crop land in areas with more than a 15% incline to other uses (WEM and WAM)	This measure involves the conversion of inclined crop land into perennial grassland (pastures, meadows) in order to decrease the intensity of soil organic matter depletion and soil carbon emissions, creating a carbon sink. Areas above 15% inclination by law should not be cultivated and are not considered to be agricultural land.
AFOLU — Land	Contour farming on croplands on an inclined terrain (5-15% incline) (WEM and WAM)	This measure involves reducing the quantity of soil carbon released during downslope cultivation of cropland by encouraging farmers to adopt contour farming on terrain with a 5-15% incline through a systematic awareness-raising campaign.
AFOLU — Land	Perennial grass in orchard and vineyards on inclined terrain (>5%) (WEM and WAM)	This measure would plant perennial grass in vineyards and orchards using downslope cultivation in order to reduce erosion, protect organic matter in soil, and reduce carbon emissions from soil.
Waste — Solid Waste Disposal	Closure of existing landfills (WEM and WAM)	This measure would reduce emissions of CH_4 and CO_2 by rehabilitating existing landfills and illegal ("wild") dumpsites with very high, high, and medium risk ratings in each of Macedonia's five waste management regions through measures such as covering existing non-compliant landfills, supplemented by gas extraction and flaring.
Waste — Solid Waste Disposal	Mechanical and biological treatment (MBT) in new landfills with composting (WEM and WAM)	This measure would reduce emissions of CH_4 and CO_2 opening new regional landfills in all waste management regions that feature systems for the mechanical and biological treatment of solid waste and composting.
Waste — Solid Waste Disposal	Waste paper collection (WEM and WAM)	This measure would reduce emissions of CH_4 and CO_2 through the installation of containers for collecting of selected waste, mainly paper.

4.4 ASSESSMENT OF MITIGATION MEASURES

The economic and environmental aspects of the climate change mitigation policies and measures were assessed for two factors: 1) Specific cost (the amount of investment required in order to reduce 1 t CO_2-eq by implementing a policy/measure, as expressed in EUR/t CO_2-eq); and 2) Mitigation potential (the extent to which emission reductions are achieved by applying a policy/measure, as expressed in t CO_2-eq). The combined presentation of these two parameters results in the Marginal Abatement Cost Curve (MAC curve), which serves as a tool for determining priorities in the implementation of mitigation policies and measures.

Additionally, the social aspect of the mitigation measures has been assessed though an analysis of job creation potential using the same methodological approach (a model for domestic green jobs) developed and implemented under the Intended Nationally Determined Contributions. That makes the measures triple win (win-win-win) measures, since they satisfy three criteria – economic, environmental and additional benefits.

4.4.1 MARGINAL ABATEMENT COSTS

The MAC curve for the considered mitigation policies and measures for 2030 is shown in Figure 25: Marginal abatement cost curve for 2030. Total emission reductions by 2030 that can be achieved by implementing all policies and measures according to the presumed dynamics are more than 10,940 Gg CO_2-eq (for comparison, total emissions in the WOM Scenario in 2030 are 23,177 Gg CO_2-eq). Al-

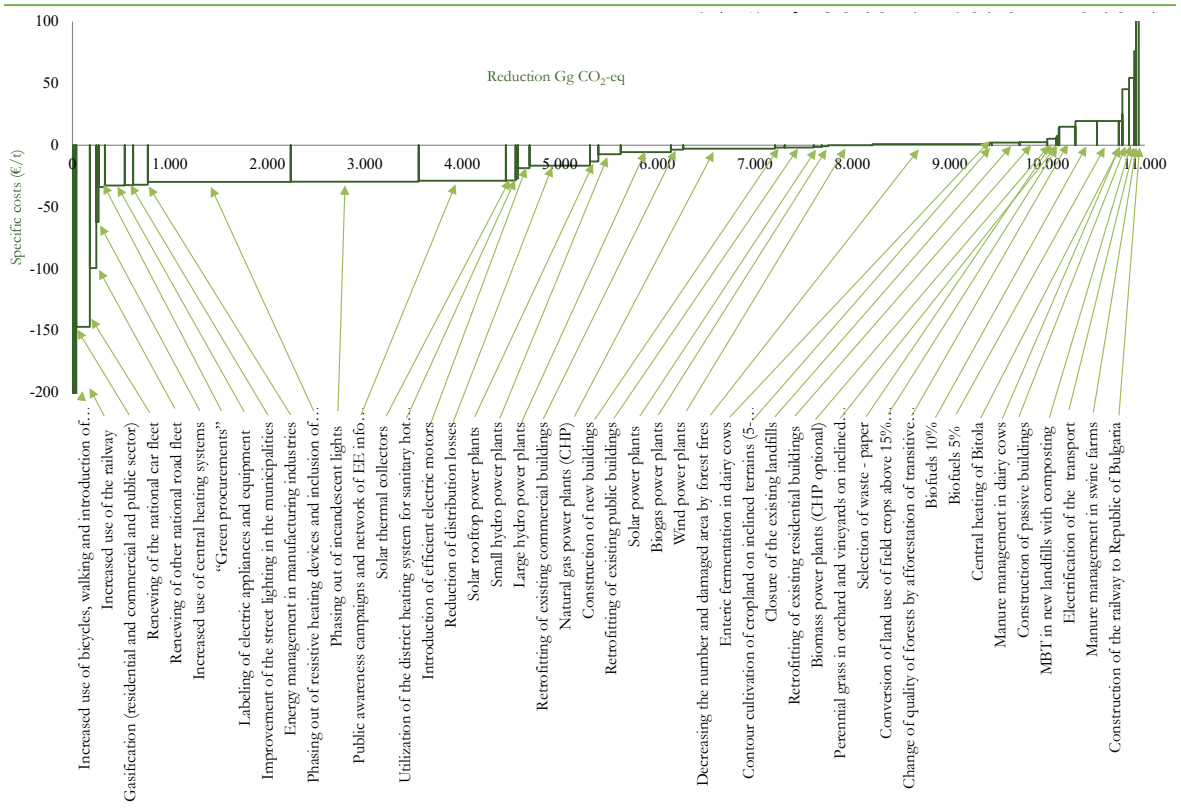


Figure 25: *Marginal abatement cost curve for 2030*

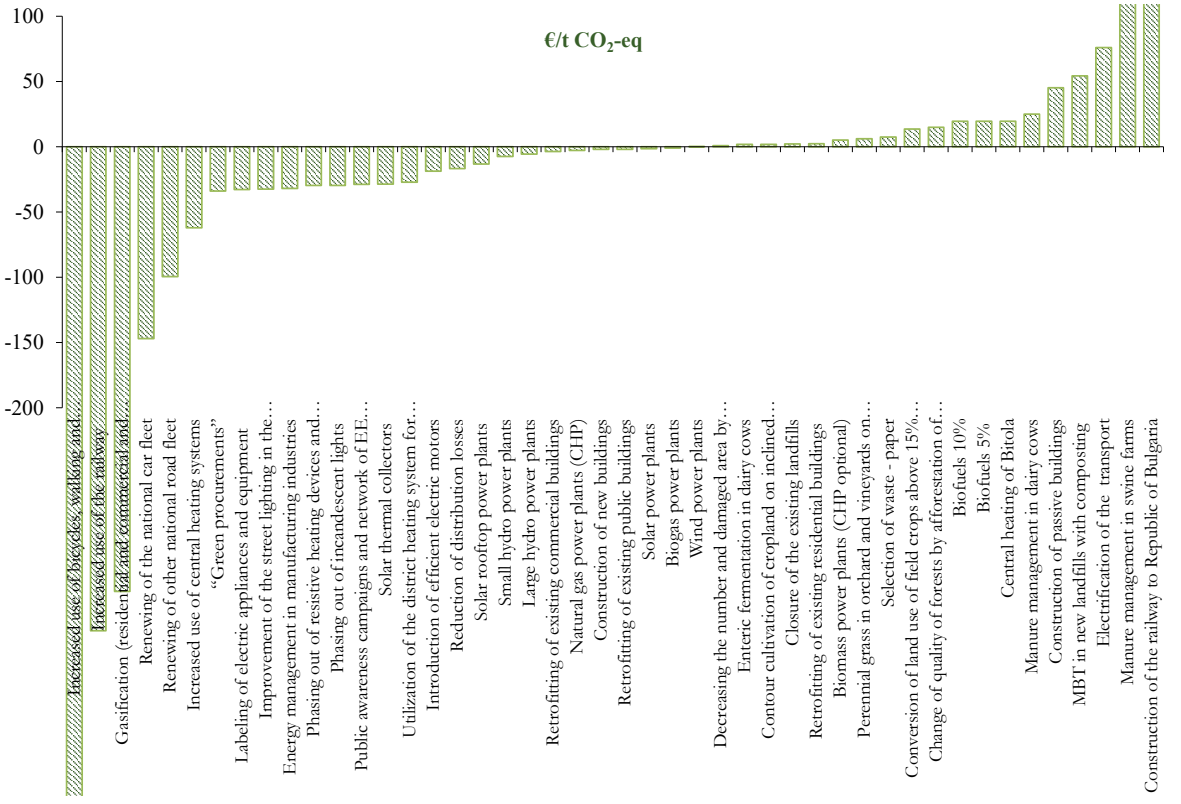


Figure 26: *Specific costs for 2030 (in EUR/tCO_2-eq)*

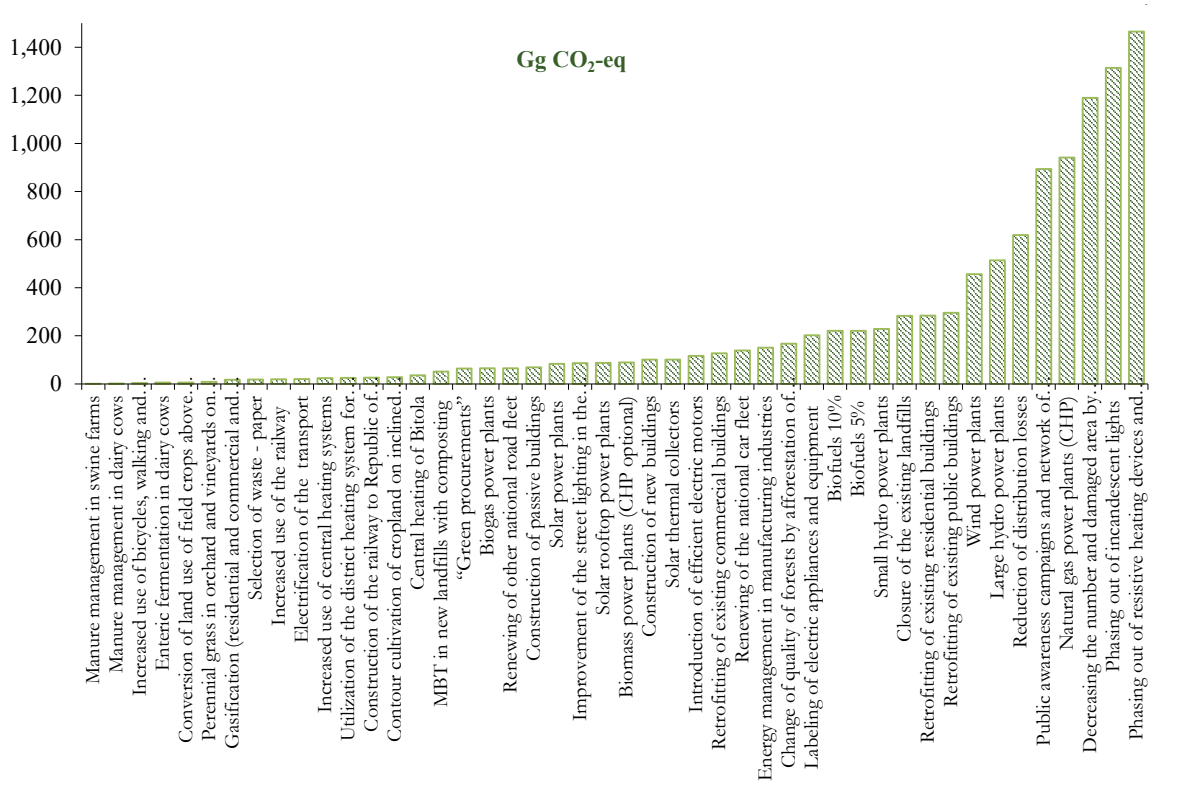


Figure 27: *Reduction of CO_2-eq emissions in 2030 (in Gg)*

most 80% of these reductions can be achieved with policies and measures that have negative costs. These are mostly inexpensive measures that change consumer behavior, and their implementation should be a high priority.

The specific costs of the proposed mitigation policies and measures are shown more clearly in Figure 26: Specific costs for 2030 (in EUR/tCO2-eq), where it can be noted that almost 2/3 of the measures have negative costs. When these are cross-referenced with the reductions that occur due to their implementation (Figure 25: Marginal abatement cost curve for 2030), significant win-win options can be distinguished, such as: Renewing of the national car fleet, Labeling of electric appliances and equipment, Improvement of the street lighting in the municipalities, inclusion of more heat pumps, Energy management in manufacturing industries, Phasing out of incandescent lights, Public awareness campaigns and network of EE info centers, Solar thermal collectors, Introduction of efficient electric motors, Reduction of distribution losses, and Solar rooftop power plants. Some of the policies and measures that have reasonably small costs (e.g. Wind power plants, Retrofitting existing residential buildings, Introduction of biofuels, Enteric fermentation in dairy cows, Change of quality of forests by afforestation, and Conversion of land use of field crops above 15% inclination) should also be considered for possible realization.

With respect to mitigation potential (Figure 27: Reduction of CO2-eq emissions in 2030 (in Gg)), the top five measures with the highest potential were the inclusion of more heat pumps, phasing out incandescent lights, decreasing the number and extent of forest fires, introducing natural gas-fired CHP plants, and public awareness campaigns and network of EE info centers, which all have negative (or very low) specific costs.

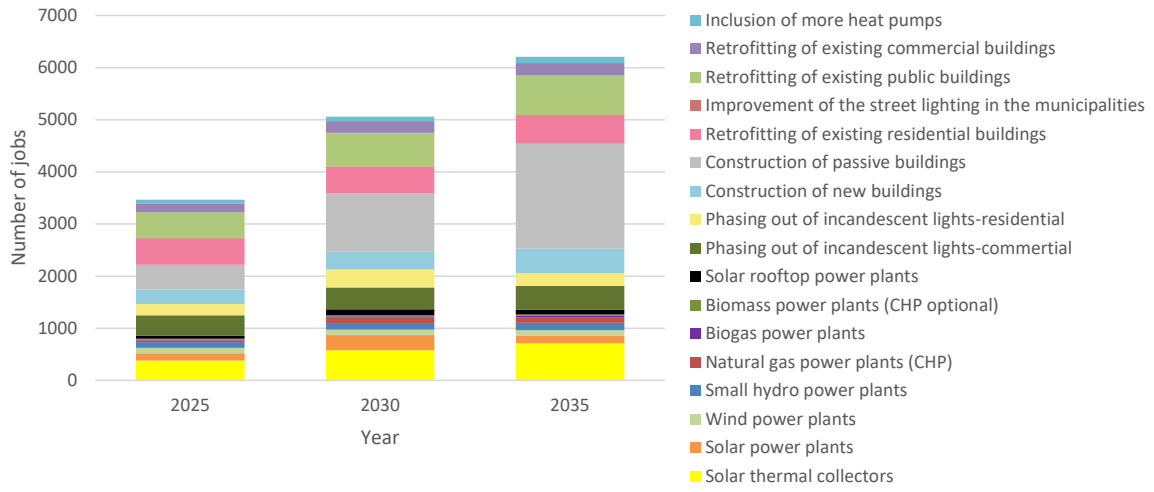


Figure 28: *Number of domestic green jobs*

4.4.2 GREEN JOBS

In order to be able to analyze the overall contribution of the proposed policies and measures towards sustainable development, it is necessary, to assess the social aspects of the measures selected. For this report, the mitigation team conducted an analysis of job creation potential using the same methodological approach to model green job creation that was developed and implemented for the INDCs.

As shown in Figure 28: Number of domestic green jobs, over 6,200 green jobs[7] can be expected in 2035 by implementing energy efficiency measures in buildings and low-carbon energy supply (renewable sources and gas).

Other key findings included the following:

- The area with the highest potential for creating jobs is **energy efficiency measures in the building sector**. The most important measures in this group are related to the retrofit of buildings (bringing buildings up to existing standards or to a passive house standard introduced by adopting an improved construction code), which will increase the number of jobs in the construction sector and in the building materials industries (cement, bricks and tiles, insulations, paints, etc.). Overall, in Macedonia, new buildings construction according to a new standard for energy efficiency and upgrading old buildings could create over 4,000 new jobs by 2035.
- Lighting improvement refers to buildings, but also to public lighting. The transition to LED lighting, which has a much higher added value, will create jobs, because new sales channels and innovative installations will form. It is estimated that a USD 1 million investment in this sector will create 5.1 direct jobs and 4.2 indirect jobs. By applying this measure, a total of 720 new jobs might be created by 2035.
- The introduction of more heat pumps also has the potential to create jobs in terms of sales, installation, and maintenance. It is estimated that this measure could create up to 120 new jobs by 2035.
- Jobs related to "more efficient transport" are difficult to calculate. These jobs will mainly be created in the production of vehicles, which is unlikely to take place in the country. On the other hand, if the electrification of passenger cars enters the market, jobs will be created that are related to chargers and smart chargers, which will be installed in homes, businesses, and public parking lots. However, some jobs will be lost, such as those at gas stations.

7 This figure does not include approximately 14,000 additional green jobs created outside of Republic of Macedonia.

- Job creation related to the transition to public transport, bicycles, walking, and railways is difficult to assess. They may be linked to new investments in alternative modes of transport, as well as the maintenance of supporting technologies.
- Investments in industrial energy efficiency are also difficult to assess because they are very specific to each industry and each process.
- Policies and measures in energy supply include increasing the efficiency of existing power plants, switching to low-carbon fossil fuels and to renewable energy sources for the production of electricity and heat and biofuels for transport.
- Increasing the efficiency of existing power plants will create only a small number of new jobs in the reconstruction phase, but in the long run, a higher level of automation is expected, so few new jobs are expected. The partial transition from coal-fired electricity production to natural gas-fired power plants would create 100 new jobs by 2035.
- The use of more renewable energy sources for electricity generation, especially photovoltaic systems, wind, biomass, hydro systems and plants using waste gas could create approximately 540 jobs by 2035, mainly in the photovoltaic systems sector, which is quite labor-intensive, especially if small systems are installed on rooftops.
- Another good option is the use of more renewable energy sources for heat production, such as solar thermal systems, biomass and heat pumps. The installation of solar thermal collectors could create 710 jobs by 2035.
- Greater use of biofuels in transport can be a good option in case biofuels are produced locally. At the moment, it does not appear to be an economically viable option in the Macedonian market.

4.5. SCENARIO WITH EXISTING MEASURES (WEM SCENARIO)

Compared to the Reference Scenario, the WEM Scenario features 35 measures/policies from the list of measures given in the previous section (indicated in Table 6: Overview of mitigation measures selected for inclusion in the WAM and/or WEM scenarios with light green shading). Measures included in this scenario have already started or are about to start; they are identified as a priority in sectoral plans and strategies; or they are implied from laws that have been adopted or will soon be adopted. Therefore, this scenario is also called "**W**ith **E**xisting **M**easures" (WEM) scenario, and it can also be seen as a baseline scenario that is likely to be achieved.

4.5.1 RESULTS UNDER THE WEM SCENARIO

The main outputs under the Energy sector in the WEM scenario are as follows:

- A 2.3% average annual increase in final energy and a total increase of 68% in 2035 (3,074 ktoe) compared to 2012 (1,830 ktoe);
- A 1.6% average annual increase in electricity consumption and a total increase of 45.1% in 2035 (10,159 GWh) compared to 2012 (7.004 GWh);
- A 2.0% average annual increase in total installed capacity and an increase of 58.3% in 2035 (2,898 MW) compared to 2012 (1,830 MW);
- A 1.8% average annual increase in GDP and a total increase of 49.2% in 2035 compared to 2012;
- A 0.1% average annual increase of greenhouse gas emissions and a total increase of 2.4% in 2035 compared to 2012.

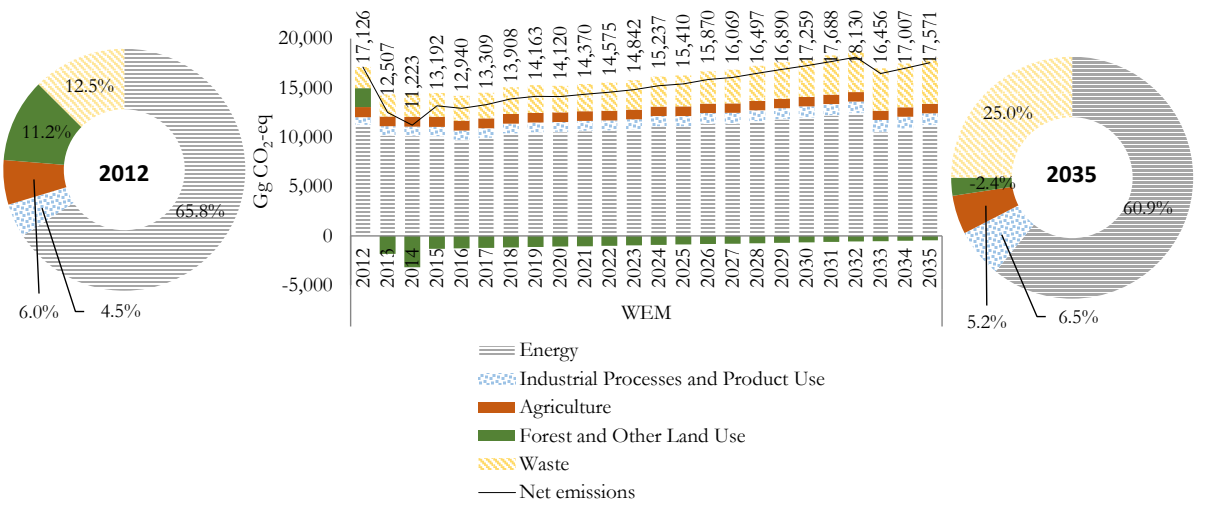


Figure 29: *Total GHG emissions by sectors – WEM scenario (in Gg CO_2-eq)*

Implementing the measures/policies from the Energy, AFOLU, and Waste sectors, and taking into account the emissions from the Industrial Processes and Product Use sector from the Reference Scenario, results in the following outputs for total emissions (Figure 29: Total GHG emissions by sectors – WEM scenario (in Gg CO2-eq)):

- Greenhouse gas emissions increase continuously from 2015 to 2032,
- Greenhouse gas emissions increase by 2.6% in 2035 compared to 2012,
- Emissions peak in 2032, amounting to 18,130 Gg CO_2-eq,
- The energy sector comprises the largest share of emissions (60.9%) in 2035,
- Throughout the scenario, the Forestry sector sequesters emissions, which makes this category sustainable.

Measures in the Energy sector with the greatest potential for reducing greenhouse gas emissions are **Public awareness campaigns and a network of EE info centers** and **Large hydro power plants**. The measure with the most significant potential to reduce GHG emissions overall is the **Closure of existing landfills** in the Waste sector.

4.5.2 ECONOMIC ANALYSIS OF THE WEM SCENARIO

An investment of EUR 17,056.8 million for the period 2017-2035 (EUR 897.7 million annually) would be required to implement the proposed measures in the Energy sector under the WEM Scenario. This would amount to approximately 6.75% of the average annual GDP for the same period (EUR 13,300.0 million). If the investments from the private sector are exempted, the remaining investments total EUR 2,604.2 million (EUR 137.1 million annually), with funding coming from the budget of the Republic of Macedonia, municipalities, the City of Skopje, and the government-owned utility. It is important to emphasize that these investments contribute to **reducing total system costs** (EUR 37,803 million discounted to 2012) compared to the reference scenario costs (EUR 39,415 million), which is a ***reduction*** of 4.1%. In order to obtain this reduction, it is necessary to invest EUR 72.2 million for the 2017-2035 period, or EUR 3.8 million per year. Most of the investments are from PE "Makedonski sumi" and other forestry enterprises, which contribute 92.1% to the total investments foreseen.

In the AFOLU sector, measures in the Forestry category contribute by far the most to the reduction of greenhouse gas emissions, i.e. they account for 95.5% of the total emission reduction from the Agriculture, Forestry and Other Land use sector in 2035.

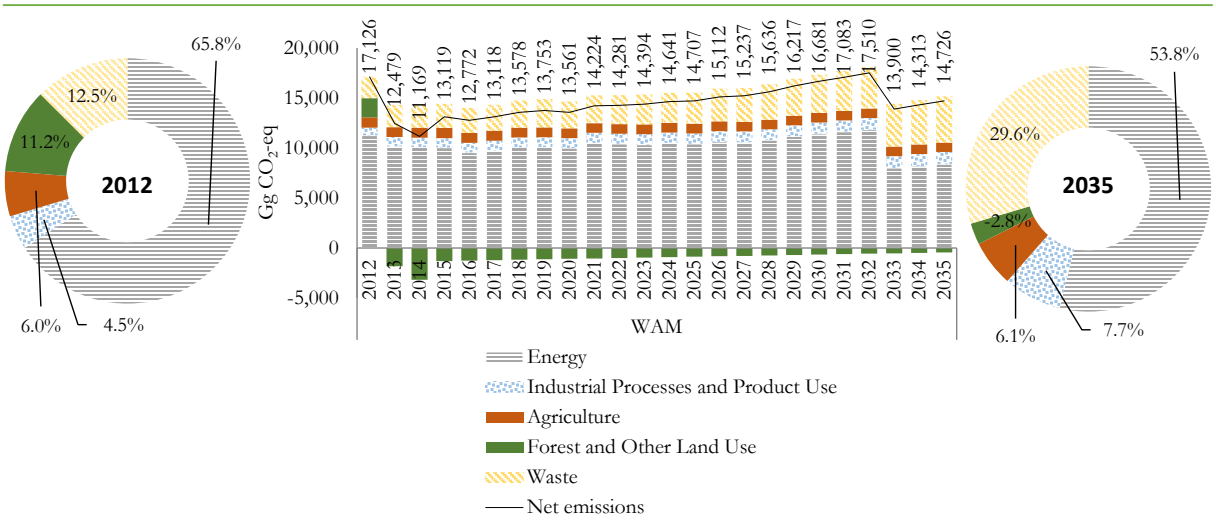


Figure 30: *Total GHG emissions by sectors – WAM scenario (in Gg CO_2-eq)*

Investments of EUR 93 million are necessary to implement the WAM scenario in the Waste sector for the period from 2017 to 2035, or an average of EUR 4.9 million annually. The measure with the most significant potential for greenhouse gas emissions reduction is the closure of the existing landfills.

4.6 SCENARIO WITH ADDITIONAL MEASURES (WAM SCENARIO)

The WAM scenario includes all the WEM scenario measures/policies, but also includes 11 additional measures/policies that are less likely to be realized and are therefore referred to as "Additional Measures." These measures are listed in Table 6: Overview of mitigation measures selected for inclusion in the WAM and/or WEM scenarios in dark green shading. None of these measures is in progress, and each of them has a status of planned measure. The only exception is measure Construction of a railway line to the Republic of Bulgaria for which the funds for realization have been provided.

The main indicators by which the WAM scenario is described indicate the following outputs:

- A 2.0% average annual increase in final energy consumption or a total increase of 57.3% in 2035 (2,879 ktoe) compared to 2012 (1,830 ktoe);
- A 1.1% average annual increase in electricity consumption or a total increase of 30.1% in 2035 (9,110 GWh) compared to 2012 (7,004 GWh);
- A 1.7% annual increase in total installed capacity or an increase of 46.1% in 2035 (2,674 MW) compared to 2012 (1.830 MW);
- A 1.0% increase in total energy required, or an increase of 25.7% in 2035 compared to 2012;
- A 1.2% *decrease* in GHG emissions, with a **total decrease** of 24.4% in 2035 compared to 2012.

The implementation of all of the measures/policies selected under the WEM scenario results in the following outputs related to GHG emissions (Figure 30: Total GHG emissions by sectors – WAM scenario (in Gg CO2-eq)):

- Greenhouse gas emissions increase continuously from 2015 to 2032,
- Greenhouse gas emissions decrease by 14% in 2035 compared to 2012,
- Emissions peak in 2032 at 17,510 Gg CO_2-eq,

- The energy sector comprises the largest share of emissions (53.8%) in 2035,
- Throughout the scenario, the Forestry sector sequesters emissions, which makes this category sustainable.

4.6.1 ECONOMIC ANALYSIS OF THE WAM SCENARIO

Investments of EUR 22,638.0 million are needed for the period 2017-2035 (an average of EUR 1,191.5 million annually) to implement the WAM scenario. These investments are equal to approximately 8.96% of average annual GDP for the same period (EUR 13,300.0 million). If investments from the private sector are excluded, the remaining investments amount to EUR 5,220.4 million, or an average of EUR 274.8 million annually, and they would be provided by the Budget of the Republic of Macedonia, municipalities, the City of Skopje, the government-owned utility JSC ELEM, and public-private partnerships. It is very important to emphasize that these investments contribute to the **reduction of total system costs** (EUR 37,045 million discounted to 2012) compared to the Reference scenario costs (EUR 39,415 million) by 6%.

4.7 CONCLUSIONS

4.7.1 SUMMARY OF FINDINGS

Regarding total greenhouse gas emissions from all sectors combined (Figure 31: Comparison of total GHG emissions from all sectors in WOM, WEM and WAM scenarios, 2030 (in Gg CO2-eq)), the following can be concluded:

- Emissions in the WEM scenario in 2035 will decrease by 25.2% compared to emissions in the WOM scenario,
- Emissions in the WAM scenario in 2035 will decrease by 27.8% compared to emissions in the WOM Scenario.

Figure 32: Comparison of historical GHG emissions with emissions in the WOM, WAM and WEM scenarios (1990=100 %) provides a historical overview of GHG emissions from 1990 from the **Energy sector** according to the national inventory. It also compares emission

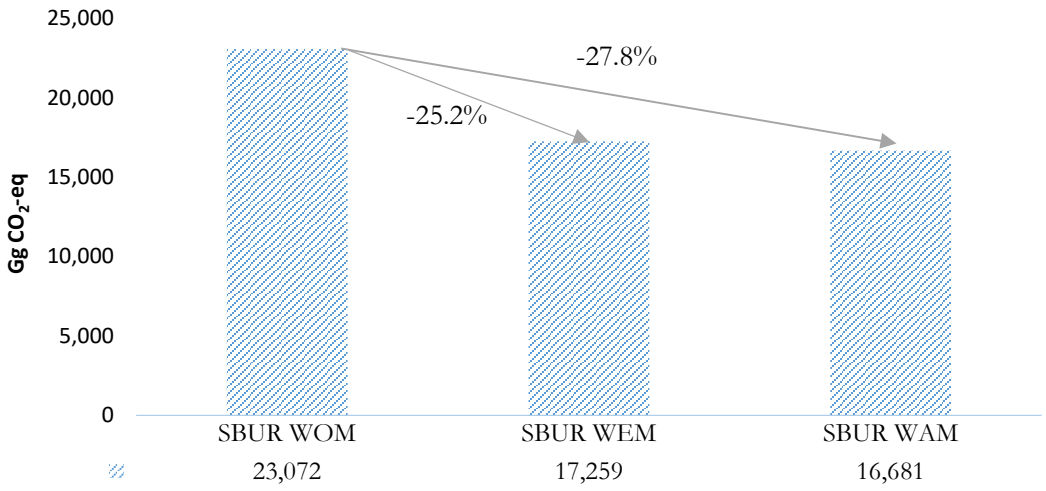


Figure 31: *Comparison of total GHG emissions from all sectors in WOM, WEM and WAM scenarios, 2030 (in Gg CO_2-eq)*

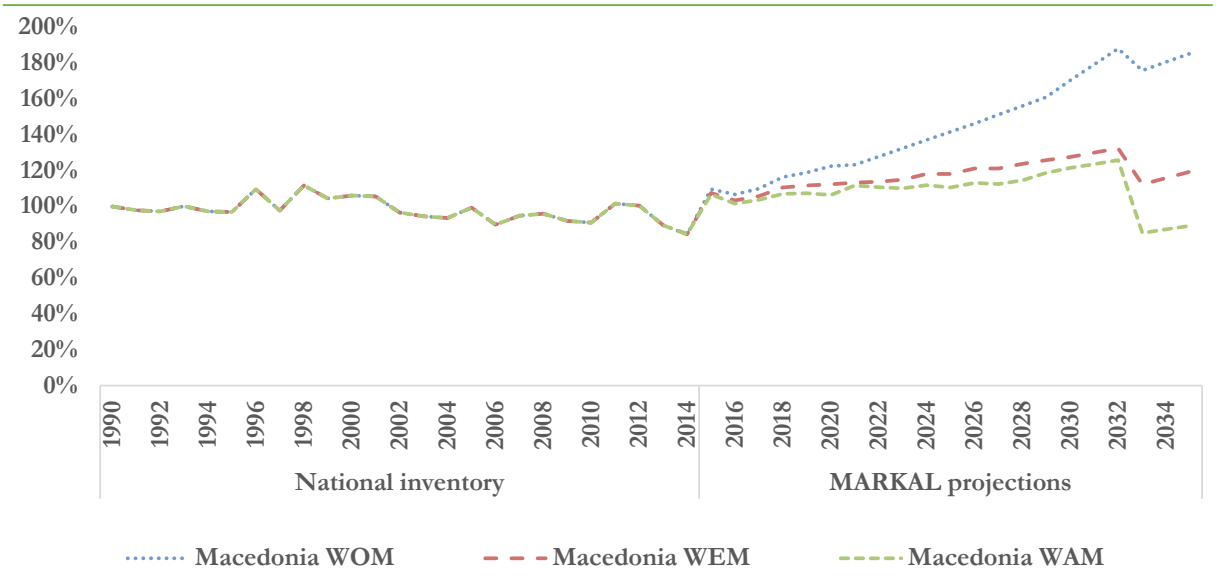


Figure 32: *Comparison of historical GHG emissions with emissions in the WOM, WAM and WEM scenarios (1990=100 %)*

projections according to the three mitigation scenarios indexed to the year 1990.[8] As the figure indicates, if measures are not taken, emissions would increase by as much as 90%. However, with the implementation of the proposed mitigation measures in the WEM scenario, emissions will be lower than the reference scenario, but they will increase by approximately 21% compared to 1990. If the measures from the WAM mitigation scenario are implemented, then greenhouse gas emissions would ***decrease*** by approximately 10% in 2035 compared to 1990.

4.7.2 UN SUSTAINABLE DEVELOPMENT GOALS AND THE WAM AND WEM SCENARIOS

In addition to comparing the mitigation scenarios with Macedonia's INDCs, the mitigation team also analyzed the scenario results with respect to several **key indicators** for sustainable development related to climate change and energy. These indicators are in line with the EU's Sustainable Development Strategy (SDS) and the Global Sustainable Development Goals (SDGs). The team also compared these indicators with the EU average (EU-28) and with other countries in Southeast Europe.

Given that the energy sector is the largest source of greenhouse gas emissions, Table 7: UN indicators for sustainable development (SDG) summarizes several key indicators from the SDGs for the three scenarios for this sector. It can be concluded that in the scenarios for climate change mitigation, most of the final energy (about 23%) will be obtained from renewable sources, unlike the WOM scenario where their share is about 17% in 2025, 15% in 2030 and 13% in 2035. Another indicator is the energy intensity, expressed as the ratio between the total primary energy and GDP, which reflects the degree to which the economy of a country has managed to separate energy consumption from economic growth. The Republic of Macedonia is a country with high energy intensity (about 0.4 kgoe/EUR in 2015), nearly four times the average of the European developed countries (about 0.1 kgoe/EUR in 2015). In the WOM scenario, although there is a downward trend in energy intensity, it remains high and in 2035 it is 3 times higher than the EU average in 2015. In the mitigation scenarios, there is a decreasing trend of energy intensity, and it approaches the EU average. Thus, in the WAM scenario, this indicator reaches a value that is 80% higher than the EU average, i.e. it is at the level of Slovenia in 2013.

8 The 25% increase in 2015 is due to the fact that from 2015 to 2035, GHG emissions for electricity imports are also included for reasons explained in Section 4.1.

Table 7: UN indicators for sustainable development (SDG)

	WOM			WEM			WAM		
	2025	2030	2035	2025	2030	2035	2025	2030	2035
Proportion of population with access to electricity	100%	100%	100%	100%	100%	100%	100%	100%	100%
Renewable energy share in the total final energy consumption	16.8%	14.8%	13.4%	23.1%	23.1%	23.3%	23.5%	22.8%	22.4%
Energy intensity measured in terms of primary energy and GDP (kgoe/EUR)	0.32	0.29	0.33	0.29	0.25	0.22	0.27	0.24	0.18

According to the indicator that monitors the trend of greenhouse gas emissions from almost all sectors, i.e. greenhouse gas emissions per capita (tCO_2-eq/capita), the country exhibits an upward trend in each of the three scenarios. The value of this indicator in the WAM scenario increases by 16% in 2035. That means that every Macedonian citizen in 2035 will generate 7.5 t CO_2-eq, while in 2012 each citizen generated 6.5 t CO_2-eq.

Finally, in accordance with the Mitigation scenario an **Action Plan** for climate change mitigation was prepared, in which the stakeholders to be involved in the implementation of all 35 measures and policies were identified. Furthermore, the plan contains information for each measure on the type of measure, source of financing, indicative future emission reductions, specific costs (cost of reduced t CO_2), necessary investments for implementation, and the potential to create green jobs. This Action Plan forms a solid foundation for creating national policies to enable low-carbon, sustainable development, and it is included as Annex 5 of this report.

4.8 INCORPORATION OF THE UNFCCC TECHNICAL ANALYSIS RECOMMENDATIONS

It should be noted that the mitigation analysis conducted for the SBUR incorporates feedback received as the result of the UNFCCC Technical Analysis of the FBUR that was conducted in 2015. Table 8: Summary of How Comments on Mitigation Reporting in the FBUR Have Been Addressed in the SBUR provides a list of reviewer comments and responses from the mitigation team in conjunction with the SBUR.

Table 8: *Summary of How Comments on Mitigation Reporting in the FBUR Have Been Addressed in the SBUR*[9]

Decision	Reporting requirements	Yes/ Partly /No	Comments on the extent of the information provided	Response to the comments
Decision 2/CP.17, annex III, paragraph 12	For each mitigation action or groups of mitigation actions including, as appropriate, those listed in document FCCC/AWGLCA/2011/INF.1, developing country Parties shall provide the following information to the extent possible:			
(a)	Name and description of the mitigation action, including information on the nature of the action, coverage (i.e. sectors and gases), quantitative goals and progress indicators	Partly	Mitigation measures are described in section 4.3 and annex 3 to the BUR. In some instances, information is missing on quantitative goals or it is not explicitly stated. Progress indicators associated with mitigation actions are not consistently explained (e.g. they are missing for action 4.3.2, or mitigation action 11 in annex 1)	In this BUR, all the required information for each mitigation measure is provided including: name and description of the mitigation action, information on the nature of the action, coverage (i.e. sectors and gases), quantitative goals and progress indicators
(b)	Information on methodologies and assumptions:			
	▪ Methodologies	Partly	The tabular presentation of mitigation actions in annex 1 contains a field to describe methodologies to complement descriptions in section 4.3. However, the methodologies describe steps envisaged, along with enabling conditions to implement actions, rather than describing the methodologies chosen to estimate reductions	Both methodology for implementation of the mitigation measure and methodology for estimation of the emission reduction are included in this BUR.
	▪ Assumptions	Partly	Similar to methodologies above, the tabular presentation of mitigation actions in annex 1 contains a field on assumptions describing enabling conditions to implement potential actions. Economic assumptions related to modelling individual mitigation actions and associated reductions are described in section 4.3	In this BUR, the field "Assumptions" includes the assumptions related to the modelling of the individual mitigation measure.

9 Source of Comments: "Summary Report on the Technical Analysis of the first biennial update report of the Former Yugoslav Republic of Macedonia submitted on 26 February 2015." FCCC/SBI/ICA/2015/TASR.1/MDK (29 September 2015). UNFCCC.

Decision	Reporting requirements	Yes/ Partly /No	Comments on the extent of the information provided	Response to the comments
(c)	Objectives of the action and steps taken or envisaged to achieve that action:			
	▪ Objectives of the action	Yes	A field within the tabular format is not provided, but objectives can be inferred from the descriptions of actions in section 4.3 and annex 1	A field "Main objective" of the measure is included within the tabular format in this BUR.
	▪ Steps taken or envisaged to achieve that action	Partly	A field within the tabular format provides this information in annex 1, but information is not consistently provided across the proposed or planned mitigation actions in section 4.3 and annex 1. In addition, information related to steps taken or envisaged to achieve actions is included in the descriptions of the methodologies section of annex 1 for each action	Steps taken and steps envisaged are provided in the tabular representation of each mitigation measure in this BUR.
(d)	Information on the progress of implementation of the mitigation actions and the underlying steps taken or envisaged, and the results achieved, such as estimated outcomes (metrics depending on type of action) and estimated emission reductions, to the extent possible:			
	▪ Progress of implementation of the mitigation actions	Partly	Implementation status (conceptual, planned, adopted, etc.) can be inferred through the descriptions in section 4.3 and annex 1 tabular format for most actions. However, information on progress, such as time frames for implementation, is not consistently or clearly provided for all actions (e.g. provided for actions 4.3.2 and 4.3.6, but not provided for action 4.3.12; provided generally for the WEM scenario in annex 3)	In this BUR, the implementation status is given in the Action plan (provided in Section 7), and the time frame for each mitigation measure is given in the tabular presentation of the measures.

Decision	Reporting requirements	Yes/ Partly /No	Comments on the extent of the information provided	Response to the comments
	▪ Underlying steps taken or envisaged	Partly	Information is provided via descriptions in the annex 1 tabular format, in addition to this information being included within the methodology field in annex 1. In some instances, this information is also provided in descriptions within section 4.3, but information is not consistently or clearly provided for all actions (e.g. missing for some actions such as actions 4.3.11 and 4.3.12 (mitigation actions 3 and 9))	Steps taken and steps envisaged are provided in the tabular representation of each mitigation measure in this BUR.
	▪ Results achieved, such as estimated outcomes (metrics depending on type of action) and estimated emission reductions, to the extent possible	Yes	The projected emission reductions are provided for each mitigation action in kt CO_2 eq in sec-tion 4.3 and annex 1. For mitigation actions where implementation is under way, some in-terim results are provided that are consistent with progress indicators identified (e.g. action 3.3 or mitigation action 13)	For each mitigation measure, the results achieved (if the measure is in progress) and envisioned are presented depend-ing on the progress indicators. Addition-ally, for each measure the estimated emission reduction is provided for the years 2025, 2030 and 2035.
(e)	Information on international market mechanisms	Partly	Section 2.3.1 indicates a national CDM strategy. Some mitigation actions in annex 1 include a field on international market mechanisms (e.g. mitigation actions 35, 37 and 38)	Information on financial sources are in-cluded in the Action plan (provided in Section 7) for each mitigation measure

CONSTRAINTS AND GAPS, AND RELATED FINANCIAL, TECHNICAL AND CAPACITY NEEDS, INCLUDING A DESCRIPTION OF SUPPORT NEEDED AND RECEIVED

- New, expanded summary of support received by donor and type of assistance
- Budget estimates provided for National Action Plan for Climate Change Mitigation
- New national overview of research related to climate change with specific recommendations on future research needs and research capacity

THE PROCESS IN A NUTSHELL

- Broad, participatory approach, including NGO involvement in a leading role
- Collection of data at multiple levels (municipal, national, international donors).
- Quality assurance: recommendations developed on data classification and subsequent BURs

Used a wide participatory approach, involving:

institutions **19**

persons **14** (93% women)

CHAPTER 5

CONSTRAINTS AND GAPS, AND RELATED FINANCIAL, TECHNICAL AND CAPACITY NEEDS, INCLUDING A DESCRIPTION OF SUPPORT NEEDED AND RECEIVED

5.1 OVERVIEW

This chapter contains information on constraints and gaps in climate change and related financial, technical and capacity-building needs, including a description of support needed and received by Parties not included in Annex I to the Convention (non-Annex I Parties). As such, it corresponds to the guidance to Parties, pursuant to Decision 2/CP.17, annex III, section V, paragraphs 14-16. Findings in this section, which cover the time period 2014-2017, summarize the results of a stakeholder consultation process that was conducted as part of the preparation of this report.[1] It also expands on the scope of information provided under the FBUR by providing needs at both the national and the local level and by providing supplementary information on support received for climate change activities by donor and by type of assistance.

In addition, the scope and content of this chapter explicitly takes into account the findings of the Technical Analysis of the Macedonian FBUR undertaken by the UNFCCC[2] in the following ways:

- This assessment contains a comprehensive Chapter on Financial, technical and capacity building needs, containing most of the elements contained in the IPCC Handbook for the development of this assessment/chapter and differentiates between different types of needs.
- Information on financial needs contains the indicative budget of the national action plan for climate change mitigation, as well as financial needs from local climate change strategies that have been developed, accompanied by a disaggregated analysis of needs

5.2 TECHNICAL AND CAPACITY NEEDS

Because technical and capacity needs vary depending upon the level of public administration, this section reports first on national-level needs and then on local-level needs.

1 Detailed information on this process and all data from the assessment are presented in Center for Climate Change, Gevgelija (2016), which is available at www.klimatskipromeni.mk

2 "Summary Report on the Technical Analysis of the first biennial update report of the Former Yugoslav Republic of Macedonia submitted on 26 February 2015." FCCC/SBI/ICA/2015/TASR.1/MDK (29 September 2015). UNFCCC.

5.2.1 TECHNICAL AND CAPACITY NEEDS AT THE NATIONAL LEVEL

The climate change department of MOEPP has limited capacity, and national climate change reporting and assessments are dependent on donor projects. However, the Macedonian government has approved a roadmap for the development of capacity in the government and inter-institutional coordination to support effective implementation of Macedonia's NDCs. The implementation of these activities could significantly improve climate mainstreaming in the country, and it would also help the Republic of Macedonia to fulfill its international climate obligations and pledges.

The FBUR reported on three specific capacity support needs at MOEPP (Table 9: Estimated Capacity Building Needs at MOEPP). Although MOEPP has made significant efforts to address these gaps and constraints, the same constraints have been identified once again.

Table 9: *Estimated Capacity Building Needs at MOEPP*

	Activity	Requirements	Support needs per year in USD
1.	Institutionalization of the national GHG inventory process via permanent administrative and financial support	▪ Increase the number of staff	▪ 1 employee = 9,200
2.	Capacity reinforcement to access financing with consideration of gender mainstreaming;	▪ Increase the number of staff	▪ 2 employees = 18,400
3.	Training to ensure the MRV processes	▪ Capacity building and education ▪ Increase the number of staff	▪ Trainings 2 per year =8,000 ▪ 2 employees=18,400
	Total annual funds needed		**USD 46,000**

In the Ministry of Economy, the following capacity building needs have been identified within the Energy Efficiency strategy relevant to climate change (Table 10: Estimated Capacity Building Needs at the Ministry of Economy (Energy Efficiency Strategy)):

Table 10: *Estimated Capacity Building Needs at the Ministry of Economy (Energy Efficiency Strategy)*

	Activity	Requirements	Support needs per year in USD
1.	Promote strategies/propose policies	▪ Increase the number of staff	▪ 1 employee = 9,200
2.	Propose fiscal policy measures to encourage EE and RES projects, promote technology and related services	▪ Increase the number of staff	▪ 2 employees = 18,400
3.	Provide support to municipalities to help them achieve their EE and RES programs	▪ Capacity building and education	▪ Training for 2 employees = 8,000
4.	Develop long-term scenarios for energy supply/demand for energy activities at state and local levels	▪ Increase the number of staff ▪ Capacity building activities	▪ 2 new employees = 18,400 ▪ Training for 2 employees = 8,000
	Total annual funds needed		**USD 62,000**

In the Energy Agency, the following priority needs have been identified for the successful implementation of the EE strategy relevant to climate change mitigation (Table 11):

Table 11: *Estimated capacity building needs of the Energy Agency (Energy Efficiency Strategy)*

	Activity	Requirements	Support needs per year
1.	Develop and maintain appropriate and transparent data bases on energy efficiency and renewable energy sources (monitoring and reporting services)	▪ Increase the number of staff	▪ 1 employee = 9,200
2.	Propose internationally harmonized standards for improving equipment efficiency	▪ Increase the number of staff	▪ 1 employee = 9,200
3.	Organize information dissemination campaigns for EE and RES	▪ Increase the number of staff	▪ 1 employee = 9,200
4.	Encourage private initiatives and cooperation, as well as joint ventures in realization of EE and RES projects	▪ Increase the number of staff ▪ Capacity building activities	▪ 2 employees = 18,400 ▪ Trainings 2 per year for key employees = 8,000
5.	Promote the use of economically and environmentally acceptable EE and RES technologies	▪ Increase the number of staff	▪ 1 employee = 9,200
	Total annual amount needed		**USD 63,200**

In general, capacity constraints at the national level are primarily due to a **lack of capacity within the key institutions responsible for climate change policy**. In the Republic of Macedonia, the present institutional capacity to implement climate change policies and to monitor and evaluate them is weak. As a result, climate change-related work is often dependent on project-specific activities and donor support. At the organizational level, the **limited number of personnel** in MOEPP and the Ministry of Economy (Department of Energy within the Ministry of Economy), coupled with limited staff at the Energy Agency and relevant sectoral Ministries (Ministry of Health, Ministry of Agriculture, etc.), cannot provide sufficient capacity to implement climate change policies and comply with UNFCCC requirements. Furthermore, the **legal framework on climate change** is still located within the Law on Environment, which does not provide a comprehensive foundation for long-term policy and strategic planning.

5.2.2 TECHNICAL AND CAPACITY NEEDS AT THE LOCAL LEVEL

There are several common themes regarding capacity needs at the local level:

- The need to strengthen "capacities to implement environmental legislation in integrated way, including climate change issues…taking into consideration all possible impact and necessary measures, providing guidance how to harmonize local environmental planning documents where climate change aspects are also included."[3]
- The need for appropriate and sufficient staffing given the large number of competencies in the environmental sector (approximately 130) that have been delegated to municipalities and the current small number of staff assigned to this work.
- The lack of a systematic training program to ensure that municipal employees have sufficient capacity to address climate change issues.

Table 12: Capacity building needs at the municipal level provides an overview of capacity building needs at the municipal level (Republic of Macedonia has 78 municipalities). It should be noted that these capacity needs also apply to environmental management and international environmental agreements more broadly, so it is expected that increased capacity could be cost-shared.

3 EU (2016).

Table 12: *Capacity building needs at the municipal level*

Activity/Measure	Resources	Financial needs in USD annually
Staffing	▪ 1 environmental expert ▪ 1 authorized environmental expert	▪ 9,200 ▪ 9,200
Resources and facilities	▪ 2 offices ▪ 2 PCs ▪ Website (domain, updating and hosting)	▪ 600 ▪ 1,200 ▪ 840
Capacity building measures	▪ Two trainings ▪ Networking ▪ Coordination meetings with other institutions and sectors within the municipality	▪ 8,000 ▪ 150 ▪ 200
Total annual amount needed		**46,000**

5.2.3 TECHNICAL AND CAPACITY NEEDS RELATED TO CLIMATE CHANGE RESEARCH

The state of the climate research and systematic observation in the country is very important driver for the climate mainstreaming of the country. Several themes emerge in the assessment of needs related to climate change research:

- As an EU candidate country, Republic of Macedonia is making a significant effort to support its scientific community in climate change-related research activities, but there is a **lack of a systematic approach for fostering climate research** and systematic observation.
- While the scientific community in Macedonia is very interested and active in undertaking climate-related research activities, there is a **lack of continuous funding** in this sector, leaving research efforts dependent on external funding and international donors and projects.
- There is a lack of **cross-sectoral published research on climate change** by Macedonian authors, with the majority of research papers focusing on medicine or general technical sciences.
- There are no centers of excellence/research institutes for climate-related issues in the country.
- A lack of financial support for publication in international scientific journals has affected all fields of research, although the government has introduced a financial incentive of 500 EUR for papers by Macedonian authors in international scientific journals.

Annex 9 provides an overview of research papers and articles published in the period 2012 – 2016.

5.2.4 FINANCIAL NEEDS AT THE NATIONAL LEVEL

The **economic analysis conducted under the mitigation section** of this report (Chapter 4) found that for the mitigation activities under the WEM mitigation scenario, financial needs totaled EUR 17,056.8 million in the energy sector, EUR 72.2 million in the AFOLU sector, and EUR 93 million in the waste sector, for a total of **EUR 17,222.1 million for the period 2017-2035**.[4] Therefore, an average of **EUR 906.42 million annually** is needed to implement the mitigation scenario, which is equivalent to approximately 10.02% of average annual GDP (EUR 9,083 million for the year 2016[5]). If investments from the private sector are excluded, the remaining investments total EUR 2,604.2 million, or an

4 Costs by policy and measure are tabulated in Annex 5 and Annex 6 of this report.

5 https://tradingeconomics.com/macedonia/gdp

average of EUR 137.06 million annually. Funding for these investments would be provided by the Budget of the Republic of Macedonia, municipalities, the City of Skopje, the government-owned utility JSC ELEM, and public-private partnerships.

The SBUR team also conducted a **comprehensive analysis of relevant strategic documents** that considered planned projects in the energy and environmental sector and donor support for the next 5-7 years. In the **renewable energy sector**, total investments for the implementation of the program on RES development in the period until 2020 (Table 13: Financial support needs for development of the RES sector) are estimated at around EUR 1.52 billion.

Table *13*: *Financial support needs for development of the RES sector*[6]

Activity/project	Status (ongoing/ planned/completed)	Overall support needed (million EUR)	Support received	Additional support needed
		(a)	(b)	(c)
Revitalization of Existing HPPs	ongoing	70		
Construction of LHPPs, Chebren and Galiste	planned	519		
Construction LHPPs Boskov Most	planned	70		
Construction of LHPPs Lukovo Pole with HPP Crn Kamen	planned	45		
Construction of LHPP Gradec	planned	156		
Construction of SHPPs (100 MW)	/	200		
Geothermal energy	/	60		
WPPs (230 W)	/	230		
Photovoltaic system (20MW)	/	80		
Solar System for hot water (80000 households)	/	60		
TPP-HP using waste biomass and TPP using biogas (20MW)	/	30		
Total		**1,520**		

Financing for the revitalization of existing RES generation facilities and the construction of new RES facilities can be achieved with investments from AD ELEM (EUR 260 million EUR in company funds and credits), public-private partnerships in the amount of EUR 670 million, concessions (EUR 480 million) and private investors in the construction of waste biomass and biogas plants (EUR 30 million). The state budget should allocate approximately EUR 20 million to support research on geothermal potential. Households and private companies are expected to invest EUR 50 million in solar hot water systems and receive EUR 10 million in support from the government budget.

In the **energy sector**, total investments in the period until 2030 are estimated at slightly more than EUR 3.6 billion for the option involving coal-fired thermal power plants. Due to the long-term lack of investment in the energy sector, maintenance, modernization and development will require significant capital investments (Table 14: Financial support needs for development of the energy sector), and it will be necessary to increase the involvement of the private sector and attract foreign capital to Macedonia's energy market.

6 Source: *Renewable Energy Sources Strategy of Macedonia till 2020* (2010). HPP = hydropower plant; LHPP = large hydropower plant; SHPP = small hydropower plant; WPP = wind power plant; TPP = thermal power plant.

Table 14: *Financial support needs for development of the energy sector*[7]

Activity/project	Status (ongoing/ planned/ completed)	Overall support needed (million EUR) (a)	Support received (b)	Additional support needed (c)
Revitalization of the equipment in the TPP Bitola, TPP Oslomej and TPP Negotino	ongoing	260		
Revitalization of the existing HPP	ongoing	67		
CHP using natural gas	completed	250		
TPP Bitola 4, TPP Mariovo and TPP Negotino, lignite fired	planned	1,120		
Development of the transmission grid	planned	109.3		
Activities in the heating infrastructure	/	56.3		
Gasification	/	240		
Total:		**3,622.6**		

In the **energy efficiency** sector, the total financial needs for energy efficiency measures are estimated at 23 million EUR/ktoe: approximately 17 million for the residential sector and 6 million EUR/ktoe for the commercial and public building sectors.[8] Table 15: Financial Support Needs for EE Measures provides an overview of the financial support needs for activities related to climate change mitigation in regards to the National Strategy for Energy Efficiency in the Republic of Macedonia until 2020. According to the Energy Efficiency Strategy, the cost of the measures and the investments in the EE are highly dependent on the category and the activities foreseen. However, the most cost-effective investments are awareness-raising activities, energy management, and the inspections of major energy consumers. The total cost of the mitigation activities foreseen in this strategy are estimated at EUR 522.06 million, with the most significant share (EUR 357.28 million) to be covered by the private sector.

Table 15: *Financial Support Needs for EE Measures*[9]

Activity/Project	Date	Million EUR/ ktoe	Sector	Source
Promotional info campaign	2010-2020	0.267	Energy/Residential sector	Energy Efficiency Strategy of the Republic of Macedonia until 2020
New buildings (heating, solar systems, new appliances, lighting)- certification, energy codes		3.16	Energy/Residential sector	Energy Efficiency Strategy of the Republic of Macedonia until 2020
Social housing		4.62	Energy/Residential sector	Energy Efficiency Strategy of the Republic of Macedonia until 2020

7 Source: *The Strategy for Energy Development in the Republic of Macedonia for the Period 2008-2020 with a Vision to 2030* (2010). Note: the activity "Revitalization of existing HPPs" is included in both the RES Strategy and the Strategy for Energy Development. However, the cost estimates are different in each strategy (EUR 70 million in the RES Strategy and EUR 67 mil in the Energy Development Strategy).

8 Source: National Strategy for Energy Efficiency in the Republic of Macedonia till 2020 (2010).

9 Ibid.

Activity/Project	Date	Million EUR/ ktoe	Sector	Source
Allocators for District Heating		2.561	Energy/Residential sector	Energy Efficiency Strategy of the Republic of Macedonia until 2020
EE building retrofits		7.26	Energy/Residential sector	Energy Efficiency Strategy of the Republic of Macedonia until 2020
Information campaign and municipal EE network	2010-2020	1.25	Energy/ Commercial and public building sector	Energy Efficiency Strategy of the Republic of Macedonia until 2020
Inspections of boilers/air conditioning systems	2010-2020	0.27	Energy/ Commercial and public building sector	Energy Efficiency Strategy of the Republic of Macedonia until 2020
Energy management and corporate social responsibility	2010-2020	0.08	Energy/ Commercial and public building sector	Energy Efficiency Strategy of the Republic of Macedonia until 2020
Building energy performances improving-certificates		3.8	Energy/ Commercial and public building sector	Energy Efficiency Strategy of the Republic of Macedonia until 2020

Financial needs in the **waste sector** were identified according to the waste management strategy of the Republic of Macedonia 2008-2020 (Table 16: Financial needs for investments in the waste sector). Priority investments in the transposition of legislation and in the basic municipal and hazardous waste infrastructure will total approximately 1.4% of GDP annually (EUR 9,083 million for the year 2016[10]). More sophisticated technological facilities for the biotechnological and thermal treatment of waste shall require additional capital investments; those investments will become unavoidable with the implementation of the waste management strategy. Approximately 10% of annual investments in the establishment of a waste management system will cover the costs related to legal transposition and implementation. The other 90% will be spent in capital investments, with approximately 40% in the industrial sector and 60% in municipal waste systems and infrastructure, which will be covered by public financing.

Table 16: *Financial needs for investments in the waste sector*[11]

Activity	Financial needs (Million EUR)
Investment costs for remediation of closed municipal landfills	30
Remediation activities in the priority hot spots	77
Reduction of environmental impacts caused by waste, priority investments in the transposition of legislation and in basic municipal and hazardous waste infrastructure	4.89
Total capital costs of transposing the key EU directives related to waste issues into the Macedonian legislative framework and implementing them fully	400
TOTAL	**511.89**

10 https://tradingeconomics.com/macedonia/gdp

11 Source: Waste Management Strategy of the Republic of Macedonia 2008-2020 (2008).

Finally, a **series of cross-cutting projects** that are planned in the energy, transport, and environment sectors, which are directly relevant to climate change, is provided in tabular format in Annex 7. These projects are funded by the European Union under the 2012-2019 programming period for IPA-II, the pre-accession funding instrument for candidate countries; they are in various stages of implementation.[12]

5.2.5 FINANCIAL NEEDS AT THE LOCAL LEVEL

Resilient Skopje, the Climate Change Strategy for the Macedonian capital, has identified the following financial needs in the energy and transport sector for climate change mitigation, which are disaggregated by measure (Table 17: Financial support needs of the City of Skopje regarding implementation of climate change mitigation activities) and by sector (Table 18).

Table 17: Financial support needs of the City of Skopje regarding implementation of climate change mitigation activities[13]

Policy/measure	Budget in million EUR	Responsible institution for implementation	Sector
Solar collectors for the buildings of the City of Skopje and the municipalities.	4	City of Skopje and its municipalities	Energy supply
Creating conditions for measures to stimulate the installation of solar collectors by households	4	MoE, MoF, City of Skopje and its municipalities[14] and the citizens	Energy supply
Creating conditions for measures to stimulate the installation of photovoltaic systems (installed on municipal and private buildings)	6	City of Skopje and the municipalities, citizens, the business sector, MoE, Energy Agency, EVN	Energy supply
5% share of bio-fuels in transportation by2020.	6	MoE, manufacturers, importers and retailers in petroleum products, the citizens, Skopje and its municipalities	Energy supply
Renovating hospitals and applying energy-efficiency measures	4	MoH. MoF, City of Skopje and its municipalities	Buildings
Creating conditions for stimulating measures for improving the heat insulation of buildings in the commercial and service sectors in Skopje and its municipalities.	4	Commercial and service sectors, City of Skopje and its municipalities	Buildings
Replacing incandescent light bulbs (modernization of lighting in buildings owned by the City of Skopje and its municipalities, households, and commercial and service sectors.	2	MoE, Energy Agency, retailers in household appliances, the citizens of the city of Skopje, City of Skopje and its municipalities	Buildings

12 Source: http://cfcd.finance.gov.mk/?page_id=852

13 Source: City of Skopje (2017).

14 Municipality of Centar, Municipality of Gazi Baba, Municipality of Aerodrom, Municipality of Cair, Municipality of Kisela Voda, Municipality of Butel, Municipality of Shuto Orizari, Municipality of Karpos, Municipality of Gjorče Petrov, and Municipality of Saraj.

Policy/measure	Budget in million EUR	Responsible institution for implementation	Sector
Creating conditions for stimulating measures for greater penetration of heat pumps in households and in the commercial and service sectors.	2	MoE, Energy Agency, retailers in household appliances, the citizens, City of Skopje and its municipalities	Buildings
Penetration of devices with higher efficiency.	2	MoE, Energy Agency, merchants of household appliances, the citizens, City of Skopje and its municipalities	Buildings
Application of the Energy Efficiency Rulebook for Buildings and the 2010/31/EU Directive when renovating residential buildings.	4	Citizens, private investors, City of Skopje and its municipalities	Buildings
Application of the Energy Efficiency Rulebook for Buildings and the 2010/31/EU Directive when building new residential buildings.	4	Citizens, private investors, City of Skopje and its municipalities	Buildings
To carry out a detailed survey about heating habits in Skopje in order to adopt informed policies, including collecting and analyzing gender-disaggregated data	2	City of Skopje and its municipalities, BEK, EVN	Buildings
Procurement of vehicles for the City of Skopje in accordance with Green Public Procurement criteria	2	City of Skopje and its municipalities, public enterprises	Transportation
Renewal of fleet vehicles	2	Citizens, City of Skopje and its municipalities	Transportation
TOTAL	**48**		

Table 18: *Financial support needs of the City of Skopje regarding implementation of climate change mitigation activities, by sectors*[15]

Sector	Million EUR
Energy Supply	20
Buildings	24
Transport	4
Total	**48**

At the local level, municipalities around the country have financial needs for capacity building for staffing, resources and facilities, and training and networking. Table 12: Capacity building needs at the municipal level in Section 5.2.2 above provides cost estimates for these measures.

15 Ibid.

5.3 CONSTRAINTS AND GAPS

5.3.1 CAPACITY CONSTRAINTS AND GAPS

Unfortunately, despite support received in the form of capacity building, awareness-raising, and funding for training, grants, and education, there are still significant gaps and constraints regarding climate change mainstreaming. While the country has used IPA funding from the EU to implement a number of projects, it has not been able to leverage the potential of this funding mechanism due to the following[16]:

- Limited institutional capacity in public administration (political influence, bran drain from public institutions towards NGO and private companies[17], rule of law issues etc.) and a lack of professional knowledge and skills employees in government and public utilities.
- Lack of capacity and knowledge for recognizing potential projects that are in line with the tasks and objectives of IPA funding.
- Lack of a network (web) platform with available climate-related data, projects, news and events, financing, and other information for all relevant institutions and companies.
- Lack of public information campaigns on climate change and lack of incentives for implementing energy efficiency/ climate change mitigation measures.
- Lack of transparency and information sharing necessary for project preparation in spite of public disclosure laws.
- Lack of cooperation across sectors and Ministries and an absence of incentives to cooperate.
- Lack of project management capacity, including the ability to prevent and address mismanagement.
- An analysis of the legislative and regulatory framework for climate-related MRV in the country[18] also identified several capacity gaps:
- Lack of appropriate legislation that will enable Macedonia to adopt the EU regulation on MRV (Regulation 525/2013) that also pertains to Energy Community parties. This legislation could come in the form of an amendment to the current Law on Environment and associated secondary legislation or in the form of a new law on climate action.
- A gap between existing monitoring systems an integrated, multi-agency system of collecting and sharing data in the appropriate format according to standards that comply with international reporting requirements.
- Lack of trained personnel and job positions at MOEPP to establish and implement climate change MRV measures.
- Lack of training for personnel outside of a specific MRV unit who will nonetheless be responsible for overseeing various aspects of data collection and sharing, particularly staff in the Macedonian Environmental Information Office at MOEPP.

In addition to work conducted during the preparation of the SBUR, a 2016 gap analysis related to mainstreaming Sustainable Development Goals (SDGs) into national planning also examined climate change-related capacity gaps under its work on SDG13 (Take urgent action to combat climate change and its impacts). In general, the study found that at the policy level and at the level of individuals, awareness of climate change issues was on the rise. The study also identified the following capacity gaps:

16 Institute for European Politics: The Use of IPA Funds in the Republic of Macedonia, March 2013, Friedrich Ebert Stiftung.

17 Assessment, Republic of Macedonia 2012, Support for Improvement in Governance and Management: http://www.oecd.org/site/sigma/publicationsdocuments/fYRoM_Assess_2012.pdf

18 Dimovski (2017): 34-5.

- A gap in integrating climate change considerations into sectoral policies (although progress is cited) and the lack of an appropriate monitoring framework with quantifiable and measurable indicators of achievement.
- Lack of a comprehensive National Adaptation Plan (NAP).
- Lack of an operationalized comprehensive MRV system for mitigation and lack of an MRV scheme for adaptation measures.
- Lack of a pertinent educational curriculum for all educational levels on climate change.
- A gap in intregrating climate change priorities into national R&D and innovation policy and programming.

5.3.2 FINANCIAL CONSTRAINTS AND GAPS

Analysis has identified the following financial constraints and gaps at the institutional and inter-sectoral level:

- Lack of access to capital for investments in efficient appliances and EE retrofits and the absence of incentive programs and financial mechanisms such as performance contracting.
- Energy pricing that does not reflect the environmental and economic cost of production and consumption, particularly a lack of cost-recovery pricing and a lack of real-time metering for residential energy consumption.
- The relative difficulty of ascertaining the energy-related operating costs of consumer products, such as television sets, due to a lack of energy labelling.

5.4 SUPPORT RECEIVED

The Republic of Macedonia has received significant financial, capacity building, technical and technological support from international donor organizations and developed countries. This report documents support received in the period 2014 – 2017. It should be emphasized that the country has funded a number of projects with direct or indirect impacts on climate change mitigation through its own national and local budgets.

5.4.1 EXTERNAL SUPPORT

All projects that have been identified and captured in the summary reporting tables on support received (Table 19: Support for Climate Change-Related Activities from Multi-Lateral Donors, Type of Support, and Funding Level, 2014-2017, Table 19 and Annex 8) have been awarded as climate projects with direct impact on climate change mitigation and are part of the activities listed in the BUR. Therefore, during the initial stage of the development of the assessments of this type, it is extremely important to identify/adopt specific criteria for selection of eligible projects for reporting in the following BURs/NCs.

Table 19: Support for Climate Change-Related Activities from Multi-Lateral Donors, Type of Support, and Funding Level, 2014-2017 provides summary information about the support received for climate change activities during the 2014-2017 period from multilateral institutions, and it contains detailed information on the scope of the support received - financial, technology transfer, capacity-building or technical.

Table 20 provides similar information for the same period for financial institutions and regional development banks. The complete list of climate-related projects funded in the country with direct and/or indirect impacts on climate change by donor and level of support is provided in tabular format in Annex 8 of this report, as is support for the preparation of BURs and associated activities.

Table 19: *Support for Climate Change-Related Activities from Multi-Lateral Donors, Type of Support, and Funding Level, 2014-2017*

Reporting period:	**2014 – 2017**							
Funding source	**Description of support, including the national contribution, in million USD**							
	Preparation of BUR				**Climate change activities contained in the BUR**			
	Financial	Capacity-Building (Capacity Building + Technical support)	Technology support	Technology transfer	Financial	Capacity-Building (Capacity Building + Technical support)	Technology support	Technology transfer
Multilateral sources								
1 EU					0.717	4.017		
2 IPA CBC						0.399		
3 EU Community Programmes						0.135		
4 GEF		0.673			0.049	0.717		
5 UNDP						0.038		
Subtotal		**0.673**				**6.071**		
Total				**6.745**				

Table 20: *Support received by multilateral financial institutions, including regional development banks*

Reporting period:		**2014 - 2017**							
Funding source		**Description of support, in million USD**							
		Preparation of BUR				**Climate change activities contained in the BUR**			
		Financial	Capacity-Building (Capacity Building + Technical support)	Technology support	Technology transfer	Financial	Capacity-Building (Capacity Building + Technical support)	Technology support	Technology transfer
Multilateral financial institutions, including regional development banks									
1	KfW	-	-	-	-	104.280	-	-	-
2	World Bank	-	-	-	-	-	-	-	-
3	EBRD(European Bank for Reconstruction and Development)	-	-	-	-	-	2.880	-	-
Subtotal			**-**				**107.160**		
TOTAL					**107.160**				

5.4.2 DOMESTIC SUPPORT

The Republic of Macedonia has provided financial support for climate change activities through national budget allocations by the Macedonian Government, the City of Skopje budget, the budgets of municipalities within the City of Skopje, and several municipalities outside of the capital.

Table 21: Anticipated budget allocations from the Budget of the Republic of Macedonia for all activities that contribute towards climate change mitigation (directly and indirectly) provides an overview of national budgetary allocations for climate change-related activities for the year 2017 for two key government ministries and one agency. For others, budget allocations are not listed at the programmatic level in a way that would allow them to be included in the table. As the table indicates, the Government of the Republic of Macedonia is currently spending a minimum of approximately 1.97% of its budget on climate-related activities.

Table 21: *Anticipated budget allocations from the Budget of the Republic of Macedonia for all activities that contribute towards climate change mitigation (directly and indirectly)*

	2017 budget (in mill USD)	Main budget (in mill USD)	Self-financing activities (in mill USD)	Loans in mill USD)	Donations (in mill USD)
Ministry of environment and physical planning					
Investments in environment	3.098	2.139			0.958
Sewage and discharge channels	1.668	1.668			
Monitoring	0.469	0.276	0.192		
Environment protection	3.618	3.534			0.084
Total	**8.850**	**7.617**	**0.192**	**-**	**1.042**
Ministry of transport and communications					
Traffic and communications	3.777	3.777			
Project for water supply and discharge of waste waters	5.035	1.499		3.537	
Gasification	36.844	1.478		35.365	
Investment in railway infrastructure	22.776	11.530		11.246	
Total	**68.432**	**18.284**	**-**	**50.148**	**-**
National Hydrometeorological Service					
Hydrology and monitoring of environment conditions	0.199	0.169	0.029		
Forecast, warning, information and equipment	0.444	0.440	0.004		
Total	**0.642**	**0.609**	**0.034**	**-**	**-**
Total for climate change-related activities	77.925	26.510	0.225	50.148	1.042
Total budget	**3,952.827**				
% of expenses for climate change vs total budget	**1.97%**				

Other sources of domestic support include the following:

- The Government of the Republic of Macedonia's contribution for co-financing of direct climate related projects/activities in the period 2014 – 2017 is estimated at EUR 18.845 million
- **The Fund for innovation and Technology Development (FITD)** has financed five climate-related projects in the period 2015-2017 amounting to EUR 447,592 in financial contributions.
- The **City of Skopje** has taken substantial steps to address climate change, and it is providing 1.42% of its total budget for climate change mitigation actions. Its 2017 budget anticipates spending to-

taling USD 1.952 million on climate change-related investments and programs.

- **Municipalities within the City of Skopje** have allocated a total of USD 4.284 million for mitigation-related projects such as investments in waste and wastewater treatment, energy efficiency, and gasification.
- **Municipalities outside of the capital** have provided nearly USD 150,000 in co-financing for climate change strategies and activities, and they have provided co-financing for activities supported by the GEF Small Grants Programme.

5.4.3 SUMMARY OF SUPPORT

Table 22: Summary of projects having direct and indirect climate mitigation impact and climate co-benefits by donor and by type of support, 2014-2017 presents a summary of all projects that have direct and indirect climate mitigation impacts and climate co-benefits. The activities in these projects do not always correspond to activities foreseen in the SBUR, and not all of the projects were approved/implemented as climate change projects.

Table 22: *Summary of projects having direct and indirect climate mitigation impact and climate co-benefits by donor and by type of support, 2014-201719*

Reporting period:		**2014-2017**							
Funding source		**Donor and national contribution for climate change activities (million USD)**							
		Financial (Donor Contribution)	Financial (Donor Contribution)	Capacity-Building (Donor Contribution)	Capacity-Building (National Contribution)	Technical support (Donor Contribution)	Technical support (National Contribution)	Technology transfer (Donor Contribution)	Technology transfer (National Contribution)
Multilateral sources									
1	EU	125.628	204.870	0.874	-	29.559	3.541	-	-
2	IPA CBC	-	-	0.249	-	0.158	0.070	-	-
3	EU Community Programmes	-	-	-	-	0.135	-	-	-
4	GEF	0.074	0.108	-	-	1.390	0.285	-	-
5	KfW	104.280	18.120	-	-	-	-	-	-
6	USAID	1.500	-	-	-	6.899	0.219	-	-
7	Swiss Development Cooperation	31.069	-	-	-	2.182	-	-	-
8	Austrian Development Cooperation	-	-	-	-	1.200	-	-	-
9	Norway	-	-	0.027	-	1.182	0.240	-	-
10	German Cooperation	-	-	0.050	-	0.240	-	-	-
11	France	-	-	0.032	-	-	-	-	-
12	Macedonian Government	-	-	-	0.006	-	-	-	-
13	UNDP	-	-	-	-	0.038	0.026	-	-
14	UNIDO	-	-	-	-	0.219	-	-	-
15	Macedonian Inovation Fund and companies' own funding	-	-	-	-	-	-	-	0.537
16	World Bank	70.980	-	-	-	-	-	24.000	-
17	EBRD	-	-	-	-	2.880	-	-	-
Subtotal		**333.531**	**223.099**	**1.232**	**0.006**	**46.080**	**4.380**	**24.000**	**0.537**
TOTAL		**632.865**							

19 The numbers presented in this table are for informational purposes only and must be assessed with special attention in order not to obtain the erroneous impression that the country has received significant climate change support, which is not the case.

5.5 TECHNOLOGY NEEDS, CONSTRAINTS AND GAPS, AND SUPPORT RECEIVED

Under UNFCCC Decision 2/CP.17, Annex III, Section V Paragraph 16., "Non-Annex I Parties should provide information on technology needs, which must be nationally determined, and on technology support received." In Macedonia, technology needs, constraints, and gaps are largely influenced by general capacity needs, constraints and gaps in the energy and environmental sectors.

The Fund for Innovation and Technology Development currently provides financial support for innovation and technology transfer in Macedonia. Its mission is to encourage and support innovation activities in micro, small and medium-size enterprises (MSMEs) in order to achieve more dynamic technological development based on knowledge transfer, development research and innovations that contribute to job creation, economic growth, and development while simultaneously improving the business environment for increased competitiveness of companies. Over the period 2015-2017, the FITD has financed 5 climate-related projects with a total value of EUR 447,592.

5.5.1 TECHNOLOGY NEEDS

Technology transfer plays a critical role in the effective global response to the challenge of climate change challenge. Under the work for this SBUR, the mitigation team identified and analyzed a series of important climate technologies in several sectors as part of the WEM and WAM scenarios for Macedonia (see Chapter 4), particularly in the Energy sector (for the Energy industries and Transport sub-sectors) and the Waste sector. In addition, Macedonia intends to analyze its technology needs in greater depth when resources become available for that activity.

5.5.2 TECHNOLOGY CONSTRAINTS AND GAPS

The following constraints and gaps have been identified in climate technology transfer.

- While different strategies and feasibility studies have been prepared, they do not contain clear priorities for utilizing IPA funding, and existing priorities can fluctuate.[20]
- Energy and environmental related decision-making is divided into two separate ministries
- The largest GHG emitter in Macedonia, the government-owned utility ELEM, does not have a free-standing Environment Unit separate from their Department for Development and Investment, which can lead to conflicting tasks and goals.
- There is a lack of coordination between the government agencies responsible for climate mitigation plans and stakeholders that can undermine support for these plans.
- The absence of municipal energy efficiency planning framework limits the amount of work that can be done at the community level in conjunction with municipal authorities, entities, local consumer groups and financing schemes (national or local).
- There is a lack of an enabling legislative and regulatory environment for energy efficiency and RES due to incomplete legislation and lack of energy planning at the national and local levels.

5.6 CAPACITY BUILDING

During the reporting period of 2014-2017, Macedonia has received significant **support for capacity reinforcement** by means of various **trainings, seminars, conferences and workshops.** A list of these events is provided in Annex 10.

20 Gjorgjievski, Mate and Mila Stankovic in EPI (2012).

In climate change research, three programs stand out in terms of developing long-term capacity to understand and address climate change: 1) Financial support for researchers in Macedonia that enables them to publish in international journals; 2) Government scholarships to allow outstanding students to attend masters and doctoral programs at top universities around the world; and 3) the establishment of the National Fund for Innovation and Technology Development. Additional information about research and innovation activities is provided in Chapter 8 of this report.

Macedonia also plans to use resources available under the Capacity Building Initiatives for Transparency (CBIT) as soon as it ratifies the Paris Agreement. Planned capacity strengthening measures include the following:

- **ACTIVITIES TO STRENGTHEN NATIONAL INSTITUTIONS FOR TRANSPARENCY-RELATED ACTIVITIES IN LINE WITH NATIONAL PRIORITIES.** These include support to national institutions to lead, plan, coordinate, implement, monitor, and evaluate policies, strategies, and programs to enhance transparency, and assistance the with deployment and enhancement of an information and knowledge management structure to meet Article 13[21] needs.
- **ACTIVITIES TO PROVIDE RELEVANT TOOLS, TRAINING, AND ASSISTANCE FOR MEETING THE PROVISIONS STIPULATED IN ARTICLE 13.** These include access to tools, templates, and applications; country-specific training and peer exchange programs on transparency activities; the continued development of country-specific emissions factors and activity data; and assistance in reporting on policy measures, projections, and support received.
- **ACTIVITIES TO ASSIST WITH IMPROVEMENT OF TRANSPARENCY OVER TIME.** These include support for an assessment of institutional arrangements for data collection, analysis, and reporting; MRV systems and capacity, the identification of gaps in implementing transparency-related activities, and the introduction and maintenance of tracking tools.

5.6.1 RECOMMENDATIONS FOR ADDRESSING CAPACITY CONSTRAINTS, GAPS, AND NEEDS

In addition to the measures to support institutional capacity development through CBIT listed above, other recommended measures include the following:

In climate policy development:

- Develop a Long-Term Strategy on Climate Action that defines long-term priorities, plans and development goals for Macedonia.
- Develop a comprehensive Law on Climate Change, which should be based on the outcomes of the Long-Term Strategy on Climate Action. The Law on Climate is supposed to provide a sustainable platform for sectoral mainstreaming of climate change priorities and implementation of national climate goals.

In climate-related institutional and capacity development:

- Provide additional employees and establish climate units in certain ministries and agencies where needed.
- Undertake capacity building activities and provide toolkits for the implementation of climate-related tasks and activities.

In climate financing:

21 The Transparency Framework for Action and Support (Article 13, Paris Agreement).

- View national climate funding as a multi-sectoral topic and integrate climate finance considerations into all sectoral policies and issues.
- Establish a coordination mechanism for climate funding that can serve as a management tool at the national level.
- Coordinate local climate finance with the national investments, and ensure that investments are aligned with local mitigation and adaptation plans.
- Place more emphasis on adaptation issues in local climate finance.
- Identify and develop opportunities to establish Public-Private Partnerships (PPPs) to finance climate-related investments.

In climate change-related research: Governmental institutions should take the following steps to improve the position of Macedonia in international climate policy dialogue and to assure proper climate action in the country:

- Provide long-term funding to improve working conditions and stability in academic institutions that are dealing with environmental and climate issues;
- Fund equipment, laboratory facilities and salaries for assistants and young researchers;
- Provide funding for "sandwich" graduate programmes, where students spent time abroad as part of their studies;
- Organize and sponsor on-line courses on climate-related issues;
- Lobby inter-governmental organizations and international donor organizations to fund research institutions and research priorities located outside of high-income countries;

National research institutions and the research community in Macedonia should implement the following aspects to assure long-term and sustainable climate mainstreaming:

- Take a more proactive role in mobilizing resources from the Horizon 2020 programme and building networks for climate-related research activities;
- Encourage students and young researchers to utilize the Erasmus + programme for enriching their studies with climate-related topics or support for internships on climate related topics.
- Build and participate in networks of South-South collaboration to strengthen researchers' capacities to cooperate with Northern researchers and with Southern colleagues, and make use of existing experiences, knowledge and expertise within non-Annex I countries.
- Work together to address common research priorities that span several Southern countries in order to approach regional problems and maximize use of the existing research base
- Support young researchers to return from studies abroad so that they may continue to contribute to the generation of in-country knowledge
- Contribute to the development of global research frameworks and global models for climate change issues
- Be involved in the global review and synthesis of relevant scientific activities, for example the IPCC Assessment Reports
- Encourage citizen science in monitoring, reporting and verification, and monitoring and evaluation of the measures for climate mitigation.

Recommendations on data collection are provided in Chapter 7 in Section 7.4.

LEVEL OF SUPPORT RECEIVED FOR THE BURS

Financial support for the FBUR and SBUR documented from the Global Environmental Facility, the United Nations Development Programme (UNDP), and the Ministry of Environment and Physical Planning

Administrative support for the FBUR provided by UNDP at the country level and through the Global Support Unit for National Communications and Biennial Update Reports

10 AREAS

identified where support allowed the SBUR team to improve reporting

CHAPTER 6 LEVEL OF SUPPORT RECEIVED FOR THE BURS

6.1 LEVEL OF SUPPORT RECEIVED FOR THE BURS

To assist the Republic of Macedonia in the preparation of its **First Biennial Update Report** to the UNFCCC, which was submitted in 2015, the GEF provided support in the form of an Enabling Activity grant in the amount of USD 321,461.

For the preparation of this **Second Biennial Update Report**, the GEF provided support in the form of a grant in the amount of USD 352,000 for an Enabling Activity project that also included USD 73,900 in co-financing. Co-financing was provided in the form of a grant from UNDP (USD 43,900), a grant from MOEPP (USD 15,000), and in-kind support from MOEPP (USD 15,000). UNDP also provided support for stakeholder inclusion, planning, and identifying innovative approaches to data collection and modelling inputs. The project team also utilized in-kind technical and administrative support from the Global Support Programme for National Communications and Biennial Update Reports. Information on financial support for the BURs is also provided in tabular format in Annex 8.

6.2 SCOPE OF ACTIVITIES SUPPORTED

The grants and in-kind support received under the GEF Enabling Activity project allowed the project team to undertake the following activities, which form only a partial list of improvements in the preparation process and subsequent SBUR.

- Update the national circumstances and institutional arrangements as reported in this SBUR, including updates on Macedonia's development objectives and climate change objectives in the form of its INDCs.
- Increase stakeholder participation in the preparation of the reports and provide recommendations for ensuring sustainability in the BUR process.

- Prepare a new GHG inventory for 2013-2014 using UNFCCC-recommended software and expand the number of sectors using higher Tier data and updated and new fuel-specific and combustion-specific emission factors.
- Assess the legal framework for GHG data collection and management and recommend improvements
- Fine-tune the reference scenario and two mitigation scenarios and align them with IPCC categories for the period 2012-2035.
- Select a broad variety of mitigation options, assess their marginal abatement costs and potential for green job creation, and formulate existing options into a National Action Plan.
- Identify constraints and gaps in the implementation of mitigation measures at both the country level and the local level; and assess related financial, technology and capacity building needs
- Expand reporting to provide specific information on donors, and funding levels, and stage of implementation for support received related to climate change activities.
- Assess current domestic MRV arrangements and make recommendations on how to coordinate MRV activities across sectors and streamline reporting for various international commitments.
- Publish and submit the Second Biennial Update Report in accordance with the guidelines contained in Annex III of Dec.2/CP. 17

DOMESTIC MEASUREMENT REPORTING AND VERIFICATION SYSTEMS

A series of recommended measures for an MRV system are proposed that will comply with UN and EU requirements as well as reflect the Paris Agreement and the Macedonian NDC (which serves as its primary target under SDG13).

THE PROCESS IN A NUTSHELL

- The findings and recommendations of the MRV chapter are an outcome of a wide consultation process involving 17 representatives

29% **71%**

- Input has been provided by

19 national institutions

CHAPTER 7 DOMESTIC MEASUREMENT REPORTING AND VERIFICATION SYSTEMS

7.1 OVERVIEW

For the SBUR, the project team focused on in-depth analyses of national capacities (financial and human) to put the proposed MRV system into operation. This activity had two components:

- Identifying legal obligations for the establishment of monitoring and reporting systems and the state of their practical implementation. In other words, the study sought to determine whether there were established systems that used established criteria, metrics and defined indicators to perform monitoring and reporting in an organized manner.
- Identifying the institutions or organizations that were in charge of implementing a particular specific activity, the way in which those institutions / organizations monitored implementation, to whom and how they reported, how information and data were verified, etc.

7.2 COUNTRY CONTEXT FOR MRV

The Republic of Macedonia is in a unique situation when it comes to its international obligations regarding monitoring, reporting and verification. Namely, the Republic of Macedonia is a Party to the UNFCCC, but it is not part of Annex I; i.e., it does not have quantified commitments. Despite the fact that Republic of Macedonia is not an Annex I Party, it is voluntarily attempting to incorporate Annex I reporting principles as much as possible into the framework of its National Communications and Biennial Update Reports.

The Republic of Macedonia also has the status of a Candidate Country for EU membership, which carries certain obligations in the context of the accession process that will increase as membership negotiations progress. As the European Union and its Member States are parties to the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, they are required to report annually on their GHG emissions. They must also report regularly on their climate change policies and measures through National Communications. The annual EU GHG inventory report is prepared on behalf of the European Commission by the European Environmental Agency each

spring. In line with UNFCCC reporting requirements, each Member State's annual inventory covers emissions up until two years previously.

Finally, the Republic of Macedonia is a Contracting Party of the Energy Community (EnC), which is rapidly implementing many policies that are directly related to the issue of MRV.

7.2.1 LEGAL AND REGULATORY CONTEXT

The relevant EU legislation includes the following regulations:

- Regulation (EU) No 525/2013 of the European parliament and of the Council on mechanisms 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 (hereinafter: **Monitoring Mechanism Regulation or MMR**). This regulation is of particular importance for the Republic of Macedonia because of the recommendation of the Ministerial Council of the Energy Community, adopted in October 2016, which recommends that the Contracting Parties ensure the legal and institutional conditions for the implementation of the essential elements of this Regulation.
- Commission Implementing Regulation (EU) No 749/2014 of 30 June 2014 on structure, format, submission processes and review of information reported by Member States pursuant to Regulation (EU) No 525/2013 of the European Parliament and of the Council.
- Commission Delegated Regulation (EU) No 666/2014 of 12 March 2014 establishing substantive requirements for a Union inventory system and taking into account changes in the global warming potentials and internationally agreed inventory guidelines pursuant to Regulation (EU) No 525/2013 of the European Parliament and of the Council.

In the Republic of Macedonia, The Law on Environment[1] currently regulates the issue of monitoring of anthropogenic emissions by sources and sinks of greenhouse gases. Namely, pursuant to Article 186-a, MOEPP is supposed to establish, develop, manage and coordinate a National System for Inventory of GHG emissions. This system will provide data for the preparation of the GHG inventory, as well as for monitoring the implementation of the National Plan for Climate Change (Article 187), which is adopted for a period of six years. However, the Law on Environment does not yet regulate the issue of MRV on policies and measures in detail. In order to be effective, the law would require an amendment. The FBUR also proposed a bylaw that could clearly define an MRV system for policies and measures.

Sectoral laws and strategies provide some guidance on monitoring and reporting on policies and measures in several key areas:

- In the energy sector, the **Law on Energy**[2] regulates, albeit incompletely, the issues of monitoring, reporting and verification of the implementation of strategic documents, including institutional competence.
- The **Strategy for Energy Development** (Article 10, Law on Energy) is adopted every five years and refers to the next 20 years. The Strategy adopted by the Macedonian Government in 2010, which is valid until 2030, is currently in force.[3] There is a chapter of this Strategy, "The manner of monitoring the realization of the Program," that prescribes the structure of the annual report and the requirements for information in it. Annex 1 of the document also establishes indicators for evaluating the use and the effects of its implementation, as well as the competence to monitor each individual indicator.

1 "Official Gazette of the Republic of Macedonia" 53/2005, 81/2005, 24/2007, 159/2008, 83/2009, 48/10, 124/10, 51/11, 123/12, 93/13, 42/14 and 44/2015)

2 "Official Gazette of the Republic of Macedonia" 16/2011, 136/2011, 79/2013, 164/2013, 41/2014, 151/2014, 33/2015, 192/2015, 215/2015, 6/2016 and 53/2016

3 *The Strategy for Energy Development in the Republic of Macedonia for the period until 2035* was drafted in 2016; however, its adoption has been delayed.

- The **Strategy for the Use of Renewable Energy Sources** in the Republic of Macedonia (Article 144, Law on Energy) is adopted every five years and refers to the next 10 years. The Strategy that is currently in effect was adopted by the Macedonian Government in 2010 and is valid until 2020. An Action Plan for Renewable Energy Sources of the Republic of Macedonia has been adopted for the realization of the Strategy, the current plan[4] running from 2015 to 2025. The content, manner and deadline for submitting the data required for the preparation of the two-year report for the implementation of the Action Plan is not prescribed by law or by-law. However, as a response to the obligation of the Republic of Macedonia to the Energy Community Treaty, the report is prepared according to a template recommended by the European Commission in accordance with Article 22 of Directive 2009/28/E[5].
- The **Strategy for Energy Efficiency** of the Republic of Macedonia (Article 130, Law on Energy) was adopted by the Government for a period of 10 years, and the current one is adopted in 2010 and is valid until 2020. However, for its implementation, every three years a National Energy Efficiency Action Plan (NEEAP) is adopted. The monitoring of the implementation of measures and activities is entrusted to the Energy Agency of the Republic of Macedonia (EARM), which has to prepare and submit annual reports to the MoE, but there is no by-law that prescribes the content, manner and deadline for submission of data required for the preparation of the annual report.
- **Rail transport** is regulated by the Law on the Railway System[6]. From the viewpoint of the measures envisaged in INDC, it is important to establish that they originate from the National Transport Strategy for the period 2007 - 2017 and the National Program for Railway Infrastructure for the period 2014-2016[7] (Article 26, Law on Railway System). A three-year National Program is adopted by the Parliament, and the public enterprise Macedonian Railways - Infrastructure (PE MZ-I) prepares an annual program for railway infrastructure financing that is adopted by the Government. In the context of monitoring and reporting, the law stipulates a responsibility for PE MZ-I to report to the Macedonian Government on the implementation of its annual program during the first quarter of the year. However, it should be noted that the Law does not stipulate any methodology for preparing the annual report or for establishing a system for monitoring and reporting on implementation of the annual program for financing the railway infrastructure.
- For **road transport**, the Law on Vehicles[8] regulates the issues of market release and start of operation of vehicles, registration and roadworthiness, as well as the data registry for vehicles, which is run by the Ministry of Interior. Unfortunately, although the law has been in force for almost a decade, the by-law that should prescribe the form, the content and the manner of keeping the registry, and the manner of input and release of data, has not yet been enacted.

In conclusion, though national legislation clearly indicates that monitoring systems should be established, and several systems are under development or testing, none of the responsible institutions have comprehensive, fully-operational systems in place. At present, these institutions partially carry out their responsibilities for the preparation of certain reports that are prepared on the basis of available data and information, which is collected on an ad-hoc basis or pursuant to the legal competences, but may also be based on certain engineering estimates and calculations in cases where data and information are missing.

7.2.2 ELECTRONIC SYSTEMS FOR MONITORING AND REPORTING

A desk review and interviews conducted during the preparation of the SBUR identified several systems that were relevant to monitoring and reporting sectoral data related to climate change commit-

4 "Official Gazette of the Republic of Macedonia" 207/2015.

5 Pursuant to Article 15 of the EC Decision (2012/04/EnMC), the country is obliged to prepare a two-year progress report on the promotion and use of energy from renewable sources

6 "Official Gazette of the Republic of Macedonia" 48/10, 23/11, 80/12, 155/12, 163/13, 42/14, 130/14, 152/15, 31/16 и 178/2016

7 http://www.slvesnik.com.mk/Issues/e7894ff1966d4f72953a83c3490352e1.pdf

8 „Official Gazette of the Republic of Macedonia"140/2008, 53/2011, 123/2012, 70/2013, 164/2013, 138/2014, 159/2015, 192/2015 and 39/2016)

ments and activities. The following systems are under construction or are being tested:

- **Software to partially automate data collection for the preparation of the energy balance** of the country has been developed. This software should enter into use in 2018.
- **A monitoring and verification web platform (MVP) to monitor the implementation of the NEEAP** was developed in 2016 with technical assistance from GIZ. These activities are part of the work program of the Group for the Coordination of Energy Efficiency within the Energy Community Secretariat in Vienna. The MVP will facilitate reporting to national and international institutions. Unfor-

Figure 33: *Screenshot of the Emissions Monitoring in Industry (EMI) Software*

tunately, this tool has not yet been put into use. The most important operational issue is a lack of financial and human capacity. In addition, there is no legal basis for the use of the MVP, although it will be used by EARM.

- **ExCITE, software for monitoring energy consumption in municipalities**, was developed in 2010 with support from UNDP. The software (Figure 3), was installed on the information platform of the Association of Local Government Units (ZELS), and training was provided for municipal and central government employees. Following amendments to the Energy Law from 2013, UNDP provided additional support to the Ministry of Energy for the development of a new version that was fully tailored to the Rulebook on Information Systems. Pursuant to the Rulebook, the information system is supposed to be established and maintained by the EARM from 2016 onwards; however, adequate resources have not yet been provided by the agency.
- A special **tool to monitor the energy market in Macedonia** was developed in 2016 by the Energy Regulatory Commission (ERC) of the Government of Macedonia with financial support from Norway.[9] The tool is based on the spreadsheet program Microsoft® Excel, although the open source program LibreOffice® Calc5 can also be used for data input.
- **Emission Monitoring in Industry (EMI)** is software that was developed partly under the TNC, but entirely within the FBUR (Figure 33: Screenshot of the Emissions Monitoring in Industry (EMI) Software). It enables industry to meet its legal obligations for reporting annual emissions of greenhouse gases and air pollutants in accordance with the IPCC using CORINAIR methodology The EMI portal was developed with the help of a Java software platform (Enterprise Edition) and MySQL database, and it is installed on an Apache Geronimo open source server. It is an operational database, designed to provide links and to systematize collection of data from the industrial sector to prepare the three inventories that are the responsibility of MOEPP: the greenhouse gas inventory, the cadaster of air pollutants, and the cadaster of pollutants.
- The **Vehicle Registry**, the current system for monitoring the status of the car fleet, is an outdated, complex and closed system. However, the existing system provides a great deal of technical information, including information on factory-specified (i.e. measured) emissions of CO_2. A new electronic register of vehicles is envisioned that will collect data from the registration process, including technical inspections, as well as data from the approvals procedure and identification.

7.3 THE MONITORING MECHANISM REGULATION (MMR)

- Regulation (EU) No 525/2013 on mechanisms for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change (the MMR) revises and strengthens the EU's greenhouse gas monitoring and reporting framework in order to provide a better platform for EU action to tackle climate change. The main goals of the MMR are to improve the quality of the data reported, to enable the implementation of the Climate and Energy package by accurately tracking the progress of the Union and EU Member States towards meeting their emission targets for 2013-2020, and to incorporate periodic updates at the international level of metrics (global warming potentials) and methodologies (IPCC guidelines) in the determination of greenhouse gas inventories.

The MMR implements a new review and compliance cycle, which was established under the Effort Sharing Decision, for member states' binding annual emissions targets. They incorporate enhanced reporting on several topics, including land use, land-use change and forestry (LULUCF), maritime transport, climate adaptation, non-CO_2 impacts of aviation, and the use of revenues from auctioning of carbon allowances under the revised EU Emissions Trading System (EU ETS) Directive. They also introduce reporting on financial and technology support provided to developing countries, which would most likely go beyond the new UNFCCC reporting requirements on support.

9 Verbal information obtained from relevant persons in the ERC (see Annex 5)

In addition, the MMR requires each EU member to establish a national, integrated system for preparing emissions projection scenarios and evaluating policies and measures. Members are required to clearly lay out the procedures and institutional arrangements for preparing emissions projections, as they currently do for inventory preparation. The revisions also require member states to check that activity data, background data, and assumptions used to estimate emissions for GHG inventories are consistent with data used for reporting under legislation related to air pollution.

Finally, the MMR requires Member States to report to the Commission information on their national adaptation planning and strategies, outlining their implemented or planned actions to facilitate adaptation to climate change. That information shall include the main objectives and the climate-change impact category addressed, such as flooding, sea level rise, extreme temperatures, droughts, and other extreme weather events.

7.4 RECOMMENDATIONS FOR MRV IN THE REPUBLIC OF MACEDONIA

Given Macedonia's status as a non-Annex I Party to UNFCCC, a Candidate Country for EU membership, and a Contracting Party of the EnC, the MMR Regulation of the EU can be seen as a common denominator for MRV activities. The Republic of Macedonia should immediately begin to adjust its national legislation in order to adopt the provisions of the MMR. While Macedonia's FBUR proposed the creation of a legal framework for an MRV system in the form of amendments to the Law on Environment and a draft Rulebook on MRV, neither of these steps have been taken. Therefore, there are currently two alternatives for creating a suitable legal and regulatory framework:

- The first alternative is to immediately prepare an amendment to the Law on Environment that will fully approximate Regulation 525/2013 as adapted by the EnC; this amendment would create a legal basis for establishing the national system for MRV. Since the MMR already has an implementing regulation, namely Regulation 749/2014, secondary legislation (decree or rulebook) that specifies methodologies and requirements for establishing the national MRV system should be prepared and adopted simultaneously with the amendment to the Law on Environment.
- The second alternative is to immediately start the process of drafting an integrated law on climate action, in which, among other issues, obligations for the establishment of the MRV system will be regulated; i.e. the law would incorporate the provisions of the adjusted Regulation 525/2013, while secondary legislation would adopt the provisions of Regulation 749/2014.

The first alternative is much faster because it will focus on only two key EU regulations. On the other hand, the second alternative would be a comprehensive, long-term solution, because it could cover other EU legislation that does not have to be adopted immediately. Both of the alternatives must be compatible with the current systems and national requirements for monitoring and reporting that are described in Section 7.2.2.

Figure 34: Proposed Organization of an MRV System for Policies and Measures represents an organizational scheme for establishing the national system for MRV for policies and measures to mitigate climate change. This scheme will require some changes in national legislation in order to incorporate existing monitoring systems, which should be obliged to report to MOEPP. In other cases, organizations may have to adjust their current systems in order to provide information in the format and standards required by Macedonia's international obligations.

The **following measures** are recommended for a national MRV system that will comply with UN and EU requirements as well as reflect the Paris Agreement and the Macedonian NDC (which serves as its primary target under SDG13). These recommendations cover all three aspects of MRV in this context: 1) GHG inventories; 2) Mitigation policies and measures and emissions projections; and 3) Adaptation.

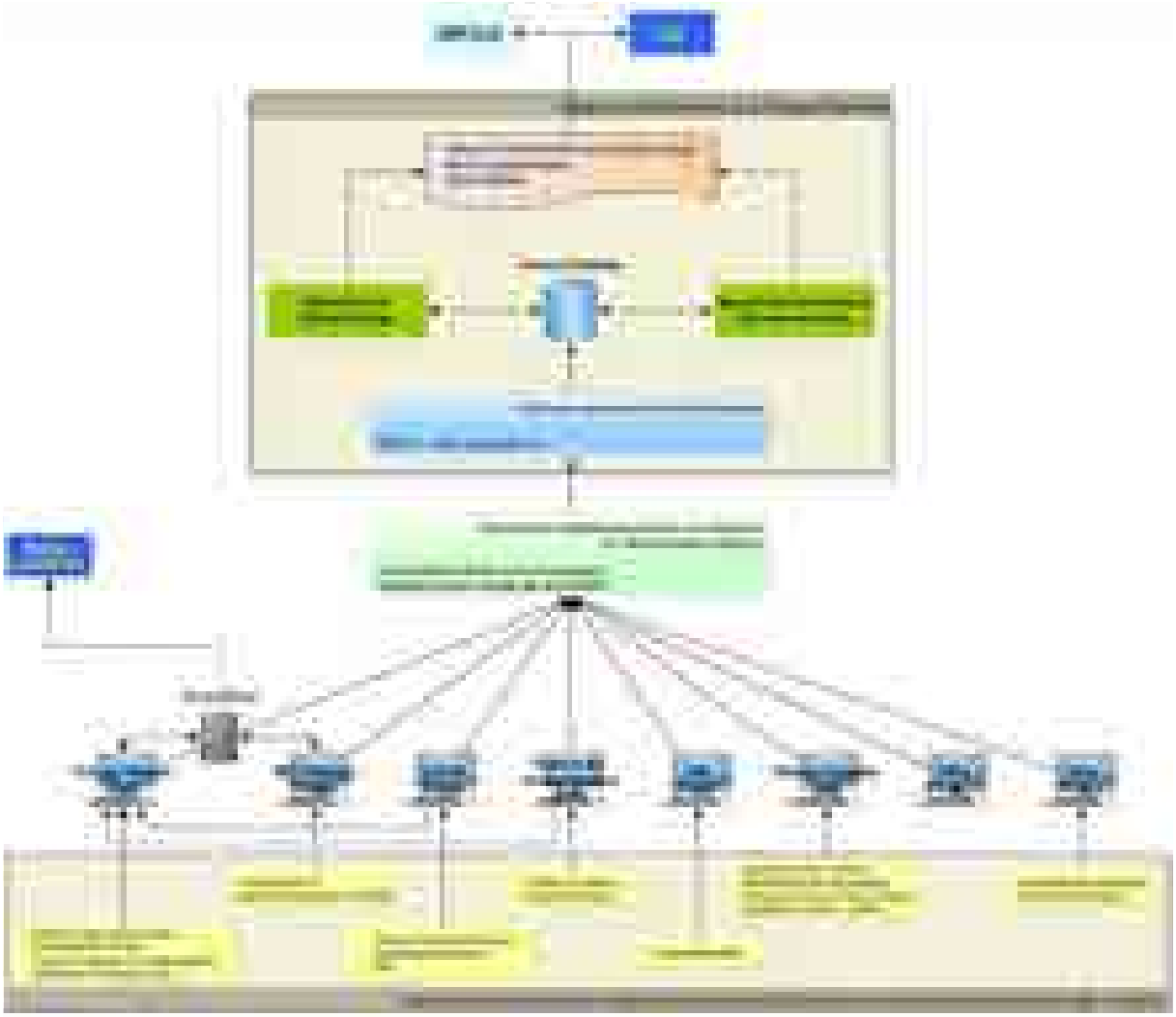


Figure 34: *Proposed Organization of an MRV System for Policies and Measures*

GHG INVENTORIES

(Required in: UN reporting – NCs and BURs; EU MMR – reporting on GHG emissions; tracking the SDG13 implementation)

- Maintain the current practices of inventory preparation;
- Enhance the reporting on land use, land-use change and forestry (LULUCF);
- Institutionalize the GHG Inventory (from project based to process based).

MITIGATION POLICIES AND MEASURES AND EMISSIONS PROJECTIONS

(Required in: UN reporting – NCs and BURs; MMR reporting on mitigation policy and measures and projections; tracking the NDC implementation; tracking the SDG13 implementation)

- Create an enabling environment for the implementation of mitigation measures (de-risking);
- Facilitate and encourage leadership by sub-national and private actors such as cities, regions, business and civil society in NDC implementation and future revisions;

- For each of the identified mitigation measures elaborate an MRV system, which should be in compliance with the EU MMR and include procedures and institutional arrangements that best reflect the specific conditions of the country and its mitigation obligations and that will enable tracking progress toward the mitigation target and attracting international climate financing for domestic mitigation measures. Start with the highest priority measures (with highest mitigation potential and lowest specific costs);
- Develop mechanisms for tracking investments in CC mitigation;
- Maintain the extensive analytical work for scenario development and emissions projections, creating a solid analytical base for future revisions;
- Include evaluation of the co-benefits of mitigation measures and use them among the criteria for prioritization.

ADAPTATION POLICIES AND MEASURES

(Required in: UN reporting – NCs; MMR reporting on adaptation; tracking the SDG13 implementation)

- Adopt a National Adaptation Plan at the government level;
- Develop an MRV scheme for adaptation measures, starting with measures addressing the most vulnerable sectors;
- Develop mechanisms for tracking investments in CC adaptation;
- When developing the Adaptation chapter in NCs, follow the MMR guidance on adaptation
- Facilitate and encourage leadership by sub-national and private actors, such as cities, regions, business and civil society;
- Submit an updated government climate pledge, including vulnerability and adaptation components.

Specific supporting capacity needs at relevant agencies for MRV are identified in Section 5.2.1 of this report.

OTHER RELEVANT INFORMATION

ACTIVITIES:

- Enhanced coordination in the communication of climate actions
- Making use of innovative tools and activities
- Improved system for monitoring communication activities

RESULTS:

- 10% increase in the number of respondents who in the last two years are well informed about the reasons for mitigation measures and adaptation to climate change.
- 73% of respondents obtain information related to climate change from the internet, 51% from social media, and 50% from TV.
- 20 journalists from 14 electronic and printed media outlets are trained in media coverage of climate change.

GOOD PRACTICES

- **Mainstreaming climate change -** One of seven countries in the world to include climate change in the Open Government Partnership Action plan
- **Mainstreaming Sustainable Development Goals (SDGs) into national planning -** SDG 13 has been adequately covered in national strategic documents in the areas of mitigation, vulnerability assessments, awareness and dissemination.
- **Climate Change Communications -** Significant progress on implementation of the Climate Change Communication Strategy

CHAPTER 8 OTHER RELEVANT INFORMATION

8.1 INFORMATION AND AWARENESS-RAISING ACTIVITIES

The following section presents noteworthy new developments and planned activities related to climate change in the Republic of Macedonia, particularly activities related to education and public awareness related to climate change relevant to Article 6 of the UNFCCC. The primary information portal for climate change information in the country is the national climate change website (www.klimatskipromeni.mk). The website is designed as a "one-stop shop." In addition to all national policies and reports on climate change, the website has several interactive features, including two interactive features—one for policy-makers and one for the public—that compare different mitigation measures. Another feature allows users to compare emissions from traffic congestion for different cities around the globe.

8.1.1 SURVEY ON CLIMATE CHANGE KNOWLEDGE AND PERCEPTIONS

In December 2016, UNDP and MOEPP conducted an online survey in order to provide a current snapshot of public knowledge about climate change and their perceptions of the issue. The results from this survey update the results of the public survey conducted in November 2014 under the preparation of the Third National Communication on Climate Change about key incentives for and challenges to environmental and climate-conscious behavior. The current survey also provides updated information on respondents' main sources of information about climate change and the perceived visibility of this topic in the media, as well as the visibility of various climate change campaigns and projects.

The on-line survey was conducted in the Macedonian language. It consisted of a questionnaire with 22 primarily close-ended questions, which were divided into four sections: *General Questions; Climate Change Perceptions; Behavioral Aspects;* and *Information Sources*. Most of the questions in the latter three sections were multiple-choice. Because the survey was hosted on an interactive, on-line platform, the participants' answers could be tabulated immediately after they were submitted. In this

way, participants could submit their responses and then immediately see how they fit into the overall survey findings.[1]

In order to engage the public, the on-line survey was distributed through professional mailing lists and promoted through social media outlets, such as Facebook and Twitter. The survey was also sent to 791 recipients from government, the private sector, academia, NGOs, and the media. A total of 88 Macedonian online news portals (49 Macedonian-language portals and 39 Albanian-language portals), including the MIA (Macedonian Information Agency), Sitel, and Popularno.mk, also distributed links to the survey.[2] In addition, the survey was published on the MOEPP website and at the Macedonian climate change website.[3] Finally, the general public was invited to participate through advertisements on Facebook (Figure 35: "Do you Care about Climate Change?" (Facebook Advertisement)). The target audience was specified by location in the Republic of Macedonia. The survey based on the Facebook advertising campaign was run for 14 days. The questionnaire was also promoted through various Twitter accounts.

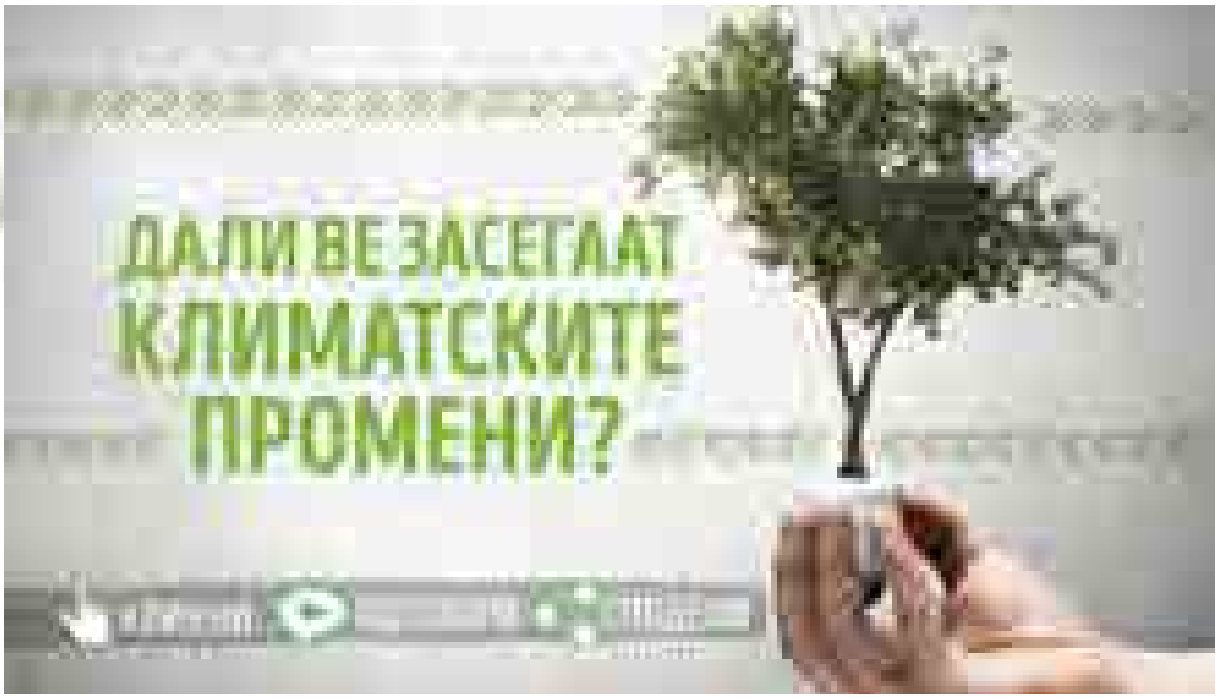


Figure 35: *"Do you Care about Climate Change?" (Facebook Advertisement)*

A total of 583 completed surveys were collected in a two-week period, with 71% of respondents from the ten municipalities of the city of Skopje and the rest from an additional 45 municipalities outside of the capital. Participants belonged to various age groups with the exception of persons over 65, and there were 5% more female respondents than male respondents. The majority of participants (474) held a university degree, and together with those with masters or PhD degrees, they represented 85% of the sample.

8.1.1.1 Survey Findings: Beliefs and Behaviors

Compared to the previous on-line survey,[4] respondents felt more knowledgeable about climate change. Half of the participants considered that they were informed about a variety of climate change impacts and consequences, and they identified the most visible climate change impacts as extreme

1 The interface of the automatic results analysis from the last page of the survey is available for viewing at (http://klimatskipromeni.mk/UNDP/SURVEY/SurveyResultsEN.html)

2 Located at http://www.mia.mk/, http://sitel.com.mk/, and http://www.popularno.mk/, respectively.

3 Located at www.klimatskipromeni.mk.

4 UNDP and MOEPP (2014). "Climate change perception and awareness level: an online survey of the citizens of the Republic of Macedonia."

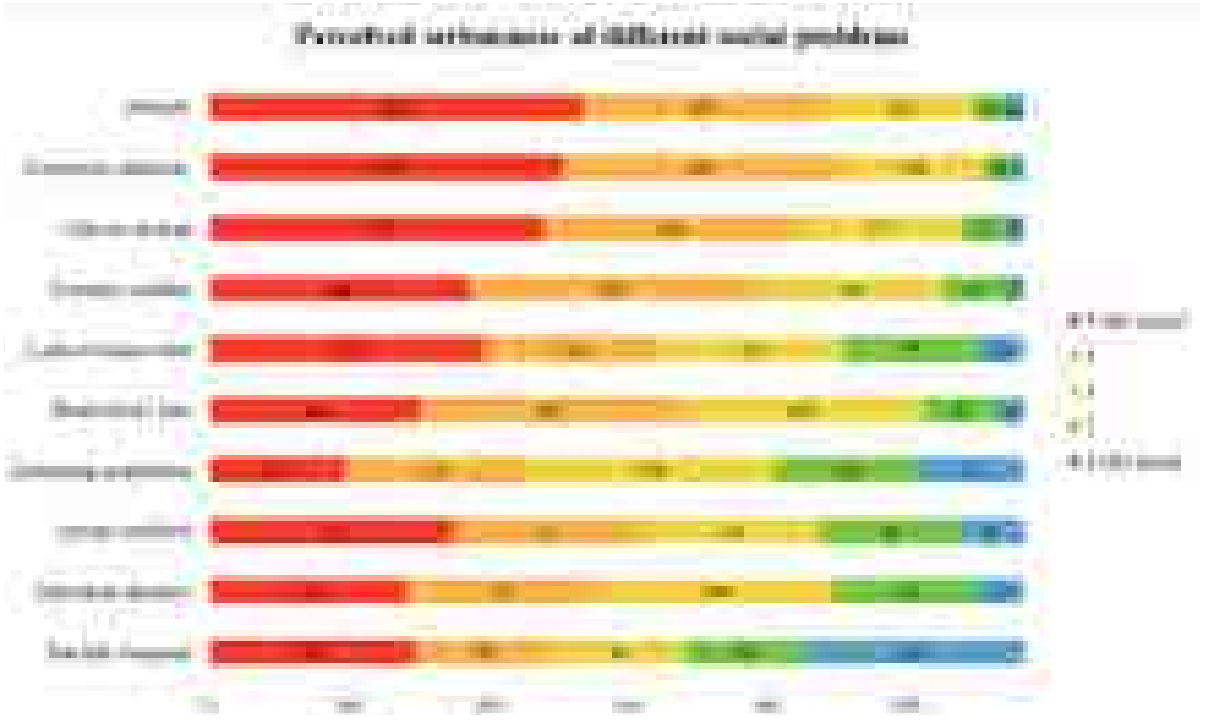


Figure 36: *Ranking of the seriousness of possible threats to society*

temperatures and irregularities in seasonal shifts and precipitation patterns. In the same line, participants reported an increase in climate change topics in the media, and half of the respondents related this increase to more frequent occurrences of extreme weather events.

Figure 36: Ranking of the seriousness of possible threats to society shows how participants ranked the seriousness of possible threats to society, where *5* represents the most serious and *1* the least serious threat. Poverty was perceived as the most serious threat by majority of participants (46%), followed by the economy (30%); climate change was ranked third. Respondents were least concerned about nuclear weapons proliferation.

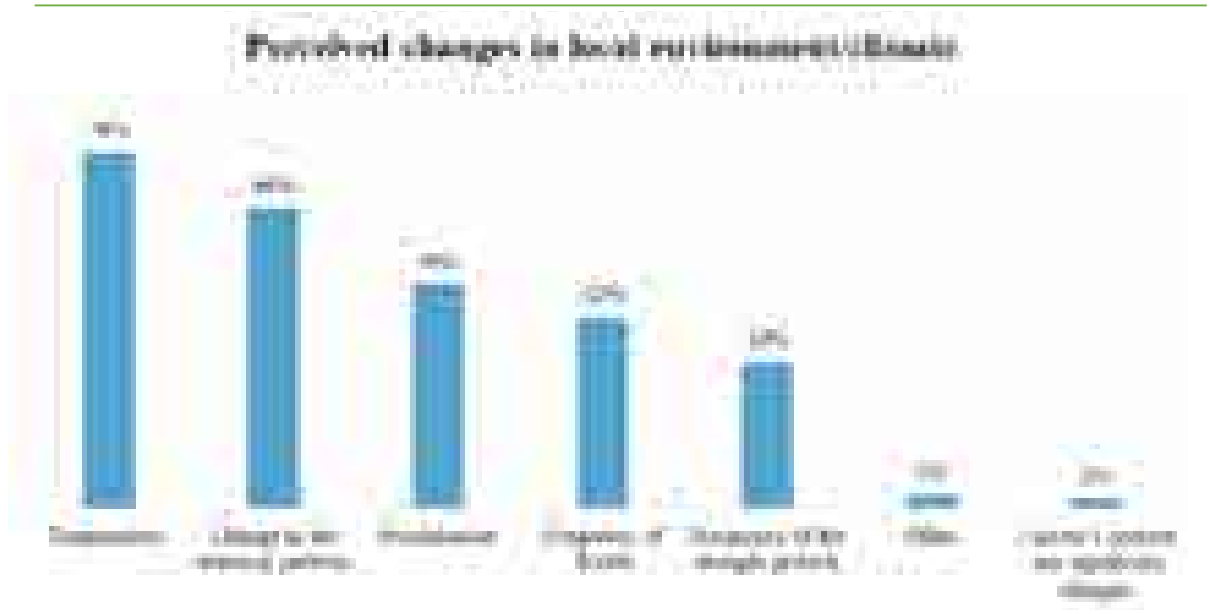


Figure 37: *Environmental/climate aspects in which participants noticed changes in the past 10 years*

Most respondents perceived some changes in the environment or climate in the past 10 years (Figure 37: Environmental/climate aspects in which participants noticed changes in the past 10 years). In particular, 78% of the respondents noted the occurrence of extreme temperatures, such as periods of extreme heat and cold, while others perceived irregular seasonal shifts (66%) and changes in precipitation patterns (49%). Other changes not listed in the survey but reported as perceived by the participants included a lack of snow and an increased occurrence in temperature inversions, leading to smog.

In the area of climate action, the majority of the respondents had heard about the Paris Agreement and its status as the first universal, legally-binding global compact to combat climate change. Nearly all respondents (94%) considered it important to fight against climate change, while most (368) thought that this should be done by reaching a global climate change agreement. When asked about their opinions on the Paris Agreement, most survey respondents considered that all countries, including their own, should contribute to addressing climate change. However, the second largest group of respondents (80), representing around one quarter of the sample, expressed doubts that individual countries would respect the targets and actions in the agreement.

In addition, participants were not satisfied with the extent to which authorities, corporations and industry—or even citizens themselves—were contributing to the fight against climate change. Similarly, 34% reported that one obstacle to environmental and climate-conscious behavior was a feeling that it is not the duty of citizens, but that of the government, companies and industries. Conversely, 61% of the participants thought that it was their duty as citizens to protect the environment. This finding signals that citizens are progressing along a learning curve in their understanding about how individuals can contribute to tackling climate change. It is also encouraging that only 2% of the sample thought that it was too late to act against climate change, compared to 14% in the previous survey.

In other encouraging findings, most of the respondents reported that they took the environment and climate into consideration when making everyday decisions, as demonstrates. The majority of respondents reported making efforts to reduce energy and water consumption and to insulate their homes to reduce the amount of energy used for heating. More than half of respondents reported buying environmentally-friendly products and recycling their waste. Reducing the use of disposable items and purchasing local products were less popular options. Finally, the least popular measures

Figure 38: *Environmental and climate friendly activities practiced by participants*

were the installation of renewable energy equipment, the purchase of fuel-efficient cars, and the use of alternative transport. The lack of popularity of purchasing equipment and fuel-efficient cars could be explained by the fact that this would imply investing a substantial sum of money that might not be available to the majority of the respondents. The fact that poverty and the economy are perceived as the most serious social problems supports this assumption. However, the reasons behind the low popularity of alternative transport are not as clear and merit further examination.

Survey respondents stated that they were motivated to pursue a path of more environmentally-friendly behavior, and almost all participants said that they would be willing to use renewable energy. The main motivation for more environmentally-friendly behavior is a desire to live in a healthy and clean environment. By and large, the results reflect a more optimistic spirit within the Macedonian population when it comes to tackling climate change than in 2014.

8.1.1.2 SURVEY FINDINGS: CLIMATE CHANGE INFORMATION

Figure 39 shows that participants consider they are informed about a variety of climate change impacts and consequences, as well as of different causes of climate change. However, the Macedonian citizens feel they are missing further information on ways to fight climate change, and especially how to adapt to climate change.

Survey participants reported obtaining most climate change-related information from the Internet (73%), followed by social media (51%) and television (50%). This confirms the trend noticed in the report from 2014 that social media were becoming an important way of disseminating climate change information. Respondents who identified themselves as decision-makers were more likely to report using MOEPP webpages, other specialized Internet portals, and project reports as sources of information. In addition, the Internet has now replaced television as the primary source of information about climate change for respondents who identified as decision-makers and for those who identified as members of the public. However, one concerning finding remained the same as in 2014: other than using the Internet (67%), most decision-makers (61%) were still learning about climate change from television.

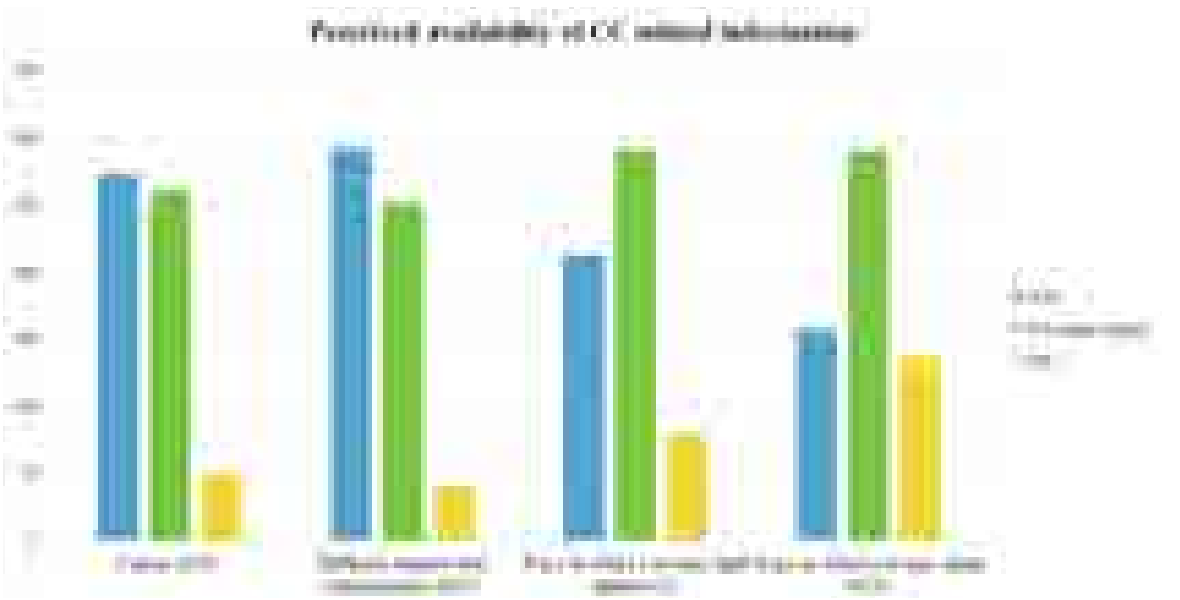


Figure 39: *Familiarity with different climate change related issues*

Once again, disseminating climate change-related information via e-mail turned out to be the least popular communication channel. However, it was interesting that in 2014, 23% of the respondents used scientific journals to become informed about climate change, while in the current survey, in spite of the high education level of the current sample, they were identified as the least popular source of information, with only 2 persons reporting using them in 2016. In addition, as suggested in the comments in the previous survey, many respondents linked the visibility of climate change issues with an increase in public awareness and interest in this topic in the country. Participants were familiar with climate change campaigns organized by international organizations (in particular UNDP and USAID) and environmental NGOs. Furthermore, almost half of the respondents were also aware of climate change information campaigns organized by MOEPP.

Finally, it should be noted that the higher number of respondents compared to the survey conducted in 2014 is a sign that the issue of climate change is appealing enough to motivate participation. Macedonian citizens proved enthusiastic about collaboration on this topic and ready to be more actively involved in climate change governance. Decision-makers should build on the positive momentum already identified in 2014 and continue with participatory activities in the area of climate change information sharing and awareness raising.

8.1.2 CLIMATE CHANGE COMMUNICATION STRATEGY

As a part of the development and implementation of the Third National Communication on Climate Change, the country developed a **communication strategy on climate change**, along with an accompanying **action plan**. The first phase of the action plan, which was implemented during the period of 2013-2016, contained four objectives: one on general communications, and three targeting particular groups (cities, workplaces, and households). When evaluated in 2017, progress on the implementation of this action plan ranged from "satisfactory" (for cities and households) to "significant" (workplaces), and "almost completely implemented" (for the general communications strategy). Key achievements included the following:

- **OVERALL COORDINATION IN CLIMATE CHANGE COMMUNICATION:** establishment of a **social innovation center; training for 20 journalists** on climate change media coverage; and a reported 10% increase over two years in survey respondents who felt well informed about climate change causes, mitigation, and adaptation.
- **COMMUNICATION WITH CITIES:** development of eight local climate change strategies and implementation of 20 adaptation measures under the **Municipal Strategy Project**,[5] which reached 127,213 citizens in 14 municipalities; development of the **Resilient Skopje** Climate Change Strategy for the capital; and the launch of two **Climate Challenges**, which resulted in 19 finalists with innovative climate solutions for cities and three overall winners.
- **COMMUNICATION AT THE WORKPLACE:** Improvements in information and benefits for companies applying for loans to improve energy efficiency, supported by the **WeBSEFF website**;[6] provision of examples from Skopje through the **"Smart Mobility, Strong Economy" open forum**; and cooperation on messaging with the USAID-funded project on climate change adaptation in agriculture, which provided training for farmers and inhabitants of 6 rural settlements with a total population of 1500 people.
- **COMMUNICATION WITH HOUSEHOLDS:** Implementation of a multi-year climate change awareness-raising campaign, "The Climate is Changing, it Depends on Us," 2014-2016 (Figure 40); two youth climate change summer camps; launch of a dedicated web portal for energy efficiency[7] and provision of content; launch of an award-winning "Energy Mathematics" campaign in conjunction with the electric utility EVN; and the celebration of European Mobility Week (2014, 2015, 2016).

5 Implemented by Milieukontakt. Additional information available at http://milieukontakt.mk/mccsp/

6 See http://www.webseff.com/

7 See http://energetskaefikasnost.info/

Figure 40: *Logo for the national climate change awareness-raising campaign "The Climate is Changing, it Depends on Us."*

The new action plan for the Macedonian Climate Change Communication Strategy, which covers the period 2017-2020, is provided in Table 23.

Table 23: *Action Plan for Climate Change Communications Strategy, 2017-2020*

ACTION PLAN TO THE COMMUNICATION STRATEGY ON CLIMATE CHANGE IN THE REPUBLIC OF MACEDONIA PERIOD 2017-2020			
OBJECTIVE 1	OBJECTIVE 2	OBJECTIVE 3	OBJECTIVE 4
GENERAL COMMUNICATION FRAMEWORK	CITY	WORK PLACE	HOUSEHOLDS
FUTURE ACTIVITIES			
■ Developing the web-site www.klimatskipromeni.mk as unified communication platform; ■ Networking communication representatives from the cities, companies, media, NGOs; ■ Using special software tools for monitoring information; ■ Using innovative tools for spreading informative and educational content ■ E-newsletter ■ Stories about the climate ■ Social networks, Facebook, Twitter ■ E-library ■ Quiz questions ■ Announcing national "champions" from all categories, annually; ■ Education	■ Development of an interactive GHG emission map for all municipalities ■ Targeted capacity building in municipalities; ■ Systematic collection of information on climate action by filling in an e-questionnaire every 6 months;	■ Cooperation with the start-up agency and organizing hackathons for starting "climate businesses"; ■ Developing social entrepreneurship and climate change acceleration program; ■ Continuing the climate challenge #ОдТебеЗависи/ ItDependsOnYOu for the other target groups; ■ Implementing/ supporting campaigns for developing climate and environmentally friendly behaviour at the work place.	■ Implementing/ supporting campaigns for mitigating climate change impact on households; ■ Online promotion of existing campaigns or initiatives for developing habits mitigating/reducing climate change; ■ Supporting policies for energy efficient homes

8.2 MAINSTREAMING GENDER IN CLIMATE CHANGE

As an important component of ongoing support from the Global Support Programme to the preparation of National Communications and Biennial Update Reports, the country plans to have a gender/climate action plan by the end of 2017 that will outline concrete steps and responsibilities related to integrating gender considerations into subsequent reporting to the UNFCCC, with implementation to start in 2018.

In addition, a multi-country workshop is planned for the near future in Skopje to support the Republic of Macedonia and four other Western Balkans countries in integrating gender considerations into UNFCCC reporting. The workshop will focus on putting approaches from the 2015 publication *Gender Responsive National Communications Toolkit*[8] into practice. The target audience for the training consists of experts overseeing country reports, government gender experts, and officials from government agencies serving as UNFCCC focal points. The workshop is designed to support participants in the development of an action plan and to create a forum for sharing good practice in mainstreaming gender considerations into climate change reports.

8.3 CLIMATE CHANGE AND INNOVATION

Information and Communication Technologies (ICTs) are utilized in a variety of education and awareness-raising activities related to climate change in the country, ranging from on-line surveys to outreach to cities, workplaces, and households. However, there has also been a unique initiative to focus explicitly on *technological innovation* to address climate change challenges. In 2014, UNDP, USAID, the Swedish Embassy, the Social Innovation Hub, and MOEPP came together for a climate change project with a difference. While there was growing expert consensus on climate change, the project partners wanted to know what citizens themselves thought. The Hub led the creation of a nationwide **Climate Challenge**.

The Climate Challenge invited members of the public to submit their own innovative proposals for tackling climate change. The two-month publicity campaign involved celebrities, Social Innovation Camp Methodology along with traditional media, and pitch workshops in five cities. The campaigns resulted in a huge response on social media, with over 200 media reports and over 30,000 visitors to the challenge website. It also generated 129 applications to the challenge, resulting in 10 finalists and 2 winners. The winner, the "smart sole," enables shoes to generate small amounts of energy as their wearer walks. While this idea might seem like a gimmick, to a refugee in Skopje – traversing the city on foot and for whom the phone is a lifeline – the potential benefit is enormous. The video with this idea went viral, with more than 80,000 views in just a few days after going live.

In order to provide continuity to encourage citizens to come up with new ideas, a second Climate Challenge was launched in 2015. This challenge was more focused on urban resilience to climate change, concentrating efforts around issues such as waste, transport, and green space. The local authorities were more deeply engaged, ready and waiting to help the best idea with any possible obstacles such as permits, licenses, or regulations. This round of the challenge mobilized additional funds of approximately USD 70,000, and it supported a series of innovative events that raised awareness of the challenge among the media and the public, including contests for both of these groups.

This second challenge was very successful in many respects: the quality of the ideas received (68 in total and 28 long listed, compared to 2015 when 129 were received and only 28 long listed); the nature of the ideas and their phase of maturity; the quality of the 9 finalists' entries; the number of private companies that provided support (33 mentors helped the 9 teams at the weekend camp); and the public outreach surrounding the challenge, which included 120 media reports and over half a million social media impressions). The winner of the second challenge was ReBot, a solution for "smart recycling" that captivated the jury with a passionate and inspired presentation of an innova-

8 UNDP, UNEP, GEF, 2015. See: http://www.un-gsp.org/news/gender-responsive-national-communications-toolkit

tive solution for recycling and sorting plastic waste. The team feels "great and motivated" and now has all the resources needed to "wake people up about recycling."[9] As the prototype is being built, the ReBot team will conduct a nationwide recycling-awareness campaign so that people better understand the need to sort waste and to raise interest in the program. Although the scheme will launch on a small scale in Skopje (which generates one quarter of all waste generated in the country), the team is aiming high and hopes to expand not only to all regions in the country, but also to elsewhere in the Balkans.

9 UNDP (2016).

ANNEX

Annex 1: Detailed tables of the GHG Inventory

Table 24. GHG Inventory table for 1990

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)			Emissions (Gg)			
Categories	Net CO_2*	CH_4	N_2O	HFCs	PFCs	SF_6	NOx	CO	NMVOCs	SO_2
Total National Emissions and Removals	9,814.66	117.00	1.52	0.00	114.46	0.00	24.73	64.85	17.68	116.27
1 - Energy	9,201.23	8.03	0.15	NO	NO	NO	23.07	7.04	6.62	94.49
1.A - Fuel Combustion Activities	9,201.23	0.52	0.15	NO	NO	NO	23.07	7.04	1.04	94.49
1.A.1 - Energy Industries	6,179.59	0.07	0.08				13.51	0.54	0.09	88.96
1.A.2 - Manufacturing Industries and Construction	1,669.98	0.09	0.02				8.22	5.33	0.81	4.86
1.A.3 - Transport	771.48	0.25	0.05				0.44	0.09	0.04	0.01
1.A.4 - Other Sectors	580.17	0.11	0.00				0.89	1.08	0.10	0.66
1.A.5 - Non-Specified	0.00	0.00	0.00				0.00	0.00	0.00	0.00
1.B - Fugitive emissions from fuels	0.00	7.51	0.00	NO	NO	NO	24.73	64.85	17.68	116.27
1.B.1 - Solid Fuels	0.00	7.48	NA				23.07	7.04	6.62	94.49
1.B.2 - Oil and Natural Gas	0.00	0.03	NA				23.07	7.04	1.04	94.49
1.B.3 - Other emissions from Energy Production	0.00	0.00	NA				13.51	0.54	0.09	88.96
1.C - Carbon dioxide Transport and Storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO						NO	NO	NO	NO
1.C.2 - Injection and Storage	NO						NO	NO	NO	NO
1.C.3 - Other	NO						NO	NO	NO	NO
2 - Industrial Processes and Product Use	825.59	0.09	0.00	0.00	114.46	NO	0.88	0.10	0.65	10.44
2.A - Mineral Industry	286.13	NO	NO	NO	NO	NO	0.86	0.00	0.15	3.26
2.A.1 - Cement production	249.37						0.86	0.00	0.15	3.26
2.A.2 - Lime production	28.09						0.00	0.00	0.00	0.00
2.A.3 - Glass Production	0.09						0.00	0.00	0.00	0.00
2.A.4 - Other Process Uses of Carbonates	8.58						0.00	0.00	0.00	0.00
2.A.5 - Other (please specify)	NO	NO	NO				NO	NO	NO	NO
2.B - Chemical Industry	0.31	0.00	NO	NO	NO	NO	0.00	0.03	0.00	0.00
2.B.1 - Ammonia Production	NO						NO	NO	NO	NO

2.B.2 - Nitric Acid Production			NO				NO	NO	NO	NO
2.B.3 - Adipic Acid Production			NO				NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO				NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO					NO	NO	NO	NO
2.B.6 - Titanium Dioxide Production	NO						NO	NO	NO	NO
2.B.7 - Soda Ash Production	0.31						0.00	0.03	0.00	0.00
2.B.8 - Petrochemical and Carbon Black Production	NO	NO					NO	NO	NO	NO
2.B.9 - Fluorochemical Production				NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	539.15	0.09	0.00	0.00	114.46	0.00	0.00	0.00	0.00	0.00
2.C.1 - Iron and Steel Production	22.20	0.00					0.00	0.00	0.00	0.00
2.C.2 - Ferroalloys Production	354.22	0.09					0.00	0.00	0.00	0.00
2.C.3 - Aluminium production	13.01				114.46		0.00	0.00	0.00	0.00
2.C.4 - Magnesium production	NO					NO	NO	NO	NO	NO
2.C.5 - Lead Production	22.24						0.00	0.00	0.00	0.00
2.C.6 - Zinc Production	127.48						0.00	0.00	0.00	0.00
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D.1 - Lubricant Use	NO						NO	NO	NO	NO
2.D.2 - Paraffin Wax Use	NO						NO	NO	NO	NO
2.D.3 - Solvent Use							NO	NO	NO	NO
2.D.4 - Other (please specify)	NO	NO	NO				NO	NO	NO	NO
2.E - Electronics Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor				NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display					NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics					NO		NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid					NO		NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F.1 - Refrigeration and Air Conditioning				NO			NO	NO	NO	NO
2.F.2 - Foam Blowing Agents				NO			NO	NO	NO	NO
2.F.3 - Fire Protection				NO	NO		NO	NO	NO	NO
2.F.4 - Aerosols				NO			NO	NO	NO	NO
2.F.5 - Solvents				NO	NO		NO	NO	NO	NO
2.F.6 - Other Applications (please specify)				NO	NO		NO	NO	NO	NO

2.G - Other Product Manufacture and Use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.G.1 - Electrical Equipment					NO	NO	NO	NO	NO	NO
2.G.2 - SF6 and PFCs from Other Product Uses					NO	NO	NO	NO	NO	NO
2.G.3 - N2O from Product Uses			NO				NO	NO	NO	NO
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NO	NO	NO	NO	NO	NO	0.01	0.07	0.50	7.18
2.H.1 - Pulp and Paper Industry	NO	NO					0.01	0.07	0.03	0.03
2.H.2 - Food and Beverages Industry	NO	NO					NO	NO	0.48	7.16
2.H.3 - Other (please specify)	NO	NO	NO				NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-216.30	44.45	1.26	NA	NA	NA	0.61	2.28	6.11	0.02
3.A - Livestock	0.00	42.36	0.16	NA	NA	NA	0.11	0.00	5.87	0.00
3.A.1 - Enteric Fermentation		36.33					NO	NO	NO	NO
3.A.2 - Manure Management		6.03	0.16				0.11	NO	5.87	NO
3.B - Land	-206.31	NA	NE0	NA	NA	NA	NO	NO	NO	NO
3.B.1 - Forest land	-206.31						NO	NO	NO	NO
3.B.2 - Cropland	NE						NO	NO	NO	NO
3.B.3 - Grassland	NE						NO	NO	NO	NO
3.B.4 - Wetlands	NE		NE				NO	NO	NO	NO
3.B.5 - Settlements	NE						NO	NO	NO	NO
3.B.6 - Other Land	NE						NO	NO	NO	NO
3.C - Aggregate sources and non-CO2 emissions sources on land	3.74	2.09	1.09	NA	NA	NA	0.50	2.28	0.25	0.02
3.C.1 - Emissions from biomass burning		NE	NE				0.08	2.28	0.23	0.02
3.C.2 - Liming	NO						NO	NO	NO	NO
3.C.3 - Urea application	3.74						NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils			0.71				0.42	NO	0.02	NO
3.C.5 - Indirect N2O Emissions from managed soils			0.28				NO	NO	NO	NO
3.C.6 - Indirect N2O Emissions from manure management			0.11				NO	NO	NO	NO
3.C.7 - Rice cultivations		2.09					NO	NO	NO	NO
3.C.8 - Other (please specify)		NO	NO				NO	NO	NO	NO
3.D - Other	-13.73	NA	NA	NA	NA	NA	NO	NO	NO	NO
3.D.1 - Harvested Wood Products	-13.73						NO	NO	NO	NO
3.D.2 - Other (please specify)	NO	NO	NO				NO	NO	NO	NO
4 - Waste	4.15	64.43	0.11	NA	NA	NA	0.17	2.96	0.07	0.01
4.A - Solid Waste Disposal	0.00	62.32	0.00	NA	NA	NA	0.00	0.00	0.00	0.00
4.B - Biological Treatment of Solid Waste	0.00	0.00	0.00	NA	NA	NA	0.00	0.00	0.00	0.00

4.C - Incineration and Open Burning of Waste	4.15	0.34	0.00	NA	NA	NA	0.17	2.96	0.07	0.01
4.D - Wastewater Treatment and Discharge	0.00	1.77	0.11	NA	NA	NA	NE	NE	0.00	NE
4.E - Other (please specify)	NO	NO	NO	NA	NA	NA	NO	NO	NO	NO
5 - Other	NO	NO	NO	NA	NA	NA	NO	NO	NO	NO
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NA	NA	NA	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo Items (5)										
International Bunkers	15.77			NO	NO	NO	NO	NO	NO	NO
1.A.3.a.i - International Aviation (International Bunkers)	15.77	0.00	0.00				NO	NO	NO	NO
1.A.3.d.i - International water-borne navigation (International bunkers)	NO	NO	NO				NO	NO	NO	NO

**CO_2 net emissions (emission minus removals)*

Table 25. GHG Inventory table for 2003

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)			Emissions (Gg)			
Categories	Net CO_2*	CH_4	N_2O	HFCs	PFCs	SF_6	NOx	CO	NMVOCs	SO_2
Total National Emissions and Removals	5,554.54	117.86	1.37	89.79	53.41	0.00	22.16	64.85	17.68	116.27
1 - Energy	8,602.13	10.93	0.18	NO	NO	NO	20.18	33.60	11.09	103.74
1.A - Fuel Combustion Activities	8,602.13	2.60	0.18	NO	NO	NO	20.18	33.60	4.89	103.74
1.A.1 - Energy Industries	6,157.55	0.08	0.09				14.99	0.66	0.10	98.30
1.A.2 - Manufacturing Industries and Construction	832.32	0.06	0.01				2.62	5.12	0.59	4.83
1.A.3 - Transport	998.89	0.27	0.05				0.05	0.33	0.01	0.00
1.A.4 - Other Sectors	613.36	2.19	0.03				2.51	27.49	4.19	0.60
1.A.5 - Non-Specified	0.00	0.00	0.00				0.00	0.00	0.00	0.00
1.B - Fugitive emissions from fuels	0.00	8.33	0.00	NO	NO	NO	0.00	0.00	6.20	0.00
1.B.1 - Solid Fuels	0.00	8.31	0.00				NO	NO	6.20	NO
1.B.2 - Oil and Natural Gas	0.00	0.02	0.00				0.00	0.00	0.00	0.00
1.B.3 - Other emissions from Energy Production	0.00	0.00	0.00				NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO						NO	NO	NO	NO
1.C.2 - Injection and Storage	NO						NO	NO	NO	NO
1.C.3 - Other	NO						NO	NO	NO	NO
2 - Industrial Processes and Product Use	700.84	0.06	0.00	89.79	53.41	0.00	1.18	6.02	0.97	14.53
2.A - Mineral Industry	318.60	NO	NO	NO	NO	NO	1.04	0.00	0.18	3.92
2.A.1 - Cement production	299.63						1.04	NE	0.18	3.92
2.A.2 - Lime production	5.54						NO	NO	NO	NO
2.A.3 - Glass Production	0.03						0.00	0.00	0.00	0.00
2.A.4 - Other Process Uses of Carbonates	13.40						NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO				NO	NO	NO	NO
2.B - Chemical Industry	0.01	NO	NO	NO	NO	NO	0.00	0.00	0.00	0.00
2.B.1 - Ammonia Production	NO						0.00	0.00	0.00	0.00
2.B.2 - Nitric Acid Production			NO				NO	NO	NO	NO
2.B.3 - Adipic Acid Production			NO				NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO				NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO					NO	NO	NO	NO

2.B.6 - Titanium Dioxide Production	NO						NO	NO	NO	NO
2.B.7 - Soda Ash Production	0.01						0.00	0.00	0.00	0.00
2.B.8 - Petrochemical and Carbon Black Production	NO	NO					NO	NO	NO	NO
2.B.9 - Fluorochemical Production				NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	382.23	0.06	NO	0.00	53.41	0.00	0.12	5.90	0.05	0.08
2.C.1 - Iron and Steel Production	53.09	0.00					0.12	5.90	0.05	0.08
2.C.2 - Ferroalloys Production	231.12	0.06					NO	NO	NO	NO
2.C.3 - Aluminium production	6.07				53.41		NO	NO	NO	NO
2.C.4 - Magnesium production	0.00					0.00	NO	NO	NO	NO
2.C.5 - Lead Production	7.08						NO	NO	NO	NO
2.C.6 - Zinc Production	84.88						NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D.1 - Lubricant Use	NO						NO	NO	NO	NO
2.D.2 - Paraffin Wax Use	NO						NO	NO	NO	NO
2.D.3 - Solvent Use							NO	NO	NO	NO
2.D.4 - Other (please specify)	NO	NO	NO				NO	NO	NO	NO
2.E - Electronics Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor				NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display					NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics					NO		NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid					NO		NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NO	NO	NO	89.79	NO, NE	NO	NO	NO	NO	NO
2.F.1 - Refrigeration and Air Conditioning				89.79			0.00	0.00	0.00	0.00
2.F.2 - Foam Blowing Agents				NO			0.00	0.00	0.00	0.00
2.F.3 - Fire Protection				NO	NE		0.00	0.00	0.00	0.00
2.F.4 - Aerosols				NO			0.00	0.00	0.00	0.00
2.F.5 - Solvents				NO	NE		0.00	0.00	0.00	0.00
2.F.6 - Other Applications (please specify)				NO	NE		0.00	0.00	0.00	0.00
2.G - Other Product Manufacture and Use	NO	NO	NO	NO	NO	NO, NE	0.00	0.00	0.00	0.00
2.G.1 - Electrical Equipment					NO	NE	NO	NO	NO	NO
2.G.2 - SF6 and PFCs from Other Product Uses					NO	NE	NO	NO	NO	NO
2.G.3 - N2O from Product Uses			NO				NO	NO	NO	NO

2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NO	NO	NO	NO	NO	NO	0.02	0.12	0.74	10.53
2.H.1 - Pulp and Paper Industry	NO	NO					0.02	0.12	0.04	0.04
2.H.2 - Food and Beverages Industry	NO	NO					NE	NE	0.70	10.49
2.H.3 - Other (please specify)	NO	NO	NO				NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-3,752.98	35.01	1.07	0.00	0.00	0.00	0.62	3.21	5.12	0.02
3.A - Livestock	0.00	34.31	0.13	0.00	0.00	0.00	0.09	0.00	4.79	0.00
3.A.1 - Enteric Fermentation		28.82					NO	NO	NO	NO
3.A.2 - Manure Management		5.49	0.13				0.09	NO	4.79	NO
3.B - Land	-3,741.63	NO	NE	NO	NO	NO	NO	NO	NO	NO
3.B.1 - Forest land	-4,647.55						NO	NO	NO	NO
3.B.2 - Cropland	466.66						NO	NO	NO	NO
3.B.3 - Grassland	344.13						NO	NO	NO	NO
3.B.4 - Wetlands	0.00		0.00				NO	NO	NO	NO
3.B.5 - Settlements	90.05						NO	NO	NO	NO
3.B.6 - Other Land	5.08						NO	NO	NO	NO
3.C - Aggregate sources and non-CO2 emissions sources on land	4.90	0.71	0.94	0.00	0.00	0.00	0.53	3.21	0.33	0.02
3.C.1 - Emissions from biomass burning		NO	NO				0.11	3.21	0.32	0.02
3.C.2 - Liming	NO						NO	NO	NO	NO
3.C.3 - Urea application	4.90						NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils			0.62				0.42	NO	0.01	NO
3.C.5 - Indirect N2O Emissions from managed soils			0.23				NO	NO	NO	NO
3.C.6 - Indirect N2O Emissions from manure management			0.09				NO	NO	NO	NO
3.C.7 - Rice cultivations		0.71					NO	NO	NO	NO
3.C.8 - Other (please specify)		NO	NO				NO	NO	NO	NO
3.D - Other	-16.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.D.1 - Harvested Wood Products	-16.25						NO	NO	NO	NO
3.D.2 - Other (please specify)	NO	NO	NO				NO	NO	NO	NO
4 - Waste	4.55	71.86	0.12	0.00	0.00	0.00	0.19	3.24	0.07	0.01
4.A - Solid Waste Disposal	0.00	68.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.B - Biological Treatment of Solid Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C - Incineration and Open Burning of Waste	4.55	0.38	0.00	0.00	0.00	0.00	0.19	3.24	0.07	0.01
4.D - Wastewater Treatment and Discharge	0.00	3.47	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.E - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5 - Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo Items (5)										
International Bunkers	38.59	0.00	0.00	NO	NO	NO	NO	NO	NO	NO
1.A.3.a.i - International Aviation (International Bunkers)	38.59	0.00	0.00				NO	NO	NO	NO
1.A.3.d.i - International water-borne navigation (International bunkers)	NO	NO	NO				NO	NO	NO	NO

**CO_2 net emissions (emission minus removals)*

Table 26. GHG Inventory table for 2008

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)			Emissions (Gg)			
Categories	Net CO_2*	CH_4	N_2O	HFCs	PFCs	SF_6	NOx	CO	NMVOCs	SO_2
Total National Emissions and Removals	10,832.41	125.73	1.56	390.06	0.21	0.00	25.35	64.85	17.68	116.27
1 - Energy	8,729.22	11.31	0.19	NO	NO	NO	22.40	32.13	11.28	106.43
1.A - Fuel Combustion Activities	8,729.22	2.70	0.19	NO	NO	NO	22.40	32.13	4.87	106.43
1.A.1 - Energy Industries	6,064.61	0.08	0.09				15.61	0.70	0.10	102.49
1.A.2 - Manufacturing Industries and Construction	1,048.65	0.06	0.01				4.92	3.87	0.56	3.54
1.A.3 - Transport	1,210.59	0.34	0.06				0.20	0.39	0.02	0.00
1.A.4 - Other Sectors	182.71	2.04	0.03				0.80	26.74	4.00	0.27
1.A.5 - Non-Specified	222.67	0.18	0.00				0.88	0.42	0.18	0.12
1.B - Fugitive emissions from fuels	0.00	8.61	NA	NO	NO	NO	0.00	0.00	6.41	0.00
1.B.1 - Solid Fuels	0.00	8.59	NA				NO	NO	6.41	NO
1.B.2 - Oil and Natural Gas	0.00	0.03	NA				0.00	0.00	0.00	0.00
1.B.3 - Other emissions from Energy Production	NO	NO	NA				NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO						NO	NO	NO	NO
1.C.2 - Injection and Storage	NO						NO	NO	NO	NO
1.C.3 - Other	NO						NO	NO	NO	NO
2 - Industrial Processes and Product Use	739.51	0.11	0.00	390.06	0.21	0.00	1.37	5.30	0.62	9.47
2.A - Mineral Industry	369.34	0.00	0.00	0.00	0.00	0.00	1.24	0.00	0.21	4.67
2.A.1 - Cement production	357.29						1.24	NE	0.21	4.67
2.A.2 - Lime production	0.01						NO	NO	NO	NO
2.A.3 - Glass Production	0.02						0.00	0.00	0.00	0.00
2.A.4 - Other Process Uses of Carbonates	12.03						NO	NO	NO	NO
2.A.5 - Other (please specify)	0.00	0.00	0.00				NO	NO	NO	NO
2.B - Chemical Industry	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.1 - Ammonia Production	NO						NO	NO	NO	NO
2.B.2 - Nitric Acid Production			NO				NO	NO	NO	NO
2.B.3 - Adipic Acid Production			NO				NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO				NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO					NO	NO	NO	NO

2.B.6 - Titanium Dioxide Production	NO						NO	NO	NO	NO
2.B.7 - Soda Ash Production	0.01						0.00	0.00	0.00	0.00
2.B.8 - Petrochemical and Carbon Black Production	NO	NO					NO	NO	NO	NO
2.B.9 - Fluorochemical Production				NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	370.16	0.11	0.00	0.00	0.21	0.00	0.10	5.14	0.05	0.07
2.C.1 - Iron and Steel Production	46.29	0.00					0.10	5.14	0.05	0.07
2.C.2 - Ferroalloys Production	323.85	0.11					NO	NO	NO	NO
2.C.3 - Aluminium production	0.02				0.21		NO	NO	NO	NO
2.C.4 - Magnesium production	NO					NO	NO	NO	NO	NO
2.C.5 - Lead Production	NO						NO	NO	NO	NO
2.C.6 - Zinc Production	NO						NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D.1 - Lubricant Use	NO						NO	NO	NO	NO
2.D.2 - Paraffin Wax Use	NO						NO	NO	NO	NO
2.D.3 - Solvent Use							NO	NO	NO	NO
2.D.4 - Other (please specify)	NO	NO	NO				NO	NO	NO	NO
2.E - Electronics Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor				NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display					NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics					NO		NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid					NO		NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NO	NO	NO	390.06	NO, NE	NO	NO	NO	NO	NO
2.F.1 - Refrigeration and Air Conditioning				390.06			NO	NO	NO	NO
2.F.2 - Foam Blowing Agents				NO			NO	NO	NO	NO
2.F.3 - Fire Protection				NO	NE		NO	NO	NO	NO
2.F.4 - Aerosols				NO			NO	NO	NO	NO
2.F.5 - Solvents				NO	NO		NO	NO	NO	NO
2.F.6 - Other Applications (please specify)				NO	NO		NO	NO	NO	NO
2.G - Other Product Manufacture and Use	NO	NO	NO	NO	NO	NO, NE	NO	NO	NO	NO
2.G.1 - Electrical Equipment					NO	NO	NO	NO	NO	NO
2.G.2 - SF6 and PFCs from Other Product Uses					NO	NE	NO	NO	NO	NO
2.G.3 - N2O from Product Uses			NO				NO	NO	NO	NO

2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NO	NO	NO	NO	NO	NO	0.03	0.15	0.37	4.73
2.H.1 - Pulp and Paper Industry	NO	NO					0.03	0.15	0.06	0.06
2.H.2 - Food and Beverages Industry	NO	NO					NE	NE	0.31	4.68
2.H.3 - Other (please specify)	NO	NO	NO				NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	1,355.51	32.53	1.24	NO	NO	NO	1.25	22.24	6.73	0.15
3.A - Livestock	NO	31.93	0.14	NO	NO	NO	0.09	0.00	4.50	0.00
3.A.1 - Enteric Fermentation		26.30					NO	NO	NO	NO
3.A.2 - Manure Management		5.63	0.14				0.09	0.00	4.50	0.00
3.B - Land	1,376.50	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.B.1 - Forest land	864.96						NO	NO	NO	NO
3.B.2 - Cropland	219.70						NO	NO	NO	NO
3.B.3 - Grassland	237.26						NO	NO	NO	NO
3.B.4 - Wetlands	0.00		0.00				NO	NO	NO	NO
3.B.5 - Settlements	45.55						NO	NO	NO	NO
3.B.6 - Other Land	9.03						NO	NO	NO	NO
3.C - Aggregate sources and non-CO2 emissions sources on land	4.48	0.60	1.10	0.00	0.00	0.00	1.17	22.24	2.24	0.15
3.C.1 - Emissions from biomass burning		NO	NO				0.74	22.24	2.22	0.15
3.C.2 - Liming	NO						NO	NO	NO	NO
3.C.3 - Urea application	4.48						NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils			0.73				0.42	NO	0.01	NO
3.C.5 - Indirect N2O Emissions from managed soils			0.27				NO	NO	NO	NO
3.C.6 - Indirect N2O Emissions from manure management			0.10				NO	NO	NO	NO
3.C.7 - Rice cultivations		0.60					NO	NO	NO	NO
3.C.8 - Other (please specify)		NO	NO				NO	NO	NO	NO
3.D - Other	-25.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.D.1 - Harvested Wood Products	-25.47						NO	NO	NO	NO
3.D.2 - Other (please specify)	NO	NO	NO				NO	NO	NO	NO
4 - Waste	8.18	81.78	0.13	0.00	0.00	0.00	0.33	5.82	0.13	0.01
4.A - Solid Waste Disposal	0.00	78.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.B - Biological Treatment of Solid Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C - Incineration and Open Burning of Waste	8.18	0.68	0.00	0.00	0.00	0.00	0.33	5.82	0.13	0.01
4.D - Wastewater Treatment and Discharge	0.00	2.40	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.E - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5 - Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo Items (5)										
International Bunkers	18.86	0.00	0.00	NO	NO	NO	NO	NO	NO	NO
1.A.3.a.i - International Aviation (International Bunkers)	18.86	0.00	0.00				NO	NO	NO	NO
1.A.3.d.i - International water-borne navigation (International bunkers)	NO	NO	NO				NO	NO	NO	NO

**CO_2 net emissions (emission minus removals)*

Table 27. GHG Inventory table for 2012

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)			Emissions (Gg)			
Categories	Net CO_2*	CH_4	N_2O	HFCs	PFCs	SF_6	NOx	CO	NMVOCs	SO_2
Total National Emissions and Removals	11,766.20	142.38	1.45	96.69	6.00	0.00	24.92	64.85	17.68	116.27
1 - Energy	9,162.82	10.77	0.20	NO	NO	NO	21.21	37.79	11.53	95.05
1.A - Fuel Combustion Activities	9,162.82	2.92	0.20	NO	NO	NO	21.21	37.79	5.68	95.05
1.A.1 - Energy Industries	6,039.58	0.06	0.08				13.60	0.64	0.09	88.92
1.A.2 - Manufacturing Industries and Construction	1,367.07	0.10	0.02				5.64	6.34	0.86	5.80
1.A.3 - Transport	1,374.81	0.30	0.07				0.16	0.09	0.02	0.00
1.A.4 - Other Sectors	130.11	2.29	0.03				0.83	30.30	4.54	0.21
1.A.5 - Non-Specified	251.26	0.17	0.00				0.98	0.41	0.17	0.13
1.B - Fugitive emissions from fuels	0.00	7.84	0.00	0.00	0.00	0.00	0.00	0.00	5.85	0.00
1.B.1 - Solid Fuels	0.00	7.84	0.00				NO	NO	5.85	NO
1.B.2 - Oil and Natural Gas	0.00	0.01	0.00				0.00	0.00	0.00	0.00
1.B.3 - Other emissions from Energy Production	NO	NO	NO				NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO						NO	NO	NO	NO
1.C.2 - Injection and Storage	NO						NO	NO	NO	NO
1.C.3 - Other	NO						NO	NO	NO	NO
2 - Industrial Processes and Product Use	671.96	0.08	0.00	96.69	6.00	0.00	1.09	7.54	0.65	9.55
2.A - Mineral Industry	283.02	NO	NO	NO	NO	NO	0.92	0.00	0.16	3.48
2.A.1 - Cement production	266.59						0.92	NE	0.16	3.48
2.A.2 - Lime production	NO						NO	NO	NO	NO
2.A.3 - Glass Production	0.01						0.00	0.00	0.00	0.00
2.A.4 - Other Process Uses of Carbonates	16.42						NO	NO	NO	NO
2.A.5 - Other (please specify)	0.00	0.00	0.00				NO	NO	NO	NO
2.B - Chemical Industry	0.01	NO	NO	NO	NO	NO	0.00	0.00	0.00	0.00
2.B.1 - Ammonia Production	NO						NO	NO	NO	NO
2.B.2 - Nitric Acid Production			NO				NO	NO	NO	NO
2.B.3 - Adipic Acid Production			NO				NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO				NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO					NO	NO	NO	NO

2.B.6 - Titanium Dioxide Production	NO						NO	NO	NO	NO
2.B.7 - Soda Ash Production	0.01						0.00	0.00	0.00	0.00
2.B.8 - Petrochemical and Carbon Black Production	NO	NO					NO	NO	NO	NO
2.B.9 - Fluorochemical Production				NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	388.93	0.08	0.00	0.00	6.00	0.00	0.15	7.45	0.07	0.10
2.C.1 - Iron and Steel Production	67.03	0.00					0.15	7.45	0.07	0.10
2.C.2 - Ferroalloys Production	321.23	0.08					NO	NO	NO	NO
2.C.3 - Aluminium production	0.68				6.00		NO	NO	NO	NO
2.C.4 - Magnesium production	NO					NO	NO	NO	NO	NO
2.C.5 - Lead Production	NO						NO	NO	NO	NO
2.C.6 - Zinc Production	NO						NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D.1 - Lubricant Use	NO						NO	NO	NO	NO
2.D.2 - Paraffin Wax Use	NO						NO	NO	NO	NO
2.D.3 - Solvent Use							NO	NO	NO	NO
2.D.4 - Other (please specify)	NO	NO	NO				NO	NO	NO	NO
2.E - Electronics Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor				NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display					NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics					NO		NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid					NO		NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NO	NO	NO	96.69	NO, NE	NO	NO	NO	NO	NO
2.F.1 - Refrigeration and Air Conditioning				96.69			NO	NO	NO	NO
2.F.2 - Foam Blowing Agents				NO			NO	NO	NO	NO
2.F.3 - Fire Protection				NO	NE		NO	NO	NO	NO
2.F.4 - Aerosols				NO			NO	NO	NO	NO
2.F.5 - Solvents				NO	NO		NO	NO	NO	NO
2.F.6 - Other Applications (please specify)				NO	NO		NO	NO	NO	NO
2.G - Other Product Manufacture and Use	NO	NO	NO	NO	NO	NO, NE	NO	NO	NO	NO
2.G.1 - Electrical Equipment					NO	NO	NO	NO	NO	NO
2.G.2 - SF6 and PFCs from Other Product Uses					NO	NE	NO	NO	NO	NO
2.G.3 - N2O from Product Uses			NO				NO	NO	NO	NO

2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NO	NO	NO	NO	NO	NO	0.02	0.09	0.43	5.97
2.H.1 - Pulp and Paper Industry	NO	NO					0.02	0.09	0.03	0.03
2.H.2 - Food and Beverages Industry	NO	NO					NE	NE	0.40	5.93
2.H.3 - Other (please specify)	NO	NO	NO				NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	1,920.50	32.09	1.10	0.00	0.00	0.00	2.17	50.15	9.40	0.33
3.A - Livestock	NO	31.01	0.13	NO	NO	NO	0.08	0.00	4.38	0.00
3.A.1 - Enteric Fermentation		25.72					NO	NO	NO	NO
3.A.2 - Manure Management		5.29	0.13				0.08	0.00	4.38	0.00
3.B - Land	1,936.38	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.B.1 - Forest land	1,664.96						NO	NO	NO	NO
3.B.2 - Cropland	114.93						NO	NO	NO	NO
3.B.3 - Grassland	125.85						NO	NO	NO	NO
3.B.4 - Wetlands	0.00		0.00				NO	NO	NO	NO
3.B.5 - Settlements	24.16						NO	NO	NO	NO
3.B.6 - Other Land	6.48						NO	NO	NO	NO
3.C - Aggregate sources and non-CO2 emissions sources on land	5.75	1.09	0.96	0.00	0.00	0.00	2.10	50.15	5.02	0.33
3.C.1 - Emissions from biomass burning		NO	NO				1.67	50.15	5.01	0.33
3.C.2 - Liming	NO						NO	NO	NO	NO
3.C.3 - Urea application	5.75						NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils			0.64				0.42	NO	0.01	NO
3.C.5 - Indirect N2O Emissions from managed soils			0.23				NO	NO	NO	NO
3.C.6 - Indirect N2O Emissions from manure management			0.09				NO	NO	NO	NO
3.C.7 - Rice cultivations		1.09					NO	NO	NO	NO
3.C.8 - Other (please specify)		NO	NO				NO	NO	NO	NO
3.D - Other	-21.63	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.D.1 - Harvested Wood Products	-21.63						NO	NO	NO	NO
3.D.2 - Other (please specify)	NO	NO	NO				NO	NO	NO	NO
4 - Waste	10.92	99.43	0.15	0.00	0.00	0.00	0.44	7.78	0.17	0.02
4.A - Solid Waste Disposal	0.00	96.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.B - Biological Treatment of Solid Waste	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C - Incineration and Open Burning of Waste	10.92	0.91	0.02	0.00	0.00	0.00	0.44	7.78	0.17	0.02
4.D - Wastewater Treatment and Discharge	0.00	2.15	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.E - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5 - Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo Items (5)										
International Bunkers	25.46	0.00	0.00	NO	NO	NO	NO	NO	NO	NO
1.A.3.a.i - International Aviation (International Bunkers)	25.46	0.00	0.00				NO	NO	NO	NO
1.A.3.d.i - International water-borne navigation (International bunkers)	NO	NO	NO				NO	NO	NO	NO

**CO_2 net emissions (emission minus removals)*

Table 28. GHG Inventory table for 2013

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)			Emissions (Gg)			
Categories	Net CO_2*	CH_4	N_2O	HFCs	PFCs	SF_6	NOx	CO	NMVOCs	SO_2
Total National Emissions and Removals	7,097.03	143.71	1.42	165.24	1.42	0.00	20.77	64.85	17.68	116.27
1 - Energy	8,162.67	9.52	0.18	NO	NO	NO	18.15	29.75	9.82	79.24
1.A - Fuel Combustion Activities	8,162.67	2.35	0.18	NO	NO	NO	18.15	29.75	4.47	79.24
1.A.1 - Energy Industries	5,074.61	0.05	0.07				11.39	0.57	0.08	74.04
1.A.2 - Manufacturing Industries and Construction	1,271.79	0.09	0.01				5.27	5.44	0.78	4.91
1.A.3 - Transport	1,544.49	0.32	0.08				0.13	0.17	0.01	0.00
1.A.4 - Other Sectors	83.45	1.78	0.02				0.65	23.30	3.50	0.18
1.A.5 - Non-Specified	188.34	0.10	0.00				0.70	0.27	0.10	0.11
1.B - Fugitive emissions from fuels	0.00	7.17	0.00	NO	NO	NO	0.00	0.00	5.35	0.00
1.B.1 - Solid Fuels	0.00	7.17	0.00				NO	NO	5.35	NO
1.B.2 - Oil and Natural Gas	0.00	0.00	0.00				0.00	0.00	0.00	0.00
1.B.3 - Other emissions from Energy Production	0.00	0.00	0.00				NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO						NO	NO	NO	NO
1.C.2 - Injection and Storage	NO						NO	NO	NO	NO
1.C.3 - Other	NO						NO	NO	NO	NO
2 - Industrial Processes and Product Use	754.45	0.09	0.00	165.24	1.42	0.00	1.15	7.85	0.70	10.43
2.A - Mineral Industry	301.94	NO	NO	NO	NO	NO	0.99	0.00	0.17	3.72
2.A.1 - Cement production	284.88						0.99	NE	0.17	3.72
2.A.2 - Lime production	NO						NO	NO	NO	NO
2.A.3 - Glass Production	0.01						0.00	0.00	0.00	0.00
2.A.4 - Other Process Uses of Carbonates	17.06						NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO				NO	NO	NO	NO
2.B - Chemical Industry	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.B.1 - Ammonia Production	NO						NO	NO	NO	NO
2.B.2 - Nitric Acid Production			NO				NO	NO	NO	NO
2.B.3 - Adipic Acid Production			NO				NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO				NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO					NO	NO	NO	NO

2.B.6 - Titanium Dioxide Production	NO						NO	NO	NO	NO
2.B.7 - Soda Ash Production	0.01						0.00	0.00	0.00	0.00
2.B.8 - Petrochemical and Carbon Black Production	NO	NO					NO	NO	NO	NO
2.B.9 - Fluorochemical Production				NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	452.50	0.09	0.00	0.00	1.42	0.00	0.16	7.78	0.07	0.10
2.C.1 - Iron and Steel Production	70.02	0.00					0.16	7.78	0.07	0.10
2.C.2 - Ferroalloys Production	382.32	0.09					NO	NO	NO	NO
2.C.3 - Aluminium production	0.16				1.42		NO	NO	NO	NO
2.C.4 - Magnesium production	NO					NO	NO	NO	NO	NO
2.C.5 - Lead Production	NO						NO	NO	NO	NO
2.C.6 - Zinc Production	NO						NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D.1 - Lubricant Use	NO						NO	NO	NO	NO
2.D.2 - Paraffin Wax Use	NO						NO	NO	NO	NO
2.D.3 - Solvent Use							NO	NO	NO	NO
2.D.4 - Other (please specify)	NO	NO	NO				NO	NO	NO	NO
2.E - Electronics Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor				NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display					NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics					NO		NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid					NO		NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NO	NO	NO	165.24	NO	NO	NO	NO	NO	NO
2.F.1 - Refrigeration and Air Conditioning				165.24			NO	NO	NO	NO
2.F.2 - Foam Blowing Agents				NO			NO	NO	NO	NO
2.F.3 - Fire Protection				NO	NO		NO	NO	NO	NO
2.F.4 - Aerosols				NO			NO	NO	NO	NO
2.F.5 - Solvents				NO	NO		NO	NO	NO	NO
2.F.6 - Other Applications (please specify)				NO	NO		NO	NO	NO	NO
2.G - Other Product Manufacture and Use	NO	NO	NO	NO	NO	NO, NE	NO	NO	NO	NO
2.G.1 - Electrical Equipment					NO	NO	NO	NO	NO	NO
2.G.2 - SF6 and PFCs from Other Product Uses					NO	NE	NO	NO	NO	NO
2.G.3 - N2O from Product Uses			NO				NO	NO	NO	NO

2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NO	NO	NO	NO	NO	NO	0.01	0.07	0.46	6.61
2.H.1 - Pulp and Paper Industry	NO	NO					0.01	0.07	0.02	0.02
2.H.2 - Food and Beverages Industry	NO	NO					NE	NE	0.44	6.58
2.H.3 - Other (please specify)	NO	NO	NO				NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-1,831.26	30.92	1.08	0.00	0.00	0.00	1.01	15.21	5.73	0.10
3.A - Livestock	0.00	29.83	0.13	0.00	0.00	0.00	0.07	0.00	4.20	0.00
3.A.1 - Enteric Fermentation		24.73					NO	NO	NO	NO
3.A.2 - Manure Management		5.10	0.13				0.07	0.00	4.20	0.00
3.B - Land	-1,814.80	0.00	0.00	NO	NO	NO	NO	NO	NO	NO
3.B.1 - Forest land	-2,097.01						NO	NO	NO	NO
3.B.2 - Cropland	120.65						NO	NO	NO	NO
3.B.3 - Grassland	129.98						NO	NO	NO	NO
3.B.4 - Wetlands	0.00		0.00				NO	NO	NO	NO
3.B.5 - Settlements	24.95						NO	NO	NO	NO
3.B.6 - Other Land	6.63						NO	NO	NO	NO
3.C - Aggregate sources and non-CO2 emissions sources on land	5.75	1.09	0.95	0.00	0.00	0.00	0.93	15.21	1.53	0.10
3.C.1 - Emissions from biomass burning		NO	NO				0.51	15.21	1.52	0.10
3.C.2 - Liming	NO						NO	NO	NO	NO
3.C.3 - Urea application	5.75						NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils			0.63				0.42	NO	0.01	NO
3.C.5 - Indirect N2O Emissions from managed soils			0.23				NO	NO	NO	NO
3.C.6 - Indirect N2O Emissions from manure management			0.09				NO	NO	NO	NO
3.C.7 - Rice cultivations		1.09					NO	NO	NO	NO
3.C.8 - Other (please specify)		NO	NO				NO	NO	NO	NO
3.D - Other	-22.21	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.D.1 - Harvested Wood Products	-22.21						NO	NO	NO	NO
3.D.2 - Other (please specify)	NO	NO	NO				NO	NO	NO	NO
4 - Waste	11.17	103.19	0.15	0.00	0.00	0.00	0.45	7.96	0.18	0.02
4.A - Solid Waste Disposal	0.00	100.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.B - Biological Treatment of Solid Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C - Incineration and Open Burning of Waste	11.17	0.93	0.02	0.00	0.00	0.00	0.45	7.96	0.18	0.02
4.D - Wastewater Treatment and Discharge	0.00	2.17	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.E - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5 - Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo Items (5)										
International Bunkers	31.48	0.00	0.00	NO	NO	NO	NO	NO	NO	NO
1.A.3.a.i - International Aviation (International Bunkers)	31.48	0.00	0.00				NO	NO	NO	NO
1.A.3.d.i - International water-borne navigation (International bunkers)	NO	NO	NO				NO	NO	NO	NO

**CO_2 net emissions (emission minus removals)*

Table 29. GHG Inventory table for 2014

	Emissions (Gg)			Emissions CO2 Equivalents (Gg)			Emissions (Gg)			
Categories	Net CO_2*	CH_4	N_2O	HFCs	PFCs	SF_6	NOx	CO	NMVOCs	SO_2
Total National Emissions and Removals	5,272.73	148.84	1.42	183.47	0.00	0.00	18.90	64.85	17.68	116.27
1 - Energy	7,702.36	9.45	0.18	NO	NO	NO	16.81	30.90	9.94	73.71
1.A - Fuel Combustion Activities	7,702.36	2.50	0.18	NO	NO	NO	16.81	30.90	4.75	73.71
1.A.1 - Energy Industries	4,726.38	0.05	0.06				10.63	0.51	0.07	69.50
1.A.2 - Manufacturing Industries and Construction	1,120.56	0.08	0.01				4.71	4.55	0.72	3.99
1.A.3 - Transport	1,600.55	0.32	0.08				0.14	0.10	0.01	0.00
1.A.4 - Other Sectors	82.24	1.94	0.03				0.69	25.49	3.83	0.16
1.A.5 - Non-Specified	172.63	0.11	0.00				0.64	0.26	0.12	0.06
1.B - Fugitive emissions from fuels	0.00	6.95	0.00	0.00	0.00	0.00	0.00	0.00	5.19	0.00
1.B.1 - Solid Fuels	0.00	6.95	0.00				NO	NO	5.19	NO
1.B.2 - Oil and Natural Gas	0.00	0.00	0.00				0.00	0.00	0.00	0.00
1.B.3 - Other emissions from Energy Production	NO	NO	NO				NO	NO	NO	NO
1.C - Carbon dioxide Transport and Storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO						NO	NO	NO	NO
1.C.2 - Injection and Storage	NO						NO	NO	NO	NO
1.C.3 - Other	NO						NO	NO	NO	NO
2 - Industrial Processes and Product Use	736.20	0.09	0.00	183.47	0.00	0.00	1.12	8.31	0.64	8.76
2.A - Mineral Industry	285.61	NO	NO	NO	NO	NO	0.93	0.00	0.16	3.50
2.A.1 - Cement production	267.90						0.93	NE	0.16	3.50
2.A.2 - Lime production	NO						NO	NO	NO	NO
2.A.3 - Glass Production	0.01						NO	NO	NO	NO
2.A.4 - Other Process Uses of Carbonates	17.70						NO	NO	NO	NO
2.A.5 - Other (please specify)	NO	NO	NO				NO	NO	NO	NO
2.B - Chemical Industry	0.01	NO	NO	NO	NO	NO	0.00	0.00	0.00	0.00
2.B.1 - Ammonia Production	NO						NO	NO	NO	NO
2.B.2 - Nitric Acid Production			NO				NO	NO	NO	NO
2.B.3 - Adipic Acid Production			NO				NO	NO	NO	NO
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NO				NO	NO	NO	NO
2.B.5 - Carbide Production	NO	NO					NO	NO	NO	NO

2.B.6 - Titanium Dioxide Production	NO						NO	NO	NO	NO
2.B.7 - Soda Ash Production	0.01						0.00	0.00	0.00	0.00
2.B.8 - Petrochemical and Carbon Black Production	NO	NO					NO	NO	NO	NO
2.B.9 - Fluorochemical Production				NO	NO	NO	NO	NO	NO	NO
2.B.10 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	450.58	0.09	NO	NO	NO	NO	0.16	8.11	0.07	0.1
2.C.1 - Iron and Steel Production	73.02	0.00					0.16	8.11	0.07	0.1
2.C.2 - Ferroalloys Production	377.57	0.09					NO	NO	NO	NO
2.C.3 - Aluminium production	NO				NO		NO	NO	NO	NO
2.C.4 - Magnesium production	NO					NO	NO	NO	NO	NO
2.C.5 - Lead Production	NO						NO	NO	NO	NO
2.C.6 - Zinc Production	NO						NO	NO	NO	NO
2.C.7 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D.1 - Lubricant Use	NO						NO	NO	NO	NO
2.D.2 - Paraffin Wax Use	NO						NO	NO	NO	NO
2.D.3 - Solvent Use							NO	NO	NO	NO
2.D.4 - Other (please specify)	NO	NO	NO				NO	NO	NO	NO
2.E - Electronics Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor				NO	NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display					NO	NO	NO	NO	NO	NO
2.E.3 - Photovoltaics					NO		NO	NO	NO	NO
2.E.4 - Heat Transfer Fluid					NO		NO	NO	NO	NO
2.E.5 - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NO	NO	NO	183.47	NO	NO	NO	NO	NO	NO
2.F.1 - Refrigeration and Air Conditioning				183.47			NO	NO	NO	NO
2.F.2 - Foam Blowing Agents				NO			NO	NO	NO	NO
2.F.3 - Fire Protection				NO	NO		NO	NO	NO	NO
2.F.4 - Aerosols				NO			NO	NO	NO	NO
2.F.5 - Solvents				NO	NO		NO	NO	NO	NO
2.F.6 - Other Applications (please specify)				NO	NO		NO	NO	NO	NO
2.G - Other Product Manufacture and Use	NO	NO	NO	NO	NO	NO, NE	NO	NO	NO	NO
2.G.1 - Electrical Equipment					NO	NO	NO	NO	NO	NO
2.G.2 - SF6 and PFCs from Other Product Uses					NO	NE	NO	NO	NO	NO
2.G.3 - N2O from Product Uses			NO				NO	NO	NO	NO

2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H - Other	NO	NO	NO	NO	NO	NO	0.04	0.19	0.41	5.16
2.H.1 - Pulp and Paper Industry	NO	NO					0.04	0.19	0.07	0.07
2.H.2 - Food and Beverages Industry	NO	NO					NE	NE	0.34	5.09
2.H.3 - Other (please specify)	NO	NO	NO				NO	NO	NO	NO
3 - Agriculture, Forestry, and Other Land Use	-3,175.35	31.36	1.09	NO	NO	NO	0.58	2.46	4.51	0.02
3.A - Livestock	0.00	30.15	0.13	NO	NO	NO	0.08	0.00	4.25	0.00
3.A.1 - Enteric Fermentation		25.01					NO	NO	NO	NO
3.A.2 - Manure Management		5.14	0.13				0.08	0.00	4.25	0.00
3.B - Land	-3,181.09	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.B.1 - Forest land	-3,471.18						NO	NO	NO	NO
3.B.2 - Cropland	123.78						NO	NO	NO	NO
3.B.3 - Grassland	134.93						NO	NO	NO	NO
3.B.4 - Wetlands	0.00		0.00				NO	NO	NO	NO
3.B.5 - Settlements	25.90						NO	NO	NO	NO
3.B.6 - Other Land	5.47						NO	NO	NO	NO
3.C - Aggregate sources and non-CO2 emissions sources on land	5.75	1.21	0.96	0.00	0.00	0.00	0.51	2.46	0.25	0.02
3.C.1 - Emissions from biomass burning		NO	NO				0.08	2.46	0.25	0.02
3.C.2 - Liming	NO						NO	NO	NO	NO
3.C.3 - Urea application	5.75						NO	NO	NO	NO
3.C.4 - Direct N2O Emissions from managed soils			0.64				0.42	NO	0.01	NO
3.C.5 - Indirect N2O Emissions from managed soils			0.23				NO	NO	NO	NO
3.C.6 - Indirect N2O Emissions from manure management			0.09				NO	NO	NO	NO
3.C.7 - Rice cultivations		1.21					NO	NO	NO	NO
3.C.8 - Other (please specify)		NO	NO				NO	NO	NO	NO
3.D - Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3.D.1 - Harvested Wood Products	NO						NO	NO	NO	NO
3.D.2 - Other (please specify)	NO	NO	NO				NO	NO	NO	NO
4 - Waste	9.52	107.93	0.15	0.00	0.00	0.00	0.39	6.78	0.15	0.01
4.A - Solid Waste Disposal	0.00	104.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.B - Biological Treatment of Solid Waste	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.C - Incineration and Open Burning of Waste	9.52	0.79	0.02	0.00	0.00	0.00	0.39	6.78	0.15	0.01
4.D - Wastewater Treatment and Discharge	0.00	2.69	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.E - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5 - Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
5.B - Other (please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo Items (5)										
International Bunkers	36.79	0.00	0.00	NO	NO	NO	NO	NO	NO	NO
1.A.3.a.i - International Aviation (International Bunkers)	36.79	0.00	0.00				NO	NO	NO	NO
1.A.3.d.i - International water-borne navigation (International bunkers)	NO	NO	NO				NO	NO	NO	NO

**CO_2 net emissions (emission minus removals)*

Annex 2: Activity Data

Activity Data for the Energy Sector

Table 30: Activity data used in Energy sector, for 2003 (in TJ)

IPCC Categories	Solid fuels					Liquid fuels					Gaseous fuels	Biomass
	Lignite	Coking coal	Sub-bituminous coal	Anthracite	Coke Oven Coke / Lignite Coke	Residual fuel oil	Motor gasoline	Gas/Diesel oil	LPG	Jet kerosene	Natural gas	Wood/ Wood waste
1.A - Fuel Combustion Activities	**58,646.4**	**1,833.0**	**1,001.7**	**267.0**	**817.8**	**9,040.0**	**5,537.5**	**14,319.0**	**1,750.1**	**11.6**	**2,782.0**	**7,160.0**
1.A.1 - Energy Industries	**57,036.8**	**-**	**-**	**-**	**-**	**4,960.0**	**-**	**516.0**	**94.6**	**-**	**1,511.0**	**235.0**
1.A.1.a - Main Activity Electricity and Heat Production	57,036.8	-	-	-	-	4,960.0	-	430.0	94.6	-	1,511.0	235.0
1.A.1.a.i - Electricity Generation	56,239.9	-	-	-	-	200.0	-	-	-	-	-	-
1.A.1.a.ii - Combined Heat and Power Generation (CHP)	497.1	-	-	-	-	560.0	-	-	-	-	113.0	-
1.A.1.a.iii - Heat Plants	299.8	-	-	-	-	4,200.0	-	430.0	94.6	-	1,398.0	235.0
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries	-	-	-	-	-	-	-	86.0	-	-	-	-
`	-	-	-	-	-	-	-	86.0	-	-	-	-
1.A.2 - Manufacturing Industries and Construction	**1,286.1**	**1,833.0**	**1,001.7**	**267.0**	**817.8**	**2,160.0**	**-**	**989.0**	**141.9**	**-**	**1,271.0**	**45.0**
1.A.2.m - Non-specified Industry	1,286.1	1,833.0	1,001.7	267.0	817.8	2,160.0	-	989.0	141.9	-	1,271.0	45.0
1.A.3 - Transport	**-**	**-**	**-**	**-**	**-**	**-**	**5,537.5**	**7,525.0**	**898.7**	**11.6**	**-**	**-**
1.A.3.a - Civil Aviation	-	-	-	-	-	-	-	-	-	11.6	-	-
1.A.3.a.ii - Domestic Aviation	-	-	-	-	-	-	-	-	-	11.6	-	-
1.A.3.b - Road Transportation	-	-	-	-	-	-	5,537.5	7,482.0	898.7	-	-	-
1.A.3.c - Railways	-	-	-	-	-	-	-	43.0	-	-	-	-
1.A.4 - Other Sectors	**323.5**	**-**	**-**	**-**	**-**	**1,920.0**	**-**	**5,289.0**	**614.9**	**-**	**-**	**6,880.0**
1.A.4.a - Commercial/Institutional	165.7	-	-	-	-	1,560.0	-	3,784.0	236.5	-	-	311.0
1.A.4.b - Residential	149.9	-	-	-	-	-	-	1,247.0	378.4	-	-	6,527.0
1.A.4.c - Agriculture/Forestry/ Fishing/Fish Farms	7.9	-	-	-	-	360.0	-	258.0	-	-	-	42.0
1.A.4.c.i - Stationary	7.9	-	-	-	-	360.0	-	258.0	-	-	-	42.0
Memo Items												
International Bunkers	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**539.8**	**-**	**-**
1.A.3.a.i - International Aviation (International Bunkers)	-	-	-	-	-	-	-	-	-	539.8	-	-

Table 31: Activity data used in Energy sector, for 2008 (in TJ)

IPCC Categories	Solid fuels			Liquid fuels							Gaseous fuels	Biomass
	Lignite	Sub-bituminous coal	Coke Oven Coke / Lignite Coke	Residual fuel oil	Motor gasoline	Gas/Diesel oil	LPG	Jet kerosene	Aviation gasoline	Other Petroleum products	Natural gas	Wood/ Wood waste
1.A - Fuel Combustion Activities	**61,950.2**	**277.0**	**1,331.4**	**7,807.0**	**5,232.1**	**14,993.5**	**3,159.7**	**7.3**	**5.8**	**3,716.9**	**4,017.6**	**7,193.6**
1.A.1 - Energy Industries	**59,896.4**	**-**	**-**	**3,721.3**	**-**	**412.4**	**70.4**	**-**	**-**	**-**	**2,710.8**	**96.9**
1.A.1.a - Main Activity Electricity and Heat Production	59,896.4	-	-	3,721.3	-	355.9	70.4	-	-	-	2,710.8	96.9
1.A.1.a.i - Electricity Generation	59,401.3	-	-	1,830.3	-	0.5	-	-	-	-	-	-
1.A.1.a.ii - Combined Heat and Power Generation (CHP)	292.8	-	-	-	-	-	-	-	-	-	48.0	-
1.A.1.a.iii - Heat Plants	202.3	-	-	1,891.0	-	355.4	70.4	-	-	-	2,662.8	96.9
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries	-	-	-	-	-	56.5	-	-	-	-	-	-
1.A.1.c.ii - Other Energy Industries	-	-	-	-	-	56.5	-	-	-	-	-	-
1.A.2 - Manufacturing Industries and Construction	**1,894.8**	**277.0**	**1,331.4**	**3,539.8**	**-**	**934.7**	**211.7**	**-**	**-**	**3,716.9**	**1,270.6**	**50.1**
1.A.2.a - Iron and Steel	1,891.1	277.0	1,322.9	2,625.1	-	250.6	15.0	-	-	-	1,201.5	14.6
1.A.2.b - Non-Ferrous Metals	-	-	-	-	-	6.7	25.8	-	-	-	-	-
1.A.2.c - Chemicals	-	-	-	-	-	3.6	-	-	-	-	9.0	-
1.A.2.d - Pulp, Paper and Print	-	-	-	-	-	0.2	-	-	-	-	-	0.9
1.A.2.e - Food Processing, Beverages and Tobacco	-	-	8.3	-	-	109.9	13.9	-	-	-	60.2	5.6
1.A.2.f - Non-Metallic Minerals	-	-	-	743.3	-	75.5	121.2	-	-	3,716.9	-	2.5
1.A.2.h - Machinery	3.7	-	0.2	17.6	-	33.2	35.0	-	-	-	-	2.9
1.A.2.i - Mining (excluding fuels) and Quarrying	-	-	-	106.0	-	260.2	-	-	-	-	-	0.9
1.A.2.l - Textile and Leather	-	-	-	-	-	1.2	0.3	-	-	-	-	2.1
1.A.2.m - Non-specified Industry	-	-	-	47.7	-	193.6	0.4	-	-	-	-	20.6
1.A.3 - Transport	**-**	**-**	**-**	**-**	**5,217.8**	**9,597.0**	**2161.0**	**7.3**	**5.8**	**-**	**10.4**	**0.0**
1.A.3.a - Civil Aviation	-	-	-	-	-	-	-	7.3	5.8	-	-	0.0
1.A.3.a.ii - Domestic Aviation	-	-	-	-	-	-	-	7.3	5.8	-	-	-
1.A.3.b - Road Transportation	-	-	-	-	5,217.8	9,437.9	2161.0	-	-	-	10.4	-
1.A.3.c - Railways	-	-	-	-	-	159.1	-	-	-	-	-	-
1.A.4 - Other Sectors	**98.6**	**-**	**-**	**518.6**	**14.3**	**1,431.7**	**407.9**	**-**	**-**	**-**	**-**	**6,615.7**

1.A.4.b - Residential	96.2	-	-	-	-	1,425.7	406.8	-	-	-	-	6,534.1
1.A.4.c - Agriculture/Forestry/ Fishing/Fish Farms	2.4	-	-	518.6	14.3	6.0	1.1	-	-	-	-	81.6
1.A.4.c.i - Stationary	2.4	-	-	518.6	14.3	6.0	1.1	-	-	-	-	81.6
1.A.5 - Non-Specified	**60.5**	**-**	**-**	**27.4**	**-**	**2,617.8**	**308.7**	**-**	**-**	**-**	**25.7**	**430.9**
1.A.5.a - Stationary	60.5	-	-	27.4	-	2,617.8	308.7	-	-	-	25.7	430.9
Memo Items												
International Bunkers	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**263.7**	**-**	**-**	**-**	**-**
1.A.3.a.i - International Aviation (International Bunkers)	-	-	-	-	-	-	-	263.7	-	-	-	-

Table 32. Activity data used in Energy sector, for 2012 (in TJ)

IPCC Categories	Solid fuels				Liquid fuels								Gaseous fuels	Biomass
	Lignite	Coking coal	Other bitumen. coal	Sub-bitumin. coal	Residual fuel oil	Motor gasoline	Gas/Diesel oil (Road diesel)	Gas/Diesel oil (Heating and other gaseous oil)	LPG	Petroleum coke	Jet kerosene	Aviation gasoline	Natural gas	Wood/ Wood waste
1.A - Fuel Combustion Activities	**52,908.3**	**344.1**	**46.8**	**4,975.3**	**7,865.4**	**4,712.6**	**15,785.6**	**2,352.1**	**2,597.1**	**2,494.3**	**-**	**2.1**	**4,775.1**	**8,215.6**
1.A.1 - Energy Industries	**52,172.8**	**-**	**-**	**-**	**2,550.5**	**-**	**77.5**	**4.6**	**-**	**-**	**-**	**-**	**3,829.5**	**3.6**
1.A.1.a - Main Activity Electricity and Heat Production	52,172.8	-	-	-	1616.9	-	-	-	-	-	-	-	3,829.5	-
1.A.1.a.i - Electricity Generation	52,010.2	-	-	-	953.8	-	-	-	-	-	-	-	-	-
1.A.1.a.ii - Combined Heat and Power Generation (CHP)	162.6	-	-	-	-	-	-	-	-	-	-	-	2,782.0	-
1.A.1.a.iii - Heat Plants	-	-	-	-	663.1	-	-	-	-	-	-	-	1,047.5	-
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries	-	-	-	-	933.6	-	77.5	4.6	-	-	-	-	-	3.6
1.A.1.c.ii - Other Energy Industries	-	-	-	-	933.6	-	77.5	4.6	-	-	-	-	-	3.6
1.A.2 - Manufacturing Industries and Construction	**614.3**	**344.1**	**46.8**	**4,975.3**	**4,383.9**	**-**	**1,227.5**	**654.5**	**350.8**	**2,494.3**	**0.0**	**0.0**	**849.9**	**286.5**
1.A.2.a - Iron and Steel	485.6	339.1	46.8	4,975.3	3,240.6	-	289.7	1.9	10.9	-	-	-	437.2	110.7
1.A.2.b - Non-Ferrous Metals	-	-	-	-	-	-	-	1.0	41.3	-	-	-	-	-
1.A.2.c - Chemicals	-	-	-	-	59.2	-	1.5	16.3	0.0	-	-	-	39.1	-
1.A.2.d - Pulp, Paper and Print	0.3	-	-	-	8.0	-	0.1	9.5	-	-	-	-	24.0	0.6
1.A.2.e - Food Processing, Beverages and Tobacco	1.2	4.9	-	-	395.2	-	8.4	329.0	97.8	-	-	-	216.5	49.9

1.A.2.f - Non-Metallic Minerals	-	-	-	-	510.8	-	25.7	106.5	171.8	2,494.3	-	-	53.5	
1.A.2.h - Machinery	4.7	0.1	-	-	28.6	-	4.8	16.5	25.1	-	-	-	78.3	
1.A.2.i - Mining (excluding fuels) and Quarrying	-	-	-	-	-	-	468.7	27.2	0.0	-	-	-	-	
1.A.2.l - Textile and Leather	122.0	-	-	-	87.0	-	-	49.5	3.3	-	-	-	0.1	
1.A.2.m - Non-specified Industry	0.5	-	-	-	54.4	-	428.6	97.1	0.3	-	-	-	1.3	
1.A.3 - Transport	**-**	**-**	**-**	**-**	**-**	**4,695.8**	**12,811.5**	**-**	**1,579.7**	**-**	**-**	**2.1**	**4.3**	**-**
1.A.3.a - Civil Aviation	-	-	-	-	-	-	-	-	-	-	-	2.1	-	-
1.A.3.a.ii - Domestic Aviation	-	-	-	-	-	-	-	-	-	-	-	2.1	-	-
1.A.3.b - Road Transportation	-	-	-	-	-	4,695.8	12,678.8	-	1,579.7	-	-	-	4.3	-
1.A.3.c - Railways	-	-	-	-	-	-	132.7	-	-	-	-	-	-	-
1.A.4 - Other Sectors	**62.4**	**-**	**-**	**-**	**324.6**	**16.9**	**162.9**	**798.4**	**416.0**	**-**	**-**	**-**	**-**	**7,5**
1.A.4.b - Residential	62.3	-	-	-	-	-	-	774.6	415.1	-	-	-	-	7,4
1.A.4.c - Agriculture/Forestry/ Fishing/Fish Farms	0.1	-	-	-	324.6	16.9	162.9	23.8	0.9	-	-	-	-	
1.A.4.c.i - Stationary	0.1	-	-	-	324.6	16.9	162.9	23.8	0.9	-	-	-	-	
1.A.5 - Non-Specified	**58.8**	**-**	**-**	**-**	**606.3**	**-**	**1,506.2**	**894.5**	**250.5**	**-**	**-**	**-**	**91.3**	**3**
1.A.5.a - Stationary	58.8	-	-	-	606.3	-	1,506.2	894.5	250.5	-	-	-	91.3	3
Memo Items														
International Bunkers	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**356.2**	**-**	**-**	**-**
1.A.3.a.i - International Aviation (International Bunkers)	-	-	-	-	-	-	-	-	-	-	356.2	-	-	-

Table 33. Activity data used in Energy sector, for 2013 (in TJ)

IPCC Categories	Solid fuels				Liquid fuels									Gaseous fuels	Biomass	
	Lignite	Coking coal	Other bitumin. coal	Sub-bitumin. coal	Residual fuel oil	Motor gasoline	Gas/ Diesel oil (Road diesel)	Gas/Diesel oil (Heating and other gaseous oil)	LPG	Petro-leum coke	Jet kero-sene	Aviation gasoline	Refinery gas	Natural gas	Wood/ Wood waste (Fuelwood)	Wood/ Wood waste (Wood wastes, briquettes and pellets)
1.A - Fuel Combustion Activities	**44,973.7**	**76.3**	**147.2**	**3,545.7**	**5,991.2**	**4,901.7**	**16,953.8**	**2,132.4**	**2635.1**	**2,686.3**	**-**	**5.1**	**0.6**	**5,394.7**	**6,115.7**	**225.2**
1.A.1 - Energy Industries	**43,569.7**	**-**	**-**	**-**	**1,703.0**	**-**	**73.7**	**4.8**	**-**	**-**	**-**	**-**	**0.6**	**4,265.6**	**4.1**	**-**
1.A.1.a - Main Activity Electricity and Heat Production	43,569.7	-	-	-	1,337.6	-	-	-	-	-	-	-	-	4,265.6	-	-
1.A.1.a.i - Electricity Generation	43,407.5	-	-	-	1,240.0	-	-	-	-	-	-	-	-	-	-	-
1.A.1.a.ii - Combined Heat and Power Generation (CHP)	162.1	-	-	-	-	-	-	-	-	-	-	-	-	3,096.0	-	-
1.A.1.a.iii - Heat Plants	-	-	-	-	97.6	-	-	-	-	-	-	-	-	1,169.6	-	-
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries	-	-	-	-	365.3	-	73.7	4.8	-	-	-	-	0.6	-	4.1	-
1.A.1.c.ii - Other Energy Industries	-	-	-	-	365.3	-	73.7	4.8	-	-	-	-	0.6	-	4.1	-
1.A.2 - Manufacturing Industries and Construction	**1,245.4**	**76.3**	**147.2**	**3,545.7**	**3,891.6**	**-**	**1,144.3**	**611.2**	**362.8**	**2,686.3**	**-**	**-**	**-**	**1,012.6**	**228.0**	**96.4**
1.A.2.a - Iron and Steel	1,100.4	70.9	147.2	3,545.7	2,966.0	-	103.6	1.5	20.4	145.5	-	-	-	612.6	6.5	-
1.A.2.b - Non-Ferrous Metals	-	-	-	-	-	-	0.3	1.1	41.1	-	-	-	-	-	-	-
1.A.2.c - Chemicals	-	-	-	-	55.4	-	1.3	16.1	0.0	-	-	-	-	37.4	0.4	0.3
1.A.2.d - Pulp, Paper and Print	0.3	-	-	-	8.3	-	0.3	7.7	0.1	-	-	-	-	15.2	0.5	-
1.A.2.e - Food Processing, Beverages and Tobacco	0.7	5.4	-	-	293.0	-	9.8	305.8	85.2	-	-	-	-	218.9	133.4	52.4
1.A.2.f - Non-Metallic Minerals	-	-	-	-	430.8	-	32.1	79.8	192.5	2,540.9	-	-	-	40.1	0.5	-
1.A.2.h - Machinery	0.1	0.1	-	-	20.1	-	8.2	16.5	19.5	-	-	-	-	84.0	4.9	2.8
1.A.2.i - Mining (excluding fuels) and Quarrying	-	-	-	-	-	-	434.4	22.3	0.0	-	-	-	-	-	8.8	-
1.A.2.l - Textile and Leather	143.5	-	-	-	77.9	-	-	74.7	3.3	-	-	-	-	1.2	39.4	10.4
1.A.2.m - Non-specified Industry	0.5	-	-	-	40.1	-	554.3	85.7	0.5	-	-	-	-	3.3	33.6	30.5
1.A.3 - Transport	**-**	**-**	**-**	**-**	**-**	**4,885.4**	**14,821.8**	**-**	**1695.3**	**-**	**-**	**5.1**	**-**	**5.5**	**-**	**-**
1.A.3.a - Civil Aviation	-	-	-	-	-	-	-	-	-	-	-	5.1	-	-	-	-

1.A.3.a.ii - Domestic Aviation	-	-	-	-	-	-	-	-	-	-	-	5.1	-	-	-	-
1.A.3.b - Road Transportation	-	-	-	-	-	4,885.4	14,713.6	-	1695.3	-	-	-	-	5.5	-	-
1.A.3.c - Railways	-	-	-	-	-	-	108.2	-	-	-	-	-	-	-	-	-
1.A.4 - Other Sectors	**95.1**	**-**	**-**	**-**	**204.8**	**16.3**	**244.2**	**243.8**	**313.9**	**-**	**-**	**-**	**-**	**0.4**	**5,687.3**	
1.A.4.b - Residential	54.9	-	-	-	-	-	-	222.6	313.0	-	-	-	-	0.4	5,600.1	
1.A.4.c - Agriculture/Forestry/ Fishing/Fish Farms	40.2	-	-	-	204.8	16.3	244.2	21.2	0.9	-	-	-	-	-	87.1	-
1.A.4.c.i - Stationary	40.2	-	-	-	204.8	16.3	244.2	21.2	0.9	-	-	-	-	-	87.1	-
1.A.5 - Non-Specified	**63.6**	**-**	**-**	**-**	**191.8**	**-**	**669.9**	**1,272.5**	**263.1**	**-**	**-**	**-**	**-**	**110.5**	**196.3**	**-**
1.A.5.a - Stationary	63.6	-	-	-	191.8	-	669.9	1,272.5	263.1	-	-	-	-	110.5	196.3	-
lemo Items																
International Bunkers	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**440.2**	**-**	**-**	**-**	**-**	**-**
1.A.3.a.i - International Aviation (International Bunkers)	-	-	-	-	-	-	-	-	-	-	440.2	-	-	-	-	-

Table 34. Activity data used in Energy sector, for 2014 (in TJ)

	Solid fuels				Liquid fuels								Gaseous fuels	Biomass	
PCC Categories	**Lignite**	**Coking coal**	**Other bitumen. coal**	**Sub-bitumin. coal**	**Residual fuel oil**	**Motor gaso-line**	**Gas/ Diesel oil (Road diesel)**	**Gas/Diesel oil (Heating and other gaseous oil)**	**LPG**	**Petro-leum coke**	**Jet kero-sene**	**Aviation gasoline**	**Natural gas**	**Wood/ Wood waste (Fuel-wood)**	**Wood/ Wood w (Wood wastes, briquett and pell**
.A - Fuel Combustion Activities	**41,688.3**	**39.7**	**167.5**	**3,064.2**	**4,900.5**	**4,431.3**	**18040.7**	**1,928.4**	**2,841.0**	**2,950.9**	**-**	**2.6**	**4,622.1**	**6,712.2**	
1.A.1 - Energy Industries	**40,849.7**	**-**	**-**	**-**	**1,748.6**	**-**	**76.0**	**3.1**	**-**	**-**	**-**	**-**	**3,218.3**	**5.3**	
1.A.1.a - Main Activity Electricity and Heat Production	40,849.7	-	-	-	1,646.6	-	-	-	-	-	-	-	3,218.3	0.0	
1.A.1.a.i - Electricity Generation	40,767.7	-	-	-	1,646.6	-	-	-	-	-	-	-	-	-	-
1.A.1.a.ii - Combined Heat and Power Generation (CHP)	82.0	-	-	-	-	-	-	-	-	-	-	-	1,537.0	-	-
1.A.1.a.iii - Heat Plants	-	-	-	-	-	-	-	-	-	-	-	-	1,681.4	-	-
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries	-	-	-	-	102.0	-	76.0	3.1	-	-	-	-	-	5.3	-
1.A.1.c.ii - Other Energy Industries	-	-	-	-	102.0	-	76.0	3.1	-	-	-	-	-	5.3	-
1.A.2 - Manufacturing Industries and Construction	**759.2**	**39.7**	**167.5**	**3,064.2**	**2,788.8**	**-**	**1161.8**	**611.7**	**347.6**	**2,950.9**	**-**	**-**	**1,195.2**	**329.1**	

1.A.2.a - Iron and Steel	696.6	36.3	148.9	3,064.2	1,969.7	-	110.1	1.7	20.7	650.9	-	-	763.6	5.5	-
1.A.2.b - Non-Ferrous Metals	-	-	-	-	-	-	0.2	0.5	2.3	-	-	-	38.4	1.1	-
1.A.2.c - Chemicals	-	-	-	-	46.8	-	1.0	18.4	0.0	-	-	-	36.3	-	-
1.A.2.d - Pulp, Paper and Print	0.3	-	0.7	-	9.1	-	0.4	8.2	0.5	-	-	-	15.2	0.3	-
1.A.2.e - Food Processing, Beverages and Tobacco	0.4	3.4	-	-	272.6	-	7.9	283.4	100.2	-	-	-	203.4	202.9	57.1
1.A.2.f - Non-Metallic Minerals	0.1	-	17.9	-	368.0	-	27.9	86.4	189.6	2,300.0	-	-	38.7	0.6	0.3
1.A.2.h - Machinery	0.1	-	-	-	16.5	-	9.1	12.6	31.1	-	-	-	95.4	5.3	2.9
1.A.2.i - Mining (excluding fuels) and Quarrying	-	-	-	-	-	-	525.5	17.6	0.0	-	-	-	-	9.9	-
1.A.2.l - Textile and Leather	61.6	-	-	-	73.8	-	-	116.0	2.6	-	-	-	1.9	54.6	27.5
1.A.2.m - Non-specified Industry	0.2	-	-	-	32.4	-	479.7	66.8	0.5	-	-	-	2.2	49.1	31.4
1.A.3 - Transport	**-**	**-**	**-**	**-**	**-**	**4,414.9**	**15868.9**	**-**	**1,873.0**	**-**	**-**	**2.6**	**6.2**	**-**	**-**
1.A.3.a - Civil Aviation	-	-	-	-	-	-	-	-	-	-	-	2.6	-	-	-
1.A.3.a.ii - Domestic Aviation	-	-	-	-	-	-	-	-	-	-	-	2.6	-	-	-
1.A.3.b - Road Transportation	-	-	-	-	-	4,414.9	15758.0	-	1,873.0	-	-	-	6.2	-	-
1.A.3.c - Railways	-	-	-	-	-	-	110.9	-	-	-	-	-	-	-	-
1.A.4 - Other Sectors	**67.8**	**-**	**-**	**-**	**181.2**	**16.3**	**251.5**	**265.6**	**336.7**	**-**	**-**	**-**	**1.7**	**6,102.5**	**280.8**
1.A.4.b - Residential	31.4	-	-	-	-	-	-	245.3	335.8	-	-	-	1.7	6,025.7	280.8
1.A.4.c - Agriculture/Forestry/ Fishing/Fish Farms	36.4	-	-	-	181.2	16.3	251.5	20.2	0.9	-	-	-	-	76.8	-
1.A.4.c.i - Stationary	36.4	-	-	-	181.2	16.3	251.5	20.2	0.9	-	-	-	-	76.8	-
1.A.5 - Non-Specified	**11.6**	**-**	**-**	**-**	**182.0**	**-**	**682.4**	**1,048.0**	**283.6**	**-**	**-**	**-**	**200.6**	**275.2**	**-**
1.A.5.a - Stationary	11.6	-	-	-	182.0	-	682.4	1,048.0	283.6	-	-	-	200.6	275.2	-
Memo Items	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
International Bunkers	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**514.6**	**-**	**-**	**-**	**-**
1.A.3.a.i - International Aviation (International Bunkers)	-	-	-	-	-	-	-	-	-	-	514.6	-	-	-	-

Activity Data for the IPPU Sector

Table 35. Activity data used in IPPU sector (in t)

Categories	2003	2008	2012	2013	2014
2.A - Mineral Industry					
2.A.1 - Cement production	767,817	915,553	683,134	730,000	686,497
2.A.2 - Lime production	7,709	11			
2.A.3 - Glass Production	134	97	43	38	34
2.A.4 - Other Process Uses of Carbonates					
2.A.4.a - Ceramics	437	328	275	264	254
2.A.4.b - Other Uses of Soda Ash	4,946	5,195	5,351	5,386	5,419
2.A.4.c - Non Metallurgical Magnesia Production					
2.A.4.d - Other (please specify)	25,364	22,118	32,023	33,454	34,885
2.B - Chemical Industry					
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production	-	-	-	-	-
2.B.5 - Carbide Production	-	-	-	-	-
2.B.6 - Titanium Dioxide Production	-	-	-	-	-
2.B.7 - Soda Ash Production	91	61	48	45	43
2.C - Metal Industry					
2.C.1 - Iron and Steel Production	589,871	514,370	744,730	778,008	811,286
2.C.2 - Ferroalloys Production	111,068	225,262	154,436	184,560	182,136
2.C.3 - Aluminium production	11,379	45	1,278	303	NO
2.C.4 - Magnesium production					
2.C.5 - Lead Production	16,916	-	-	-	-
2.C.6 - Zinc Production	49,347	-	-	-	-

Activity Data in the AFOLU Sector

Table 36. Activity data used for GHG emissions inventory in Livestock (number of heads)

Sepcies and categories / Видови и категории	2003	2008	2012	2013	2014
Dairy Cows / Млечни крави	160,810	147,519	161,012	154,487	155,432
Other Cattle / Други Говеда	99,166	105,954	90,228	83,846	86,175
Sheep / Овци	1,239,330	618,404	558,735	572,961	575,833
Sheep <1 Y / Овци до 1 г.	N/A	198,200	173,606	158,867	164,624
Goats / Кози	N/A	133,017	63,585	75,028	81,346
Horses / Коњи	42,883	30,936	21,676	20,682	19,371
Swine / Свињи	179,050	36,768	24,664	26,724	23,511
Finishers / Гоеници		210,107	152,253	140,768	141,542
Poultry / Живина	2,417,362				
Layers / Несилки	N/A	2,173,346	1,715,180	1,623,130	1,884,289
Broylers / Бројлери	N/A	1,597	5,046	90,184	4,355
Turkey / Мисирки	N/A	6,234	3,933	3,491	3,690
Other poultry / Друга живина	N/A	26,741	20,164	20,700	19,477

Table 37. Activity data used for GHG emissions inventory in Forest land (ha)

	2003	2008	2012	2013	2014
Forest land (total)	**966,663**	**952,182**	**1,104,549**	**1,104,152**	**1,131,151**
Forest land Remaining Forest land	**955,294**	**947,377**	**1,102,002**	**1,101,521**	**1,128,442**
Land Converted to Forest land	**11,369**	**4,805**	**2,547**	**2,631**	**2,709**
Cropland converted to Forest Land	*2,227*	*1,221*	*648*	*669*	*694*
Grassland converted to Forest Land	*8,848*	*3,417*	*1,812*	*1,871*	*1,943*
Wetlands converted to Forest Land	*162*	*54*	*29*	*30*	*27*
Settlements converted to Forest Land	*49*	*25*	*13*	*13*	*14*
Other Land converted to Forest Land	*83*	*88*	*45*	*48*	*31*

Table 38. Activity data used for GHG emissions inventory in Cropland (ha)

	2003	2008	2012	2013	2014
Cropland (total)	**517,705**	**462,531**	**454,622**	**454,341**	**456,794**
Cropland Remaining Cropland	**508,998**	**458,506**	**452,522**	**452,136**	**454,504**
Land Converted to Cropland	**8,707**	**4,026**	**2,100**	**2,205**	**2,289**
Forest Land converted to Cropland	*4611*	*2,139*	*1,116*	*1,172*	*1,217*
Grassland converted to Cropland	*2946*	*1,697*	*885*	*929*	*965*
Wetlands converted to Cropland	*914*	*85*	*44*	*46*	*48*
Settlements converted to Cropland	*131*	*71*	*37*	*39*	*40*
Other Land converted to Cropland	*105*	*34*	*18*	*19*	*19*

Table 39. Activity data used for GHG emissions inventory in Grassland (ha)

	2003	2008	2012	2013	2014
Grassland (total)	**732,982**	**542,479**	**756,557**	**751,187**	**751,086**
Grassland Remaining Grassland	**723,495**	**537,621**	**753,981**	**748,526**	**748,324**
Land Converted to Grassland	**9,487**	**4,858**	**2,576**	**2,661**	**2,762**
Forest Land converted to Grassland	*6,181*	*2,610*	*1,384*	*1,430*	*1,484*
Cropland converted to Grassland	*2,603*	*1,974*	*1,047*	*1,081*	*1,122*
Wetlands converted to Grassland	*149*	*31*	*17*	*17*	*18*
Settlements converted to Grassland	*339*	*123*	*65*	*67*	*70*
Other Land converted to Grassland	*215*	*120*	*63*	*66*	*68*

Table 40. Activity data used for GHG emissions inventory in Wetlands (ha)

	2003	2008	2012	2013	2014
Wetlands (total)	**1,892**	**1,939**	**1,997**	**2,012**	**2,026**
Wetlands Remaining Wetlands	**1,049**	**1,589**	**1,811**	**1,820**	**1,827**
Land Converted to Wetlands	**843**	**350**	**186**	**192**	**199**
Forest Land converted to Wetlands	*420*	*207*	*110*	*113*	*118*
Cropland converted to Wetlands	*218*	*78*	*41*	*43*	*44*
Grassland converted to Wetlands	*193*	*49*	*26*	*27*	*28*
Settlements converted to Wetlands	*6*	*6*	*3*	*3*	*3*
Other Land converted to Wetlands	*6*	*11*	*6*	*6*	*6*

Table 41. Activity data used for GHG emissions inventory in Settlements (ha)

	2003	2008	2012	2013	2014
Settlements (total)	**31,293**	**32,384**	**32,848**	**32,973**	**33,090**
Settlements Remaining Settlements	**30,456**	**31,980**	**32,634**	**32,752**	**32,860**
Land Converted to Settlements	**837**	**404**	**214**	**221**	**230**
Forest Land converted to Settlements	*56*	*10*	*5*	*5*	*6*
Cropland converted to Settlements	*187*	*121*	*64*	*66*	*69*
Grassland converted to Settlements	*544*	*243*	*129*	*133*	*138*
Wetlands converted to Settlements	*15*	*4*	*2*	*2*	*2*
Other Land converted to Settlements	*35*	*26*	*14*	*14*	*15*

Table 42. Activity data used for GHG emissions inventory in Other Land (ha)

	2003	2008	2012	2013	2014
Other Land (total)	**320,767**	**579,786**	**220,728**	**226,636**	**197,154**
Other land Remaining Other land	**320,026**	**578,880**	**220,147**	**226,039**	**196,610**
Land Converted to Other land	**741**	**907**	**581**	**597**	**544**
Forest Land converted to Other Land	*283*	*209*	*111*	*115*	*119*
Cropland converted to Other Land	*145*	*346*	*283*	*289*	*217*
Grassland converted to Other Land	*226*	*277*	*147*	*152*	*157*
Wetlands converted to Other Land	*28*	*37*	*19*	*20*	*29*
Settlements converted to Other Land	*58*	*38*	*20*	*21*	*22*

Table 43. Population used for estimation of GHG emission from Municipal Solid Waste and Domestic Wastewater Treatment and Discharge

Population (in millions)															
Year	**1950**	**1951**	**1952**	**1953**	**1954**	**1955**	**1956**	**1957**	**1958**	**1959**	**1960**	**1961**	**1962**	**1963**	**1964**
	1.225	1.25151	1.27801	1.30451	1.3133	1.32208	1.33087	1.33965	1.34843	1.35722	1.366	1.406	1.43013	1.45426	1.4784
Year	**1965**	**1966**	**1967**	**1968**	**1969**	**1970**	**1971**	**1972**	**1973**	**1974**	**1975**	**1976**	**1977**	**1978**	**1979**
	1.50253	1.52666	1.55079	1.57492	1.59905	1.69151	1.70866	1.72345	1.73755	1.75334	1.77241	1.79556	1.82192	1.84932	1.87465
Year	**1980**	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**
	1.89573	1.9115	1.92273	1.93128	1.93991	1.95049	1.96419	1.98006	1.99847	1.99934	1.99623	1.98846	1.97703	1.96492	1.94593
Year	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
	1.94382	1.94909	1.96064	1.97605	1.99168	2.00487	2.01492	2.02255	2.02677	2.03254	2.03686	2.04194	2.04518	2.04862	2.05272
Year	**2010**	**2011**	**2012**	**2013**	**2014**										
	2.05728	2.05979	2.06229	2.06577	2.06917										

Table 44. Other activity data used for estimation of GHG emission from Municipal Solid Waste

	IPCC Regional Default	**National**				
		2003	**2008**	**2012**	**2013**	**2014**
Waste per capita (kg/cap/yr)	520	197	349	382	384	370
% to SWDS	90	90	90	70.63	70	74.47

Table 45. Composition of waste going to the Municipal solid waste disposal sites

food (%)	**garden (%)**	**paper (%)**	**wood (%)**	**textile (%)**	**nappies (%)**	**other (%)**
30.1	0	21.8	7.5	4.7	0	35.9

Table 46. GDP (in $ million) used for estimation of GHG emission from Industrial Waste

GDP ($ million)															
Year	**1970**	**1971**	**1972**	**1973**	**1974**	**1975**	**1976**	**1977**	**1978**	**1979**	**1980**	**1981**	**1982**	**1983**	**1984**
	1,219	1,326	1,384	1,802	2,494	2,800	3,174	3,882	4,648	5,863	6,031	5,941	5,402	5,517	5,934
Year	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
	6,338	6,910	7,425	7,776	8,390	7,871	2,916	2,739	2,963	3,560	4,707	4,413	3,720	3,580	3,673
Year	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
	3,587	3,437	3,791	4,756	5,514	5,987	6,558	8,160	9,834	9,314	9,339	10,395	9,745	10,818	11,362

Table 47. Other activity data used for estimation of GHG emission from Industrial Waste

	IPCC Regional Default
Waste Generation Rate (Gg/$mGDP/yr)	0.5
% to SWDS	75.78

Table 48. Total annual amount of solid waste treated by biological treatment facilities (in Gg)

Biological Treatment System	Waste Category	Type of Waste	Waste basis	2011	2012	2013	2014
Composting	Municipal Solid Waste	Total MSW	Dry	0.947	0.738	0.441	1.945

Table 49. Activity data used for estimation of the GHG emissions from Open burning of waste

Parametar	Unit	2003	2008	2012	2013	2014
Population - P	(Capita)	2026773	2048619	2062294	2065769	2069172
Fraction of Population Burning Waste - **P frac**	(Fraction)	0.2422	0.2422	0.2937	0.3	0.2553
Per Capita Waste Generation - **MSWp**	(kg waste/capita/day)	0.54	0.96	1.05	1.05	1.05
Fraction of the waste amount burned relative to the total amount of waste treated - **Bfrac**	(Fraction)	0.6	0.6	0.6	0.6	0.6
Number of days by year	(Day)	365	365	365	365	365

Table 50. Parameters used for estimation of organically degradable material in domestic wastewater

Parametar	Unit	
Degradable organic component - BOD	(kg BOD/cap/yr)	21.9
Correction factor for industrial BOD discharged in sewers	(I)	1

Table 51. Parameters used for estimation of total organic degradable material in wastewater for each industry sector

Industry sectors	Total industry product (Pi) (t/yr)					Wastewater generated (Wi) (m3/t)	Chemical Oxygen Demand (CODi) (kg COD/m3)
	2003	2008	2012	2013	2014		
Alcohol Refining	278397	80217.125	103909.1516	126336.264	78526.9066	24	11
Beer & Malt	66797.3094	70519.7768	62221.5822	60982.691	62941.0936	6.3	2.9
Meat & Poultry	4513.843984	5107.655505	31648	32112	28047	13	4.1
Petroleum Refineries	681104	1049304	243533	78034	1474	0.6	1
Pulp & Paper (combined)	21424	27551.61956	15877	12209	35429	162	9
Vegetable Oils	25879	31211	32322	32439	33303	3.1	1

Annex 3: Methods Applied

Table 52: Methods and tiers applied in the preparation of the GHG Inventory (for 2014)[1]

Categories	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
	Method used	Emission factor	Method used	Emission factor	Method used	Emission factor	Method used	Emission factor	Method used	Emission factor	Method used	Emission factor
1 - Energy	**T1, T2**	**CS, DF**	**T1**	**DF**	**T1**	**DF**						
1.A - Fuel Combustion Activities	T1, T2	CS, DF	T1	DF	T1	DF						
1.A.1 - Energy Industries	T2	CS	T1	DF	T1	DF						
1.A.2 - Manufacturing Industries and Construction	T1, T2	CS, DF	T1	DF	T1	DF						
1.A.3 - Transport	T1, T2	CS, DF	T1	DF	T1	DF						
1.A.4 - Other Sectors	T1, T2	CS, DF	T1	DF	T1	DF						
1.A.5 - Non-Specified	T1, T2	CS, DF	T1	DF	T1	DF						
1.B - Fugitive emissions from fuels	T1	DF	T1	DF								
1.B.1 - Solid Fuels			T1	DF								
1.B.2 - Oil and Natural Gas	T1	DF	T1	DF								
2 - Industrial Processes and Product Use	**T1, T2**	**CS, DF**					**T1**	**DF**	**T1**	**DF**	**NO**	**NO**
2.A - Mineral Industry	T1, T2	CS, DF										
2.A.1 - Cement production	T2	CS										
2.A.2 - Lime production	T1	DF										
2.A.3 - Glass Production	T1	DF										
2.A.4 - Other Process Uses of Carbonates	T1	DF										
2.A.5 - Other (please specify)	NO	NO	NO	NO								
2.B - Chemical Industry	T1	DF										
2.B.1 - Ammonia Production	NO	NO										
2.B.2 - Nitric Acid Production					NO	NO						
2.B.3 - Adipic Acid Production					NO	NO						
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production					NO	NO						
2.B.5 - Carbide Production	NO	NO	NO	NO								
2.B.6 - Titanium Dioxide Production	NO	NO										
2.B.7 - Soda Ash Production	T1	DF										
2.B.8 - Petrochemical and Carbon Black Production	NO	NO										
2.B.9 - Fluorochemical Production												
2.B.10 - Other (Please specify)												
2.C - Metal Industry	T2	CS	T1	DF					NO	NO		
2.C.1 - Iron and Steel Production	T2	CS	NO	NO								

[1] *T1 - Tier1 approach, T2 - Tier2 approach, CS - Country specific, DF – Default factor, NO - Not occurring, NE - Not estimated*

Categories	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
	Method used	Emission factor	Method used	Emission factor	Method used	Emission factor	Method used	Emission factor	Method used	Emission factor	Method used	Emission factor
2.C.2 - Ferroalloys Production	T2	CS	T1	DF								
2.C.3 - Aluminium production	NO	NO							NO	NO		
2.C.4 - Magnesium production	NO	NO										
2.C.5 - Lead Production	NO	NO										
2.C.6 - Zinc Production	NO	NO										
2.C.7 - Other (please specify)												
2.D - Non-Energy Products from Fuels and Solvent Use												
2.D.1 - Lubricant Use	NO	NO										
2.D.2 - Paraffin Wax Use	NO	NO										
2.D.3 - Solvent Use												
2.D.4 - Other (please specify)	NO	NO										
2.E - Electronics Industry							NO	NO	NO	NO	NO	NO
2.E.1 - Integrated Circuit or Semiconductor							NO	NO	NO	NO	NO	NO
2.E.2 - TFT Flat Panel Display									NO	NO	NO	NO
2.E.3 - Photovoltaics									NO			
2.E.4 - Heat Transfer Fluid									NO			
2.E.5 - Other (please specify)							NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances							**T1**	**DF**				
2.F.1 - Refrigeration and Air Conditioning							T1	DF				
2.F.2 - Foam Blowing Agents							NO	NO				
2.F.3 - Fire Protection							NO	NO	NO	NO		
2.F.4 - Aerosols							NO	NO				
2.F.5 - Solvents							NO	NO	NO	NO		
2.F.6 - Other Applications (please specify)												
2.G - Other Product Manufacture and Use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		
2.G.1 - Electrical Equipment									NE	NE		
2.G.2 - SF6 and PFCs from Other Product Uses									NO	NO		
2.G.3 - N2O from Product Uses					NO	NO						
2.G.4 - Other (Please specify)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO		
2.H - Other												
2.H.1 - Pulp and Paper Industry												
2.H.2 - Food and Beverages Industry												
2.H.3 - Other (please specify)												
3 - Agriculture, Forestry, and Other Land Use	**T1**	**DF**	**T1**	**DF**	**T1**	**DF**						
3.A - Livestock	NO	NO	T1	DF	T1	DF						
3.A.1 - Enteric Fermentation			T1	DF	NO	NO						
3.A.2 - Manure Management			T1	DF	T1	DF						

Categories	CO_2		CH_4		N_2O		HFCs		PFCs		SF_6	
	Method used	Emission factor	Method used	Emission factor	Method used	Emission factor	Method used	Emission factor	Method used	Emission factor	Method used	Emission factor
3.B - Land	T1	DF										
3.B.1 - Forest land	T1	DF										
3.B.2 - Cropland	T1	DF										
3.B.3 - Grassland	T1	DF										
3.B.4 - Wetlands	NO	NO										
3.B.5 - Settlements	T1	DF										
3.B.6 - Other Land	T1	DF										
3.C - Aggregate sources and non-CO_2 emissions sources on land	T1	DF	T1	DF	T1	DF						
3.C.1 - Emissions from biomass burning												
3.C.2 - Liming												
3.C.3 - Urea application					T1	DF						
3.C.4 - Direct N_2O emissions from managed soils					T1	DF						
3.C.5 - Indirect N_2O emissions from managed soils					T1	DF						
3.C.6 - Indirect N_2O emissions from manure management					T1	DF						
3.C.7 - Rice cultivations			T1	DF								
3.C.8 - Other (please specify)												
3.D - Other	T1	DF										
3.D.1 - Harvested Wood Products	T1	DF										
3.D.2 - Other (please specify)												
4 - Waste	**T1**	**DF**	**T1, T2**	**DF**	**T1**	**DF**						
4.A - Solid Waste Disposal			T2	DF								
4.B - Biological Treatment of Solid Waste			T1	DF								
4.C - Incineration and Open Burning of Waste	T1	DF	T1	DF	T1	DF						
4.D - Wastewater Treatment and Discharge			T1	DF	T1	DF						
4.E - Other (please specify)												
5 - Other												
5.A - Indirect N_2O emissions from the atmospheric deposition of nitrogen in NOx and NH3												
5.B - Other (please specify)												
Memo Items												
International Bunkers												
1.A.3.a.i - International Aviation (International Bunkers)	T1	DF	T1	DF	T1	DF						
1.A.3.d.i - International water-borne navigation (International bunkers)	NO	NO	NO	NO	NO	NO						

Annex 4: Emission Factors

Emission Factors Used in the Energy Sector

Table 53: Emission factors used in Energy sector (in kg/TJ)

Fuel	CO_2	CH_4	N_2O
Coking coal	94,600	10	1.5
Other Bituminous Coal	94,600	10	1.5
Sub-bituminous Coal	96,100	10	1.5
Lignite	107,879*	1(10)**	1.5
Crude oil	73,333		
Residual fuel oil	78,049*	3	0.6
Gas / Diesel oil	74,100	3	0.6
Motor gasoline	69,300	0.5	2
Jet kerosene	71,500	0.5	2
LPG	63,100	1	0.1
Petroleum coke	97,500	3	0.6
Natural gas	55,066*	1	0.1
Biomass	112,000	30	4

* Country Specific Emission Factor (CS EF)
**Default CH_4 EF for lignite in Energy industries is 1 kg/TJ and in Manufacturing Industries and Construction is 10 kg/TJ
Note: The default IPCC EF for CH_4 and N_2O are used. For some of the fuels, the values differ between the IPCC categories in the Energy sector (not all are included in table above).

Emission Factors for the IPPU Sector

Table 54: Emission factors used for IPPU sector

Categories	CO_2 (t gas/ t product)	CH_4 (kg gas/ t product)	CF_4 (kg gas/ t product)	C_2F_6 (kg gas/ t product)
Mineral Industry				
Cement production	0.54			
Lime production	0.75			
Glass Production	0.20			
Other Process Uses of Carbonates				
Ceramics	0.44			
Other Uses of Soda Ash	0.41			
Other (please specify)	0.43			
Chemical Industry				
Soda Ash Production	0.14			
Metal Industry				
Iron and Steel Production	0.09			
Ferroalloys Production	4.16	1.00		
Aluminium production	1.60		1.60	0.40
Lead Production	0.52; 0.25			
Zinc Production	1.72			

Emission Factors for the AFOLU Sector

Table 55: Emission factors used for GHG emissions inventory in Livestock

Emission factor	FBUR	SBUR	Comment
Livestock			
Dairy cows (enteric - CH_4)	99 kg/head/year	99 kg/head/year	
Other cattle (enteric- CH_4)	58 kg/head/year	58 kg/head/year	
Sheep (enteric- CH_4)	5 kg/head/year	5 kg/head/year	40kg live weight
Sheep < 1 Y (enteric- CH_4)	-	5 kg/head/year	Sheep < 1 Y with 28kg live weight
Goat (enteric- CH_4)	5 kg/head/year	5 kg/head/year	
Horses (enteric- CH_4)	18 kg/head/year	18 kg/head/year	
Swine (enteric- CH_4)	1 kg/head/year	1 kg/head/year	180 kg live weight
Finishers (enteric- CH_4)	-	1 kg/head/year	Finishers 50 kg live weight
Dairy cows (manure - CH_4)	20 kg/head/year	20 kg/head/year	
Dairy cows (manure - N_2O)	0.35 kg/1000 kg/day 18% liquid slurry (40% N loss); 67% solid storage slurry (40% N loss); 1% daily spread slurry (22% N loss) 13% pasture 0.005 Direct N_2O - N	0.35 kg/1000 kg/day 18% liquid slurry (40% N loss); 67% solid storage slurry (40% N loss); 1% daily spread slurry (22% N loss) 13% pasture 0.005 Direct N_2O - N	
Other cattle (manure- CH_4)	9 kg/head/year	9 kg/head/year	
Other cattle (manure- N_2O)	0.35 kg/1000 kg/day 18% liquid slurry (40% N loss); 67% solid storage slurry (40% N loss); 1% daily spread slurry (22% N loss) 13% pasture 0.005 Direct N_2O - N	0.35 kg/1000 kg/day 18% liquid slurry (40% N loss); 67% solid storage slurry (40% N loss); 1% daily spread slurry (22% N loss) 13% pasture 0.005 Direct N_2O - N	
Sheep (manure- CH_4)	0.15 kg/head/year	0.15 kg/head/year	t
Sheep (manure- N_2O)	0.9 kg/1000 kg/day 20% solid storage 80% pasture 0.005 Direct N_2O - N	0.9 kg/1000 kg/day 20% solid storage 80% pasture 0.005 Direct N_2O - N	40 kg live weigh
Sheep < 1 Y (manure- CH_4)	-	0.15 kg/head/year	Sheep < 1 Y with 28kg live weight
Sheep < 1 Y (manure- N_2O)	-	0.9 kg/1000 kg/day 20% solid storage 80% pasture 0.005 Direct N_2O - N	Sheep < 1 Y with 28kg live weight
Goat (manure- CH_4)	0.17 kg/head/year	0.17 kg/head/year	
Goat (manure- N_2O)	1.28 kg/1000 kg/day 20% solid storage 80% pasture 0.005 Direct N_2O - N	1.28 kg/1000 kg/day 20% solid storage 80% pasture 0.005 Direct N_2O - N	
Horses (manure- CH_4)	1.64 kg/head/year	1.64 kg/head/year	
Horses (manure- N_2O)	100% pasture	100% pasture	
Swine (manure- CH_4)	6 kg/head/year	6 kg/head/year	180 kg live weight
Swine (manure- N_2O)	0.46 kg/1000 kg/day 60% Pit storage (25% N loss); 0.002 Direct N_2O – N 40% solid storage (50% N loss); 0.005 Direct N_2O - N	0.46 kg/1000 kg/day 60% Pit storage (25% N loss); 0.002 Direct N_2O – N 40% solid storage (50% N loss); 0.005 Direct N_2O - N	180 kg live weight
Finishers (manure- CH_4)	-	6 kg/head/year	Finishers 50 kg live weight

Emission factor	FBUR	SBUR	Comment
Finishers (manure-N_2O)	-	0.55 kg/1000 kg/day 60% Pit storage (25% N loss); 0.002 Direct N_2O – N 40% solid storage (50% N loss); 0.005 Direct N_2O - N	Finishers 50 kg live weight
Poultry (manure- CH_4)	0.2 kg/head/year	-	1.8 kg live weight
Poultry (manure- N_2O)	0.82 kg/1000 kg/day 100% Poultry litter (50% N loss); 0.001 Direct N_2O - N	-	1.8 kg live weight
Layers (manure- CH_4)	-	0.2 kg/head/year	1.8 kg live weight
Layers (manure- N_2O)	-	0.82 kg/1000 kg/day 100% Poultry litter (50% N loss); 0.001 Direct N_2O - N	1.8 kg live weight
Broilers (manure- CH_4)	-	0.2 kg/head/year	0.9 kg live weight
Broilers (manure- N_2O)	-	1.1 kg/1000 kg/day 100% Poultry litter (50% N loss); 0.001 Direct N_2O - N	0.9 kg live weight, specific factors for broilers were used
Turkey (manure- CH_4)	-	0.9 kg/head/year	6.8 kg live weight, specific factors for Turkey were used
Turkey (manure- N_2O)	-	0.74 kg/1000 kg/day 100% Poultry litter (50% N loss); 0.001 Direct N_2O - N	6.8 kg live weight, specific factors for Turkey were used
Other (manure- CH_4)	-	0.2 kg/head/year	1.8 kg live weight
Other (manure- N_2O)	-	0.82 kg/1000 kg/day 100% Poultry litter (50% N loss); 0.001 Direct N_2O - N	1.8 kg live weight

Emission Factors for the Waste Sector

Figure 41: Parameters used for methane calculations from Solid Waste Disposal

Table 56: Methane correction factor and distribution of waste by type of SWDS

	Unmanaged – shallow	Unmanaged – deep	Managed – anaerobic	Managed – semi-aerobic	Uncategorised SWDS
Methane correction factor (MCF)	0.4	0.8	1	0.5	0.6
Fixed distribution (%)	12	46	16	0	26

Table 57: Emission factors used for biological treatment of solid waste

	Emission Factor (g/ kg waste treated)	
	CH_4	N_2O
Composting/Total MSW	10	0.6

Table 58: Parameters used for estimation of GHG emissions from Open burning of waste

Parameter	Unit	
Dry Matter Content - dm	(Fraction)	0.97
Fraction of Carbon in Dry Matter - CF	(Fraction)	0.38
Fraction of Fossil Carbon in Total Carbon - FCF	(Fraction)	0.1
Oxidation Factor - OF	(Fraction)	0.58
Methane Emission Factor	(kg CH_4/Gg Wet Waste)	6500
Nitrous Oxide Emission Factor	(kg N_2O/Gg Dry Waste)	150

Table 59: Parameters used for estimation of emissions from Domestic and Industrial Wastewater Treatment and Discharge

Estimation of CH4 emission factor for Domestic Wastewater	
Type of treatment or discharge	Sea, river and lake discharge
Maximum methane producing capacity - B0 (kg CH4/kg BOD)	0.6
Methane correction factor for each treatment system - MCFj	0.1
Fraction of Population Income Group - Ui (Fraction)	Rural 0.4; Urban 0.6
Degree of utilization - Tij (Fraction)	0.3
Estimation of emissions of indirect N2O from Domestic Wastewater	
Estimation of nitrogen in effluent	
Per capita protein consumption (Protein) (kg/person/Year)	28.91
Fraction of nitrogen in protein (Fnpr) (kg N/kg Protein)	0.16
Fraction of non-consumption protein (Fnon-con) (-)	1.4
Fraction of industrial and commercial co-discharged protein (Find-com) (-)	1.25
Emission Factor (kg N2O-N/kg N)	0.005
Estimation of CH4 emission factor for Industrial Wastewater	
Type of treatment or discharge	Sea, river and lake discharge
Maximum Methane Producing Capacity (B0) (kg CH4/kg COD)	0.25

Annex 5: Mitigation Action Plan

Table 60: Action plan for realization of the scenario With Existing Measures (WEM)

Policy/ measure	Competent entity for realization	Type	Status	Source of funding	Indicative emissions reduction (2030) (Gg CO_2-eq)	Specific costs: (2030) (€/t CO2-eq)	Investments (mil. €)			Green jobs		
							up to 2025	2026-2030	2031-2035	2025	2030	2035
Reduction of distribution losses	▸ Electricity distribution companies ▸ Heat distribution companies ▸Ministry of Economy, Energy Agency	Technical	Ongoing	Distribution companies			107.0	36.8	76.6			
Large hydro power plants	▸ JSC ELEM ▸ Ministry of Environment and Physical Planning ▸ Ministry of Economy, Energy Agency	Technical	Planned	JSC ELEM, Public Private Partnership	514	-5.7	300.5	238.5	613.6			
Small hydro power plants	▸ Government of the RM ▸ Energy Regulatory Commission ▸ Ministry of Environment and Physical Planning ▸ Ministry of Economy, Energy Agency ▸ Private investors	Technical, Regulatory	Ongoing	Private sector	229	-7.4	108.2	44.1	24.1	138.0	142.0	146.4
Solar power plants	▸ Government of the RM ▸ Energy Regulatory Commission	Technical, Regulatory	Ongoing	Private sector	84	-1.4	15.9	39.0	31.6	339.1	676.1	237.5

	▸ Ministry of Economy, Energy Agency ▸ Private investors											
Solar rooftop power plants	▸ Government of the RM ▸ Energy Regulatory Commission ▸ Ministry of Economy, Energy Agency ▸ JSC EVN Distribucija ▸ Electricity end-users	Technical, Regulatory	Planned	Private sector	88	-13.2	18.8	37.1	22.8	257.5	392.6	139.5
Wind power plants	▸ Government of the RM ▸ Energy Regulatory Commission ▸ Ministry of Economy, Energy Agency ▸ JSC ELEM ▸ Private investors	Technical, Regulatory	Ongoing	JSC ELEM, Private sector	456	0	146.3	185.7	0.0	360.9	105.3	105.3
Biogas power plants	▸ Government of the RM ▸ Energy Regulatory Commission ▸ Ministry of Economy, Energy Agency ▸ Private investors	Technical, Regulatory	Ongoing	Private sector	65	-0.9	20.0	20.0	20.0	15.6	27.7	36.9
Biomass power plants (CHP optional)	▸ Government of the RM ▸ Energy Regulatory Commission ▸ Ministry of Economy, Energy Agency ▸ Private investors	Technical, Regulatory	Ongoing	Private sector	90	5	16.9	4.0	4.0	27.1	27.0	30.8
Central heating of Bitola	▸ Government of the RM ▸ JSC ELEM	Technical	Planned	JSC ELEM	36	20	50.0	0.0	0.0			

	▸ Ministry of Economy, Energy Agency											
Solar thermal collectors	▸ Ministry of Economy, Energy Agency ▸ Heat end-users	Technical	Ongoing	Private sector	83	-29	24.9	27.9	32.4	380.6	579.0	709.6
Labeling of electric appliances and equipment	▸ Ministry of Economy, Energy Agency ▸ Manufacturers and vendors of household appliances and equipment ▸ End-users	Regulatory	Ongoing	Private sector	202	-33	22.3	21.3	33.9			
Public awareness campaigns and network of EE info centers	▸ Ministry of Economy, Energy Agency ▸ Energy suppliers ▸ End-users	Information	Ongoing	Budget of the RM	893	-29	96.6	92.6	135.6			
Retrofitting of existing residential buildings	▸ Ministry of Economy, Energy Agency ▸ Donors and financial institutions ▸ Households	Technical, Regulatory	Ongoing	Private sector	284	2	271.1	158.1	161.0	508.3	507.9	534.3
Retrofitting of existing public buildings	▸ Ministry of Economy, Energy Agency ▸ Ministry of Finance ▸ Local self-government ▸ Public Utilities ▸ Donors and financial institutions	Technical, Regulatory	Ongoing	Central government , local self-government , city of Skopje	296	-2	228.5	186.4	218.8	494.8	644.8	756.0
Retrofitting of existing commercial buildings	▸ Ministry of Economy, Energy Agency ▸ Ministry of Finance ▸ Commercial buildings owners	Technical, Regulatory	Ongoing	Private sector	127	-4	78.7	62.7	71.0	169.3	220.1	240.6

Construction of new buildings	▸ Ministry of Economy, Energy Agency ▸ Donors and financial institutions ▸ Investors (households)	Technical, Regulatory	Ongoing	Private sector	101	-2	93.3	83.3	108.2	281.4	342.5	465.6
Improvement of the street lighting in the municipalities	▸ Local self-government ▸ Ministry of Economy, Energy Agency	Technical	Ongoing	Budget of the local self-governments	86	-32	4.0	4.5	6.0	9.2	12.6	16.4
Energy management in manufacturing industries	▸ Ministry of Economy, Energy Agency ▸ Private companies	Regulatory, Technical	Ongoing	Private sector	150	-32	0.0	0.0	0.0			
Introduction of efficient electric motors	▸ Private companies ▸ Ministry of Economy, Energy Agency	Technical	Ongoing	Private sector	117	-19	33.4	44.6	35.7			
Biofuels 5%	▸ Ministry of Economy, Energy Agency ▸ End-users	Regulatory	Planned	Private sector	221	20						
Increased use of the railway	▸ Government of the RM ▸ Ministry of Transport and Communication ▸ Ministry of Economy, Energy Agency ▸ JSC Makedonski zeleznici ▸ End-users ▸ Private companies	Technical, Information	Planned	Budget of the RM	20	-371	32.5	28.9	35.1			
Renewing of the national car fleet	▸ Government of the RM ▸ Ministry of Transport and Communication ▸ Ministry of Economy,	Regulatory, Policy, Information	Ongoing	Private sector	139	-147	3,776.2	6,238.3	985.1			

	Energy Agency ▸ End-users											
Renewing of other national road fleet	▸ Government of the RM ▸ Ministry of Transport and Communication ▸ Ministry of Interior ▸ Ministry of Economy, Energy Agency ▸ Private companies	Regulatory, Policy	Ongoing	Private sector	65	-100	27.6	706.6	708.4			
Increased use of bicycles, walking and introduction of parking policy	▸ Ministry of Economy, Energy Agency ▸ Local self-government ▸ End-users	Regulatory, Technical, Information	Ongoing	Private sector	4	-970						
Enteric fermentation in dairy cows	▸ Ministry of Agriculture, Forestry and Water Economy		Ongoing	Private sector	5.7	1.8	0.1	0.1	0.1			
Manure management in dairy cows	▸ Ministry of Agriculture, Forestry and Water Economy		Ongoing	Private sector	2.1	25.1	0.5	0.3	0.3			
Manure management in swine farms	▸ Ministry of Agriculture, Forestry and Water Economy		Ongoing	Private sector	0.4	131.6	0.5	0.3	0.3			
Decreasing the number and damaged are by forest fires	▸ PE „Makedonski sumi“ ▸ Ministry of environment and physical planning ▸ Ministry of Agriculture, Forestry and Water Economy		Ongoing	PE „ Makedonski sumi “ National parks	1,189.2	0.8	9.0	5.0	5.0			

	▸ National parks ▸ Association of private forest owners											
Change of quality of forests by afforestation of transitive forest land	▸ PE "Makedonski sumi" ▸ Ministry of environment and physical planning ▸ Ministry of Agriculture, Forestry and Water Economy ▸ National parks ▸ Association of private forest owners		Ongoing	PE „ Makedonski sumi " National parks	167.3	14.9	22.5	12.5	12.5			
Conversion of land use of field crops above 15% inclination	▸ Ministry of Agriculture, Forestry and Water Economy		Planned	Private sector	5.8	13.7	0.7	0.4	0.4			
Contour cultivation of cropland on inclined terrains (5-15%)	▸ Ministry of Agriculture, Forestry and Water Economy		Planned	Private sector	28.0	1.9	0.5	0.3	0.3			
Perennial grass in orchard and vineyards on inclined terrains (>5%)	▸ Ministry of Agriculture, Forestry and Water Economy		Planned	Private sector	8.5	6.2	0.5	0.3	0.3			

Closure of the existing landfills	▸ Ministry of environment and physical planning ▸ Public utilities ▸ Inter-municipal board for waste management	Technical	Planned	Local self-government through Public Utilities, Public Private Partnership, Grants from the EU	275	2	20.5	0	0			
Mechanical and biological treatment (MBT) in new landfills with composting	▸ Ministry of environment and physical planning ▸ Public utilities ▸ Inter-municipal board for waste management	Technical	Planned	Local self-government through Public Utilities, Public Private Partnership, Grants from the EU	52	54	70.5	0	0			
Selection of waste - paper	▸ Ministry of environment and physical planning ▸ Public utilities ▸ Inter-municipal board for waste management	Technical	Ongoing	Local self-government through Public Utilities, Public Private Partnership, Grants from the EU	19	7	2	0	0			

Annex 6: Detailed Description of Policies and Measures Used in the WEM and/or WAM Scenarios

Energy – Energy Industries

Table 61. Reduction of distribution losses

Mitigation action: ***Reduction of distribution losses***

Main objective: ***Reduction of losses in electricity and heat distribution networks***
Description: ***Operating and constructive measures necessary for losses reduction, implemented by distribution networks operators. Energy suppliers and distribution companies have obligation to achieve a certain amount of annual energy savings at end-user level.***

Information	**Type**		Technical
	Sector		Energy – Energy industries
	Relevant planning documents, legal and regulatory acts		► Strategy for Energy Development in the Republic of Macedonia ► Development plan of EVN Macedonia, AD ► Development plan of Balkan Energy Group (BEG)
	Gases		CO_2, CH_4, N_2O
	Methodology		Technical interventions on the distribution network. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology
	Assumptions		Technical interventions will reduce the losses from 17% to 11%
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	► A General investment plan in electricity distribution network is developed for the next 20 years. ► Implementing measures for operation improvement and losses reduction in the heat distribution system.
		Steps envisaged	► Replacement old electric transformer with new transformers at 20 kV voltage level ► Reduction of the reactive power in the power network ► Rehabilitation of the hot water distribution network, replacement of the existing pumps in the heating substations with new energy efficient pumps and other measures for energy efficiency improvement. ► Installation of modern equipment for regulation and monitoring in the heating substations for control and reduction of the consumed heat.
	Results achieved and estimated outcomes		Achieved energy savings: ► 3.40 ktoe in 2015 Estimated energy savings: ► 56 ktoe (652 GWh) in 2025 ► 61 ktoe (707 GWh) in 2030 ► 66 ktoe (768 GWh) in 2035
	Estimated emission reductions		► 438 Gg CO_2-eq in 2025 ► 619 Gg CO_2-eq in 2030 ► 509 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs in the scenarios with implemented measure ► 1,322.1 M€ Specific costs:

Mitigation action: ***Reduction of distribution losses***

		► -16.6 €/t CO_2-eq
	Implementing entity	► Electricity distribution companies ► Heat distribution companies ► Energy Agency of the Republic of Macedonia, Ministry of Economy
Progress indicators:		► Energy savings (ktoe/GWh) ► Emissions reductions (Gg CO_2-eq)

Table 62. Large hydro power plants

Mitigation action: ***Large hydro power plants***

Main objective: ***Increase of the domestic generation capacity from renewable energy sources***

Description: ***Construction of new large hydro power plants***

Information	**Type**		Technical
	Sector		Energy – Energy industries
	Relevant planning documents, legal and regulatory acts		► Strategy for Energy Development in the Republic of Macedonia ► Strategy for utilization of renewable energy sources in the Republic of Macedonia ► Development plan of ELEM AD (JSC Macedonian Power Plants).
	Gases		CO_2, CH_4, N_2O
	Methodology		Large hydro power plants construction. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		It is envisaged construction of large hydro power plants according to the following dynamics: ► Boshkov most – 2022 ► Lukovo pole – 2022 ► Shpilje, upgrade and revitalization – 2023 ► Tunnel Vardar – Kozjak– 2025 ► Globochica II – 2026 ► Veles – 2027 ► Chebren – 2033 ► Gradec – 2033
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	► Feasibility/pre-feasibility studies developed ► Call for tender for Chebren opened
		Steps envisaged	Invitation for tenders for construction of the others hydro power plants, selection of the best bidder and commencement of the construction.
	Results achieved and estimated outcomes		Expected installed capacity and electricity generation: ► 113 MW and 372 GWh in 2025 ► 235 MW and 710 GWh in 2030 ► 623 MW and 1240 GWh in 2035
	Estimated emission reductions		► 244 Gg CO_2-eq in 2025 ► 514 Gg CO_2-eq in 2030 ► 753 Gg CO_2-eq in 2035
	Timeframe		2018 – 2035

Mitigation action: ***Large hydro power plants***

	Costs (in 2030)	Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,329.5 M€ Specific costs: ► -5.7 €/t CO_2-eq
	Implementing entity	► ELEM AD (JSC Macedonian Power Plants). ► Ministry of Environment and Physical Planning ► Energy Agency of the Republic of Macedonia, Ministry of Economy
Progress indicators:		► Increase in installed capacity (MW) ► Increase in electricity generation (GWh) ► Emissions reductions (Gg CO_2-eq)

Table 63. Small hydro power plants

Mitigation action: ***Small hydro power plants***

Main objective: ***Increase of the domestic generation capacity from renewable energy sources***
Description: ***Construction of new small hydro power plants and introduction of flexible feed-in premium tariffs to stimulate the construction***

Information	**Type**		Technical
	Sector		Energy – Energy industries
	Relevant planning documents, legal and regulatory acts		► Strategy for Energy Development in the Republic of Macedonia ► Strategy for Utilization of Renewable Energy Sources in the Republic of Macedonia ► Renewable Energy Action Plan ► Law on Energy
	Gases		CO_2, CH_4, N_2O
	Methodology		Small hydro power plants construction and preparation of regulation on feed-in premium tariffs. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		Through stimulation with feed-in premium tariffs, it is envisaged that by 2035 additional capacity of 85 MW in small hydro power plants will be constructed, compared to the Reference scenario (or total capacity of 147 MW).
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	Regulation on feed-in tariffs adopted (17.04.2013)
		Steps envisaged	► Construction of all small hydro power plants with a provisional status of a privileged producer ► Announcement of a new tender for allocation of construction locations for new small hydro power plants ► Modification of the Regulation on feed-in tariffs to introduce flexible feed-in premium tariffs
	Results achieved and estimated outcomes		Achieved installed capacity and average annual electricity generation: ► 67 MW and 237 GWh by 15.05.2017 Expected installed capacity and electricity generation: ► 51 MW and 171 GWh in 2025 ► 73 MW and 246 GWh in 2030 ► 85 MW and 287 GWh in 2035
	Estimated emission reductions		► 113 Gg CO_2-eq in 2025

Mitigation action: ***Small hydro power plants***

	► 229 Gg CO_2-eq in 2030 ► 189 Gg CO_2-eq in 2035
Timeframe	2017 – 2035
Costs (in 2030)	Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,330.7 M€ Specific costs: ► -7.4 €/t CO_2-eq
Implementing entity	► Government of the Republic of Macedonia ► Energy Regulatory Commission ► Ministry of Environment and Physical Planning ► Ministry of Economy, Energy Agency of the Republic of Macedonia ► Private investors
Progress indicators:	► Increase in installed capacity (MW) ► Increase in electricity generation (GWh) ► Emissions reduction (Gg CO_2-eq)

Table 64. Solar power plants

Mitigation action: ***Solar power plants***

Main objective: ***Increase of the domestic generation capacity from renewable energy sources***

Description: ***Construction of solar power plants (larger than 10 kW) and introduction of flexible feed-in premium tariffs to stimulate the construction***

Information	**Type**		Technical, regulatory
	Sector		Energy – Energy industries
	Relevant planning documents, legal and regulatory acts		► Strategy for Energy Development in the Republic of Macedonia ► Strategy for Utilization of Renewable Energy Sources in the Republic of Macedonia ► Renewable Energy Action Plan ► Law on Energy
	Gases		CO_2, CH_4, N_2O
	Methodology		Solar power plants construction and preparation of regulation on feed-in premium tariffs. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		Through stimulation with feed-in premium tariffs, it is envisaged that by 2035 additional capacity of 100 MW in solar power plants will be constructed, compared to the Reference scenario (or total capacity of 118 MW).
	Steps taken or envisaged to achieve the action	**Steps taken**	Regulation on feed-in tariffs adopted (17.04.2013).
		Steps envisaged	Modification of the Regulation on feed-in tariffs to introduce flexible feed-in premium tariffs.
Progress of implementation	**Results achieved and estimated outcomes**		Achieved installed capacity and average annual electricity generation: ► 16.7 MW and 21.4 GWh by 15.5.2017 Expected installed capacity and electricity generation: ► 17 MW and 23 GWh in 2025 ► 60 MW and 84 GWh in 2030 ► 100 MW and 140 GWh in 2035
	Estimated emission reductions		► 15 Gg CO_2-eq in 2025 ► 84 Gg CO_2-eq in 2030 ► 90 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1.332,4 M€ Costs for the Scenario with implemented measure: ► 1.332,3 M€ Specific costs: ► -1,4 €/t CO_2-eq
	Implementing entity		► Government of the Republic of Macedonia ► Energy Regulatory Commission ► Ministry of Economy, Energy Agency of the Republic of Macedonia ► Private investors
Progress indicators:			► Increase in installed capacity (MW) ► Increase in electricity generation (GWh) ► Emissions reduction (Gg CO_2-eq)

Table 65. Solar rooftop power plants

Mitigation action: ***Solar rooftop power plants***

Main objective: ***Increase of the domestic generation capacity from renewable energy sources***

Description: ***Construction of solar rooftop power plant and introduction of "net metering"***

Information	**Type**		Technical, regulatory
	Sector		Energy – Energy industries
	Relevant planning documents, legal and regulatory acts		► Strategy for Energy Development in the Republic of Macedonia ► Renewable Energy Action Plan ► Law on Energy
	Gases		CO_2, CH_4, N_2O
	Methodology		Solar rooftop power plants construction. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology..
	Assumptions		A construction of 80 MW of solar rooftop power plants is envisaged by 2035.
	Steps taken or envisaged to achieve the action	**Steps taken**	Analyzes performed and public debates conducted for the introduction of "net measurement", organized by the Macedonian Energy Association within the Macedonian Chamber of Commerce, in the framework of the Forum for Renewable Energy Sources.
		Steps envisaged	Introduction of "net metering" system
Progress of implementation	**Results achieved and estimated outcomes**		Expected installed capacity and electricity generation: ► 18 MW and 25 GWh in 2025 ► 55 MW and 77 GWh in 2030 ► 80 MW and 111 GWh in 2035
	Estimated emission reductions		► 19 Gg CO_2-eq in 2025 ► 88 Gg CO_2-eq in 2030 ► 86 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,331.2 M€ Specific costs: ► -13.2 €/t CO_2-eq
	Implementing entity		► Government of the Republic of Macedonia ► Energy Regulatory Commission ► Ministry of Economy, Energy Agency of the Republic of Macedonia ► EVN AD Macedonia (Distribution company) ► End-users of electricity
Progress indicators:			► Increase in installed capacity (MW) ► Increase in electricity generation (GWh) ► Emissions reduction (Gg CO_2-eq)

Table 66. Wind power plants

Mitigation action: ***Wind power plants***

Main objective: ***Increase of the domestic generation capacity from renewable energy sources***

Description: ***Construction of wind power plants and introduction of flexible feed-in premium tariffs to stimulate the construction***

Information	**Type**		Technical, regulatory
	Sector		Energy – Energy industries
	Relevant planning documents, legal and regulatory acts		► Strategy for Energy Development in the Republic of Macedonia ► Strategy for Utilization of Renewable Energy Sources in the Republic of Macedonia ► Renewable Energy Action Plan ► Law on Energy
	Gases		CO_2, CH_4, N_2O
	Methodology		Wind power plants construction and preparation of regulation on feed-in premium tariffs. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		It is envisaged that by 2035 additional capacity of 263 MW in wind power plants will be constructed, compared to the Reference scenario (or total capacity of 300 MW)
	Steps taken or envisaged to achieve the action	**Steps taken**	► Regulation on feed-in tariffs adopted (17.04.2013). ► Credit line for realization of the second phase of Wind park - Bogdanci approved
		Steps envisaged	Modification of the Regulation on feed-in tariffs to introduce flexible feed-in premium tariffs.
Progress of implementation	**Results achieved and estimated outcomes**		Achieved installed capacity and average annual electricity generation: ► 36.8 MW и 110 GWh by 15.05.2017 Expected installed capacity and electricity generation: ► 113 MW and 237 GWh in 2025 ► 263 MW and 534 GWh in 2030 ► 263 MW and 534 GWh in 2035
	Estimated emission reductions		► 154 Gg CO_2-eq in 2025 ► 456 Gg CO_2-eq in 2030 ► 314 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,332.4 M€ Specific costs: ► 0 €/t CO_2-eq
	Implementing entity		► Government of the Republic of Macedonia ► Energy Regulatory Commission ► Ministry of Economy, Energy Agency of the Republic of Macedonia ► JSC Macedonian Power Plants (ELEM AD) ► Private investors
Progress indicators:			► Increase in installed capacity (MW) ► Increase in electricity generation (GWh) ► Emissions reduction (Gg CO_2-eq)

Table 67. Biogas power plants

Mitigation action: ***Biogas power plants***

Main objective: ***Increase of the domestic generation capacity from renewable energy sources***

Description: ***Construction of biogas power plants and introduction of flexible feed-in premium tariffs to stimulate the construction***

Information	**Type**		Technical, regulatory
	Sector		Energy – Energy industries
	Relevant planning documents, legal and regulatory acts		► Strategy for Energy Development in the Republic of Macedonia ► Strategy for Utilization of Renewable Energy Sources in the Republic of Macedonia ► Renewable Energy Action Plan ► Law on Energy
	Gases		CO_2, CH_4, N_2O
	Methodology		Biogas power plants construction and preparation of regulation on feed-in premium tariffs. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		Through stimulation with feed-in premium tariffs, it is envisaged that by 2035 additional capacity of 15 MW in biogas power plants will be constructed, compared to the Reference scenario (or total capacity of 22 MW)
	Steps taken or envisaged to achieve the action	**Steps taken**	Regulation on feed-in tariffs adopted (17.04.2013).
		Steps envisaged	Modification of the Regulation on feed-in tariffs to introduce flexible feed-in premium tariffs.
Progress of implementation	**Results achieved and estimated outcomes**		Achieved installed capacity and average annual electricity generation: ► 6 MW and 50.2 GWh by 15.05.2017 Expected installed capacity and electricity generation: ► 5 MW and 35 GWh in 2025 ► 10 MW and 70 GWh in 2030 ► 15 MW and 105 GWh in 2035
	Estimated emission reductions		► 23 Gg CO_2-eq in 2025 ► 65 Gg CO_2-eq in 2030 ► 71 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332. M€ Costs for the Scenario with implemented measure: ► 1,332.3 M€ Specific costs: ► -0.9 €/t CO_2-eq
	Implementing entity		► Government of the Republic of Macedonia ► Energy Regulatory Commission ► Ministry of Economy, Energy Agency of the Republic of Macedonia ► Private investors
Progress indicators:			► Increase in installed capacity (MW) ► Increase in electricity generation (GWh) ► Emissions reduction (Gg CO_2-eq)

Table 68. Biomass power plants (CHP optional)

Mitigation action: ***Biomass power plants (CHP optional)***

Main objective: ***Increase of the domestic generation capacity from renewable energy sources***
Description: ***Construction of biomass power plants (CHP optional) and introduction of flexible feed-in premium tariffs to stimulate the construction***

Information	**Type**		Technical, regulatory
	Sector		Energy – Energy industries
	Relevant planning documents, legal and regulatory acts		► Strategy for Energy Development in the Republic of Macedonia ► Strategy for Utilization of Renewable Energy Sources in the Republic of Macedonia ► Renewable Energy Action Plan ► Law on Energy
	Gases		CO_2, CH_4, N_2O
	Methodology		Biomass power plants construction and preparation of regulation on feed-in premium tariffs. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		Through stimulation with feed-in premium tariffs, it is envisaged that by 2035 a capacity of 15 MW in biomass power plants will be constructed.
	Steps taken or envisaged to achieve the action	**Steps taken**	Regulation on feed-in tariffs adopted (17.04.2013).
		Steps envisaged	Modification of the Regulation on feed-in tariffs to introduce flexible feed-in premium tariffs.
Progress of implementation	**Results achieved and estimated outcomes**		Achieved result: Currently (end of June 2017) the following capacity is installed and the average annual electricity generation is expected to be: ► 2.2 MW and 12.8 GWh Expected installed capacity and electricity generation: ► 10 MW and 40 GWh in 2025 ► 12,5 MW and 50 GWh in 2030 ► 15 MW and 60 GWh in 2035
	Estimated emission reductions		► 55 Gg CO_2-eq in 2025 ► 90 Gg CO_2-eq in 2030 ► 85 Gg CO_2-eq in 2035
	Timeframe		2020 – 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,332.9 M€ Specific costs: ► 5 €/t CO_2-eq
	Implementing entity		► Government of the Republic of Macedonia ► Energy Regulatory Commission ► Ministry of Economy, Energy Agency of the Republic of Macedonia ► Private investors
Progress indicators:			► Increase in installed capacity (MW) ► Increase in electricity generation (GWh) ► Emissions reduction (Gg CO_2-eq)

Table 69. District heating in Bitola

Mitigation action: ***Central heating of Bitola***

Main objective: ***Utilization of the waste heat from TPP Bitola***

Description: ***Construction of central heating system in Bitola and utilization of the waste heat from TPP Bitola***

Information	**Type**		Technical
	Sector		Energy – Energy industries
	Relevant planning documents, legal and regulatory acts		► Strategy for Energy Development in the Republic of Macedonia ► Development plan of JSC Macedonian Power Plants (ELEM AD)
	Gases		CO_2, CH_4, N_2O
	Methodology		Central heating system construction. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		A construction of a central heating system that will use the waste heat from TPP Bitola is envisaged
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	► A decision for construction adopted ► A loan from KfW Bank is provided
		Steps envisaged	Opening a call for tender and commencement of construction
	Results achieved and estimated outcomes		Expected installed capacity and heat generation: ► 100 MW and 60 GWh in 2025
	Estimated emission reductions		► 25 Gg CO_2-eq in 2025 ► 36 Gg CO_2-eq in 2030 ► 25 Gg CO_2-eq in 2035
	Timeframe		2015-2019
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,333.1 M€ Specific costs: ► 20 €/t CO_2-eq
	Implementing entity		► Government of the Republic of Macedonia ► JSC Macedonian Power Plants (ELEM AD) ► Ministry of Economy, Energy Agency of the Republic of Macedonia
Progress indicators:			► Increase in installed capacity (MW) ► Increase in heat generation (GWh) ► Emissions reduction (Gg CO_2-eq)

Table 70. Natural gas power plants (CHP)

Mitigation action: ***Natural gas power plants (CHP)***

Main objective: ***Reduction of import dependency and greater utilization of the gas pipeline system***

Description: ***Construction of natural gas power plants (CHP)***

Information	**Type**		Technical
	Sector		Energy – Energy industries
	Relevant planning documents, legal and regulatory acts		► Strategy for Energy Development in the Republic of Macedonia ► Development plan of JSC Macedonian Power Plants (ELEM AD) ► Development plan of TE-TO AD Skopje ► Study for gasification of the Republic of Macedonia
	Gases		CO_2, CH_4, N_2O
	Methodology		Natural gas power plants construction. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		It is envisaged that by 2035 additional capacity of 520 MW in natural gas power plants will be constructed, compared to the Reference scenario (or total capacity of 1120 MW).
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	► Analysis conducted - Study for optimization of the plant and the technological process of "Energetika" - ELEM. ► Development plans of private companies (TE-TO AD Skopje) developed
		Steps envisaged	
	Results achieved and estimated outcomes		Expected installed capacity and electricity generation: ► 240 MW and 1,844 GWh in 2030 ► 520 MW and 2,880 GWh in 2035
	Estimated emission reductions		► 947 Gg CO_2-eq in 2030 ► 1,247 Gg CO_2-eq in 2035
	Timeframe		2025-2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,329.8 M€ Specific costs: ► -3 €/t CO_2-eq
	Implementing entity		► Ministry of Economy, Energy Agency of the Republic of Macedonia ► JSC Macedonian Power Plants (ELEM AD) ► TE-TO AD Skopje ► Other private investors
Progress indicators:			► Increase in installed capacity (MW) ► Increase in electricity generation (GWh) ► Emissions reduction (Gg CO_2-eq)

Energy -- Residential and Non-specified (Commercial and Service sector)

Table 71. Solar thermal collectors

Mitigation action: ***Solar thermal collectors***

Main objective: ***Meeting the targets set in the Energy Efficiency Action Plan and the Renewable Energy Sources Action Plan***

Description: ***Installation of solar thermal collectors for hot water***

Information	**Type**		Technical
	Sector		Energy – Residential, non-specified (Commercial and service sector)
	Relevant planning documents, legal and regulatory acts		► Strategy for Energy Development in the Republic of Macedonia ► Strategy for Utilization of Renewable Energy Sources in the Republic of Macedonia
	Gases		CO_2, CH_4, N_2O
	Methodology		Installation of solar thermal collectors. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology
	Assumptions		It is envisaged that by 2035: ► 40% of hot water demand in urban houses, ► 16% of hot water demand in urban apartments and ► 50% of hot water demand in rural areas to be provide by solar thermal collectors
	Steps taken or envisaged to achieve the action	**Steps taken**	Reimbursement of part of the costs for purchased and installed solar thermal collectors in the amount of 30%, but not more than 300 €, realized by the Ministry of Economy. From 2007 to 2016, 14,785 requests were submitted, out of which 4,237 were reimbursed.
		Steps envisaged	Continuation of the incentive measures for solar thermal collectors installation
Progress of implementation	**Results achieved and estimated outcomes**		Achieved annual energy savings: ► 4.9 ktoe (57 GWh) in 2015 (together with heat pumps) Expected annual energy savings: ► 6.9 ktoe (80 GWh) in 2025 ► 11.3 ktoe (132 GWh) in 2030 ► 15.9 ktoe (185 GWh) in 2035
	Estimated emission reductions		► 15 Gg CO_2-eq in 2025 ► 83 Gg CO_2-eq in 2030 ► 90 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,329.5 M€ Specific costs: ► -29 €/t CO_2-eq
	Implementing entity		► Ministry of Economy, Energy Agency of the Republic of Macedonia ► End-users of heat
Progress indicators:			► Energy savings (ktoe/GWh) ► Emissions reduction (Gg CO_2-eq)

Table 72. Labeling of electric appliances and equipment

Mitigation action: ***Labeling of electric appliances and equipment***

Main objective: ***Penetration of appliances with higher efficiency (class A^{++}, A^{+}, A, B) and meeting the target set in the Energy Efficiency Action Plan***

Description: ***Labeling of electric appliances and equipment to provide relevant information on the energy consumption of the products. The application of the labeling and eco-design of the products is necessary to ensure that the products sold in Macedonia are in compliance with the EU regulations.***

Information	**Type**		Regulatory
	Sector		Energy – Residential, non-specified (Commercial and service sector)
	Relevant planning documents, legal and regulatory acts		► Third Energy Efficiency Action Plan ► Rulebook on labelling consumption of energy and other resources on devices using energy. ► Regulation on eco-design of products
	Gases		CO_2, CH_4, N_2O
	Methodology		Labeling of electric appliances and equipment. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		As a result of this measure it is expected that by 2035 the share of energy efficient technologies will be 2.5%.
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	► New Rulebook on labelling consumption of energy and other resources on devices using energy adopted in September 2016 by the Ministry of Economy ► Draft version of the new Regulation on eco-design of products developed
		Steps envisaged	Adoption of the new Regulation on eco-design of products developed
	Results achieved and estimated outcomes		Achieved annual energy savings: ► 0.7 ktoe (8.1 GWh) in 2015 Expected annual energy savings: ► 8.9 ktoe (103 GWh) in 2025 ► 15.4 ktoe (178 GWh) in 2030 ► 22.6 ktoe (262 GWh) in 2035
	Estimated emission reductions		► 104 Gg CO_2-eq in 2025 ► 202 Gg CO_2-eq in 2030 ► 240 Gg CO_2-eq in 2035
	Timeframe		2017 - 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1.332,4 M€ Costs for the Scenario with implemented measure: ► 1.325,8 M€ Specific costs: ► -33 €/t CO_2-eq
	Implementing entity		► Ministry of Economy, Energy Agency of the Republic of Macedonia ► Producers and suppliers of electrical equipment and household appliances ► End-users
Progress indicators:			► Energy savings (ktoe/GWh) ► Emissions reduction (Gg CO_2-eq)

Table 73. Phasing out of resistive heating devices and inclusion of more heat pumps

Mitigation action: ***Phasing out of resistive heating devices and inclusion of more heat pumps***

Main objective: ***More efficient use of electricity to meet the target set in the Energy Efficiency Action Plan***
Description: ***Phasing out heating devices with resistive heaters and their replacement with heat pumps in compliance with EU Climate and Energy Policy***

Information	**Type**		Regulatory, policy
	Sector		Energy – Residential, non-specified (Commercial and service sector)
	Relevant planning documents, legal and regulatory acts		► Third Energy Efficiency Action Plan ► EU Climate and Energy Policy
	Gases		CO_2, CH_4, N_2O
	Methodology		Adopting a Decision that will prevent the sale of heating devices with resistive heaters. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology
	Assumptions		A Decision should be adopted in 2018, prohibiting the sale of resistive heating devices. It is assumed that heating devices with resistive heaters will be gradually replaced with heat pumps. The transition period would be about 15 years.
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	/
		Steps envisaged	Adopting a Decision to ban the sale of heating devices with resistive heaters.
	Results achieved and estimated outcomes		Achieved annual energy savings: ► 4.9 ktoe (57 GWh) in 2015 (together with solar thermal collectors) Expected annual energy savings: ► 79 ktoe (918 GWh) in 2025 ► 128 ktoe (1,486 GWh) in 2030 ► 196 ktoe (2,283 GWh) in 2035
	Estimated emission reductions		► 718 Gg CO_2-eq in 2025 ► 1,465 Gg CO_2-eq in 2030 ► 1,350 Gg CO_2-eq in 2035
	Timeframe		2017 - 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,289.0 M€ Specific costs: ► -30 €/t CO_2-eq
	Implementing entity		► Ministry of Economy, Energy Agency of the Republic of Macedonia ► End-users
Progress indicators:			► Energy savings (ktoe/GWh) ► Emissions reduction (Gg CO_2-eq)

Table 74. Public awareness campaigns and network of energy efficiency (EE) info centers

Mitigation action: ***Public awareness campaigns and network of EE info centers***

Main objective: ***Raising public awareness about the importance and benefits from buying and using appliances with higher efficiency class in order to meet the target set in the Energy Efficiency Action Plan***

Description: ***Establishment of EE info centers in the local self-governments or Centers of the planning regions, in which energy advisors will operate, will share free advice to the interested citizens about the possibilities of saving energy and saving money in their homes***

Information	**Type**		Information
	Sector		Energy – Residential, non-specified (Commercial and service sector)
	Relevant planning documents, legal and regulatory acts		Third Energy Efficiency Action Plan
	Gases		CO_2, CH_4, N_2O
	Methodology		Conducting information campaigns and opening information centers for energy efficiency. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		Investment in public awareness rising campaigns that will increase the share of more efficient appliances (with higher class of efficacy) to 105 by 2035.
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	► Platform for energy efficiency, for education of the population and journalists and experience sharing of the private sector for successfully implemented EE measures implemented. ► Info Center for Energy of the City of Skopje opened. ► Free advices to the customers for reasonable consumption of electricity enabled by EVN's Customer Service Centre
		Steps envisaged	► Broadcasting of TV spots, announcements, campaigns and documentary films ► Extension of the Platform for energy efficiency ► Continuous work of the existing and opening new information centers.
	Results achieved and estimated outcomes		Achieved annual energy savings: ► 2.7 ktoe (31 GWh) in 2015 Expected annual energy savings: ► 38 ktoe (447 GWh) in 2025 ► 63 ktoe (735 GWh) in 2030 ► 94 ktoe (1.100 GWh) in 2035
	Estimated emission reductions		► 410 Gg CO_2-eq in 2025 ► 893 Gg CO_2-eq in 2030 ► 884 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,306.7 M€ Specific costs: ► -29 €/t CO_2-eq
	Implementing entity		► Ministry of Economy, Energy Agency of the Republic of Macedonia ► Energy suppliers ► End-users
Progress indicators:			► Energy savings (ktoe/GWh) ► Emissions reduction (Gg CO_2-eq)

Table 75. Retrofitting of existing residential buildings

Mitigation action: ***Retrofitting of existing residential buildings***

Main objective: ***Retrofitting of existing residential buildings with aim to meet the target set in the Energy Efficiency Action Plan***

Description: ***Reconstructions of residential buildings including windows replacement, initiated by the owners and/or supported by commercial banks and funds which exist in the Republic of Macedonia This measure will provide issuing of certificates for energy performance of buildings, as a prerequisite for putting the reconstructions into operation.***

Information	**Type**		Technical, regulatory
	Sector		Energy – Residential
	Relevant planning documents, legal and regulatory acts		► Third Energy Efficiency Action Plan ► Rulebook on energy performance of buildings. ► Rulebook on Energy Audit
	Gases		CO_2, CH_4, N_2O
	Methodology		Retrofitting of existing residential buildings. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		Annual renovation rate of 1% for the existing residential buildings, while meeting the standard for at least C class (90 kWh/m^2)
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	► 31 buildings for collective housing were renovated (EE measures implemented) under the USAID/Habitat Project for residential energy efficiency. ► Financial support for rehabilitation of buildings for collective housing with implementation of EE measures provided by some municipalities ► Call for applications for reimbursement of 50% of the costs for windows replacement and installation of PVC and aluminum windows, but not more than 500 €, provided by the Ministry of Economy ► The process of drafting the Law on Energy Efficiency started (a working group established)
		Steps envisaged	► Adoption of the Law on Energy Efficiency ► National Building Renovation Strategy ► Establishment of an Energy Efficiency Fund
	Results achieved and estimated outcomes		Achieved annual energy savings: ► 5.6 ktoe (65 GWh) in 2015 Expected annual energy savings: ► 18 ktoe (212 GWh) in 2025 ► 27 ktoe (318 GWh) in 2030 ► 37 ktoe (426 GWh) in 2035
	Estimated emission reductions		► 161 Gg CO_2-eq in 2025 ► 284 Gg CO_2-eq in 2030 ► 292 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,333.1 M€ Specific costs: ► 2 €/t CO_2-eq
	Implementing entity		► Ministry of Economy, Energy Agency of the Republic of Macedonia ► Donors and financial institutions ► Households
Progress indicators:			► Energy savings (ktoe/GWh) ► Emissions reduction (Gg CO_2-eq)

Table 76. Retrofitting of existing public buildings

Mitigation action: ***Retrofitting of existing public buildings***

Main objective: ***Retrofitting of existing public buildings with aim to meet the target set in the Energy Efficiency Action Plan***

Description: ***Reconstuction including windows replacement of existing public buildings under jurisdiction of the central government or local self-government. This measure will provide issuing of certificates for energy performance of buildings, as a prerequisite for putting the reconstructions into operation.***

Information	**Type**		Technical, regulatory
	Sector		Energy – Residential, non-specified (Commercial and service sector)
	Relevant planning documents, legal and regulatory acts		► Third Energy Efficiency Action Plan ► Rulebook on energy performance of buildings ► Rulebook on Energy Audit
	Gases		CO_2, CH_4, N_2O
	Methodology		Retrofitting of existing public buildings. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		Annual renovation rate of 1% for the existing public buildings
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	► Draft National Program for energy efficiency in public buildings in the Republic of Macedonia (Phase I) was developed under the GEF Sustainable Energy Project ► "Resilient Skopje" – Climate Change Strategy for the City of Skopje developed. ► The process of drafting the Law on Energy Efficiency started (a working group established).
		Steps envisaged	► Adoption of the Law on Energy Efficiency ► National Building Renovation Strategy ► Establishment of an Energy Efficiency Fund
	Results achieved and estimated outcomes		Achieved annual energy savings: ► 6 ktoe (70 GWh) in 2015 Expected annual energy savings: ► 15.6 ktoe (181 GWh) in 2025 ► 30 ktoe (349 GWh) in 2030 ► 47.3 ktoe (550 GWh) in 2035
	Estimated emission reductions		► 135 Gg CO_2-eq in 2025 ► 296 Gg CO_2-eq in 2030 ► 346 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,331.8 M€ Specific costs: ► -2 €/t CO_2-eq
	Implementing entity		► Ministry of Economy, Energy Agency of the Republic of Macedonia ► Ministry of Finance ► Local self-government ► Municipal public enterprises ► Donors and financial institutions
Progress indicators:			► Energy savings (ktoe/GWh) ► Emissions reduction (Gg CO_2-eq)

Table 77. Retrofitting of existing commercial buildings

Mitigation action: ***Retrofitting of existing commercial buildings***

Main objective: ***Retrofitting of existing commercial buildings with aim to meet the target set in the Energy Efficiency Action Plan***

Description: ***Reconstructions of existing commercial buildings including windows replacement, initiated by the owners and/or supported by commercial banks and funds which exist in the Republic of Macedonia This measure will provide issuing of certificates for energy performance of buildings, as a prerequisite for putting the reconstructions into operation.***

Information	**Type**		Technical, regulatory
	Sector		Energy – Non-specified (Commercial and service sector)
	Relevant planning documents, legal and regulatory acts		► Third Energy Efficiency Action Plan ► Rulebook on energy performance of buildings ► Rulebook on Energy Audit
	Gases		CO_2, CH_4, N_2O
	Methodology		Retrofitting of existing commercial buildings. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology
	Assumptions		Annual renovation rate of 1% for the existing commercial buildings
	Steps taken or envisaged to achieve the action	**Steps taken**	► The process of drafting the Law on Energy Efficiency started (a working group established).
		Steps envisaged	► Adoption of the Law on Energy Efficiency ► National Building Renovation Strategy ► Establishment of an Energy Efficiency Fund
Progress of implementation	**Results achieved and estimated outcomes**		Achieved annual energy savings: ► 2.5 ktoe (29 GWh) in 2015 Expected annual energy savings: ► 3.4 ktoe (39 GWh) in 2025 ► 8.7 ktoe (100 GWh) in 2030 ► 14 ktoe (163 GWh) in 2035
	Estimated emission reductions		► 64 Gg CO_2-eq in 2025 ► 127 Gg CO_2-eq in 2030 ► 148 Gg CO_2-eq in 2035
	Timeframe		2017 - 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,331.9 M€ Specific costs: ► -4 €/t CO_2-eq
	Implementing entity		► Ministry of Economy, Energy Agency of the Republic of Macedonia ► Ministry of Finance ► Commercial building owners
Progress indicators:			► Energy savings (ktoe/GWh) ► Emissions reduction (Gg CO_2-eq)

Table 78. Construction of new buildings

Mitigation action: ***Construction of new buildings***

Main objective: ***Construction of new buildings with aim to meet the target set in the Energy Efficiency Action Plan***

Description: ***Construction of new buildings in compliance with the Rulebook on energy performance of building. This measure will provide issuing of certificates for energy performance of buildings, as a prerequisite for putting the building into operation***

Information	**Type**		Technical, regulatory
	Sector		Energy – Residential
	Relevant planning documents, legal and regulatory acts		► Third Energy Efficiency Action Plan ► Rulebook on energy performance of buildings ► Rulebook on Energy Audit
	Gases		CO_2, CH_4, N_2O
	Methodology		Construction of new residential buildings. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		Construction of new residential buildings, while meeting the standard for at least C class (90 kWh/m^2)
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	► Financial support for construction of new buildings at municipality level ► The process of drafting the Law on Energy Efficiency started (a working group established)
		Steps envisaged	► Adoption of the Law on Energy Efficiency ► National Building Renovation Strategy ► Establishment of an Energy Efficiency Fund
	Results achieved and estimated outcomes		Achieved annual energy savings: ► 4.9 ktoe (57 GWh) in 2015 Expected annual energy savings: ► 9.8 ktoe (57 GWh) in 2025 ► 15.1 ktoe (118 GWh) in 2030 ► 21.6 ktoe (193 GWh) in 2035
	Estimated emission reductions		► 43 Gg CO_2-eq in 2025 ► 101 Gg CO_2-eq in 2030 ► 138 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,332.2 M€ Specific costs: ► -2 €/t CO_2-eq
	Implementing entity		► Ministry of Economy, Energy Agency of the Republic of Macedonia ► Donors and financial institutions ► Investors (households)
Progress indicators:			► Energy savings (ktoe/GWh) ► Emissions reduction (Gg CO_2-eq)

Table 79. Construction of passive buildings

Mitigation action: ***Construction of passive buildings***

Main objective: ***Meeting the requirement of the EU Directive 2010/31/EU that all buildings constructed after 31.12.2020 should be nearly zero-energy buildings***

Description: ***Construction of new passive residential buildings in compliance with the EU Directive 2010/31/EU. This measure will provide issuing of certificates for energy performance of buildings, as a prerequisite for putting the building into operation***

Information	**Type**		Technical, regulatory
	Sector		Energy – Residential
	Relevant planning documents, legal and regulatory acts		► EU Directive 2010/31/EU ► Rulebook on Energy Audit
	Gases		CO_2, CH_4, N_2O
	Methodology		Construction of passive buildings. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		Construction of new passive buildings, while meeting the standard for at least A^+ class (15 kWh/m^2) starting from 2020 and continuously increasing their number so that in 2035, 85% of new buildings are assumed to be passive.
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	► Financial support for construction of new passive buildings at municipality level ► The process of drafting the Law on Energy Efficiency started (a working group established)
		Steps envisaged	► Adoption of the Law on Energy Efficiency ► National Building Renovation Strategy ► Establishment of an Energy Efficiency Fund
	Results achieved and estimated outcomes		Expected annual energy savings: ► 1.7 ktoe (20 GWh) in 2025 ► 6.3 ktoe (73 GWh) in 2030 ► 12.7 ktoe (147 GWh) in 2035
	Estimated emission reductions		► 7 Gg CO_2-eq in 2025 ► 45 Gg CO_2-eq in 2030 ► 103 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,334.5 M€ Specific costs: ► 47 €/t CO_2-eq
	Implementing entity		► Ministry of Economy, Energy Agency of the Republic of Macedonia ► Donors and financial institutions ► Investors (households)
Progress indicators:			► Energy savings (ktoe/GWh) ► Emissions reduction (Gg CO_2-eq)

Table 80. Phasing out of incandescent lights

Mitigation action: ***Phasing out of incandescent lights***

Main objective: ***Meeting the target set in the Energy Efficiency Action Plan***

Description: ***Replacing incandescent light bulbs with halogen ones (at the beginning) and later with compact fluorescent (CFL) and LED***

Information	**Type**		Regulatory, policy
	Sector		Energy – Residential, non-specified (Commercial and service sector)
	Relevant planning documents, legal and regulatory acts		► Third Energy Efficiency Action Plan ► Commision Regulation(EC) No 244/2009 implementing Directive 2005/32/EC of the European Parlament and of the Council with regard to ecodesign requirements for non-directional household lamps
	Gases		CO_2, CH_4, N_2O
	Methodology		Introducing a Regulation that will prohibit sales of incandescent light bulbs. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		It is assumed that a Regulation will be adopted on prohibiting sales of incandescent light bulbs, its implementation will start in 2018, and it is assumed that there will be 2-3 years of transition period
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	/
		Steps envisaged	Adoption of a Regulation that will prohibit sales of incandescent light bulbs.
	Results achieved and estimated outcomes		Expected annual energy savings: ► 84 ktoe (981 GWh) in 2025 ► 106 ktoe (1.235 GWh) in 2030 ► 131 ktoe (1.524 GWh) in 2035
	Estimated emission reductions		► 677 Gg CO_2-eq in 2025 ► 1,314 Gg CO_2-eq in 2030 ► 1,131 Gg CO_2-eq in 2035
	Timeframe		2017 - 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,293.5 M€ Specific costs: ► -30 €/t CO_2-eq
	Implementing entity		► Government of the Republic of Macedonia ► Ministry of Economy, Energy Agency of the Republic of Macedonia ► End-users
Progress indicators:			► Energy savings (ktoe/GWh) ► Emissions reduction (Gg CO_2-eq)

Table 81. Improvement of the street lighting in the municipalities

Mitigation action: ***Improvement of the street lighting in the municipalities***

Main objective: ***Meeting the target set in the Energy Efficiency Action Plan***

Description: ***Replacement of the existing lamps with sodium and LED lamps***

Information	**Type**		Technical
	Sector		Energy – Non-specified (Commercial and service sector)
	Relevant planning documents, legal and regulatory acts		Third Energy Efficiency Action Plan
	Gases		CO_2, CH_4, N_2O
	Methodology		Replacement of the mercury lamps with sodium and LED lamps. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		It is envisaged that by 2035 60% of the street lights will be LED and the rest 40% will be sodium lamps
	Steps taken or envisaged to achieve the action	**Steps taken**	► Street lighting at some location replaced ► Promotional activities for the implementation of public-private partnership (PPP) taken
		Steps envisaged	► Continuing the promotional activities for the implementation of public-private partnership
Progress of implementation	**Results achieved and estimated outcomes**		Achieved annual energy savings: ► 1.7 ktoe (20 GWh) in 2015 Expected annual energy savings: ► 4.6 ktoe (53 GWh) in 2025 ► 7.3 ktoe (85 GWh) in 2030 ► 9.3 ktoe (108 GWh) in 2035
	Estimated emission reductions		► 30 Gg CO_2-eq in 2025 ► 86 Gg CO_2-eq in 2030 ► 86 Gg CO_2-eq in 2035
	Timeframe		2017 - 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,329.6 M€ Specific costs: ► -32 €/t CO_2-eq
	Implementing entity		► Ministry of Economy, Energy Agency of the Republic of Macedonia ► Local self-government
Progress indicators:			► Energy savings (ktoe/GWh) ► Emissions reduction (Gg CO_2-eq)

Table 82. "Green procurement"

*Mitigation action: "**Green procurements"***

*Main objective: **Application of energy efficiency criteria ("greening") in public procurement procedures***
*Description: **Intensified activities to ensure legal and technical knowledge and skills of public sector entities for inclusion and evaluation of requirements for energy efficiency in public procurement procedures by applying the criteria of most economically advantageous tender.***

Information	**Type**		Regulatory
	Sector		Energy – Non-specified (Commercial and service sector)
	Relevant planning documents, legal and regulatory acts		► Third Energy Efficiency Action Plan ► Law on Public Procurement ► Law on Energy
	Gases		CO_2, CH_4, N_2O
	Methodology		Implementation of energy efficiency criteria. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		Penetration of efficient appliances to 5% share by 2035
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	► Recommendations for amendment/supplementation of the Law on Public Procurement in order to incorporate requirements for EE criteria in the public procurements given by the State Audit Office. ► The process of drafting the Law on Energy Efficiency started (a working group established
		Steps envisaged	► Adoption of the Law on Energy Efficiency ► Amendments/supplementations to the Law on Public Procurement ► Changing the existing guidelines on energy efficiency criteria and providing training for public sector entities for the proper implementation of the guidelines ► Introduction of a method for monitoring the implementation of the measure.
	Results achieved and estimated outcomes		Achieved annual energy savings: ► 0.22 ktoe (2.6 GWh) in 2015 Expected annual energy savings: ► 2.9 ktoe (34 GWh) in 2025 ► 5.1 ktoe (59 GWh) in 2030 ► 7.6 ktoe (88 GWh) in 2035
	Estimated emission reductions		► 16 Gg CO_2-eq in 2025 ► 64 Gg CO_2-eq in 2030 ► 73 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,330.2 M€ Specific costs: ► -34 €/t CO_2-eq
	Implementing entity		► Ministry of Economy, Energy Agency of the Republic of Macedonia ► Public Procurement Bureau ► Local self-government
Progress indicators:			► Energy savings (ktoe/GWh) ► Emissions reduction (Gg CO_2-eq)

Table 83. Gasification (residential and commercial and public sector)

Mitigation action: ***Gasification (residential and commercial and public sector)***

Main objective: ***Enabling access to a new fuel type in residential and commercial and public sector***

Description: ***Gasification of residential and commercial and public sector through construction of a gasification network***

Information	**Type**		Technical, policy
	Sector		Energy – Residential, non-specified (Commercial and service sector)
	Relevant planning documents, legal and regulatory acts		► Strategy for Energy Development in the Republic of Macedonia ► Work Program of the Government of the Republic of Macedonia ► Study for gasification of the Republic of Macedonia
	Gases		CO_2, CH_4, N_2O
	Methodology		Construction of gasification network. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		Gradual gasification of the residential and commercial and public sector by 2020, which will be more intensified after 2020
	Steps taken or envisaged to achieve the action	**Steps taken**	► Gasification network section Klechovce – Shtip built ► Gasification network sections: Shtip – Negotino, Negotino – Bitola and Tetovo – Skopje in a process of construction
		Steps envisaged	► Finalizing the construction of the started sections ► Call for tenders for public private partnership and construction of a secondary and tertiary gasification network
Progress of implementation	**Results achieved and estimated outcomes**		Achieved share of natural gas in the final energy consumption in residential and non-specified sectors. correspondingly : ► 0.02% and 4.5% in 2015 Expected share of natural gas in the final energy consumption in residential and non-specified sectors. correspondingly : ► 6.2% and 7.7% in 2025 ► 8.5% and 9.6% in 2030 ► 10.7% and 11.2% in 2035
	Estimated emission reductions		► 17 Gg CO_2-eq in 2025 ► 17 Gg CO_2-eq in 2030 ► 58 Gg CO_2-eq in 2035
	Timeframe		2017 - 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,326.5 M€ Specific costs: ► -341 €/t CO_2-eq
	Implementing entity		► Government of the Republic of Macedonia ► Ministry of Economy, Energy Agency of the Republic of Macedonia ► JSC Macedonian Energy Resources ► JSC GAMA ► JSC Strumica Gas ► JSC Kumanovo Gas

Mitigation action: ***Gasification (residential and commercial and public sector)***		
		► Directorate for Technological Industrial Development Zones ► Private investors
Progress indicators:		► Share of natural gas in final energy consumption in Residential and Non-specified sectors (%) ► Emissions reduction (Gg CO_2-eq)

Table 84. Increased use of district heating systems

Mitigation action: ***Increased use of district heating systems***			
Main objective: ***Reduction of local pollution*** *Description:* ***Increased use of existing district heating systems through implementation of information campaigns for connecting new consumers, including those who have been disconnected from the system in the past.***			
Information	**Type**		Technical, information
	Sector		Energy – Residential, Non-specified (Commercial and service sector)
	Relevant planning documents, legal and regulatory acts		► Strategy for Energy Development in the Republic of Macedonia ► Study for determining the techno-economic optimal and environmentally sustainable structure of heating and implementation of the central supply of sanitary hot water in the City of Skopje
	Gases		CO_2, CH_4, N_2O
	Methodology		Implementation of information campaigns. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		Information campaigns will contribute to connection of the new consumers to the existing central heating system earlier than in the Reference scenario
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	► Studies for analysis of the central heating system and implementation of central supply of sanitary hot water developed ► Information campaigns for re-connection of the previously disconnected consumers and attraction of new consumers implemented
		Steps envisaged	► Continuing the implementation of the information campaigns
	Results achieved and estimated outcomes		Expected heat consumption: ► 6.5 ktoe (76 GWh) in 2025 ► 4.7 ktoe (57 GWh) in 2030 ► 14.4 ktoe (167 GWh) in 2035
	Estimated emission reductions		► 10 Gg CO_2-eq in 2025 ► 24 Gg CO_2-eq in 2030 ► 18 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,330.9 M€ Specific costs: ► -62 €/t CO_2-eq
	Implementing entity		► Ministry of Economy, Energy Agency of the Republic of Macedonia ► Balkan energy Dooel Skopje

Mitigation action: ***Increased use of district heating systems***		
		► JSC Skopje Sever ► "Energetika" –Skopje, subsidiary to JSC Macedonian Power Plants (ELEM AD) ► Private investors
Progress indicators:		► Increase of heat consumption (form central heating systems) (GWh) ► Increase in the number of consumers connected to the central heating system ► Emissions reduction (Gg CO_2-eq)

Table 85. Utilization of the heating system for obtaining sanitary hot water in combination with solar collectors

Mitigation action: ***Utilization of the heating system for obtaining sanitary hot water in a combination with solar collectors***		
Main objective: ***Meeting the target set in the Energy Efficiency Action Plan and Renewable Energy Action Plan*** *Description:* ***Obtaining sanitary hot water by utilization the heating system in a combination with solar collectors***		
Information	**Type**	Technical, information
	Sector	Energy – Residential, Non-specified (Commercial and service sector)
	Relevant planning documents, legal and regulatory acts	► Strategy for Energy Development in the Republic of Macedonia ► Study for determining the techno-economic optimal and environmentally sustainable structure of heating and implementation of the central supply of sanitary hot water in the City of Skopje
	Gases	CO_2, CH_4, N_2O
	Methodology	Implementation of systems for obtaining sanitary hot water from the heating system in a combination with solar collectors. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions	It is envisaged that by 2035, 15% of the hot water needs in the urban buildings will be provided through the heating system.
Progress of implementation	**Steps taken or envisaged to achieve the action** – **Steps taken**	► Studies for analysis of the central heating system and implementation of central supply of sanitary hot water developed
	Steps taken or envisaged to achieve the action – **Steps envisaged**	► Implementation of information campaigns ► Implementation of systems for obtaining sanitary hot water from the heating system in a combination with solar collectors at end-users level
	Results achieved and estimated outcomes	Expected annual energy savings: ► 0.8 ktoe (9 GWh) in 2025 ► 2 ktoe (24 GWh) in 2030 ► 3 ktoe (34 GWh) in 2035
	Estimated emission reductions	► 8 Gg CO_2-eq in 2025 ► 25 Gg CO_2-eq in 2030 ► 30 Gg CO_2-eq in 2035
	Timeframe	2017 - 2035
	Costs (in 2030)	Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure:

Mitigation action: ***Utilization of the heating system for obtaining sanitary hot water in a combination with solar collectors***

	► 1,331.7 M€ Specific costs: ► -27 €/t CO_2-eq
Implementing entity	► Ministry of Economy, Energy Agency of the Republic of Macedonia ► Balkan energy Dooel Skopje ► JSC Skopje Sever ► "Energetika" –Skopje, subsidiary to JSC Macedonian Power Plants (ELEM AD) ► Private investors
Progress indicators:	► Number of connected systems for obtaining sanitary hot water from the heating system in a combination with solar collectors ► Energy savings (ktoe/GWh) ► Emissions reduction (Gg CO_2-eq)

Energy -- Manufacturing industries and construction

Table 86. Energy management in manufacturing industries

Mitigation action: ***Energy management in manufacturing industries***

Main objective: ***Efficient management of manufacturing processes in industry aiming to increased production at the same energy consumption and meeting the target set in the Energy Efficiency Action Plan***

Description: ***Implementation of obligatory energy audits of manufacturing industries and implementation of ISO 50001 standard***

Information	**Type**		Regulatory, technical
	Sector		Energy – Manufacturing industries and construction
	Relevant planning documents, legal and regulatory acts		Third Energy Efficiency Action Plan
	Gases		CO_2, CH_4, N_2O
	Methodology		Implementation of the ISO 50001 standard. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		Improvement of the systems efficiency in manufacturing industries at annual rate of 0.15%
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	► Promotion of ISO 50001 standards completed ► Training on implementation of energy management in industry organized ► Certificates for energy auditors issued ► USAID project for energy management in industry realized in 17 companies ► Ongoing UNIDO/GEF Project in which one of the activities is Program for energy management in industrial companies according to ISO 50001 standard and the UNIDO Methodology. Initial results achieved in 12 companies and additionally Program for replications of the energy management systems realized in 5 companies.
		Steps envisaged	► Continuation of the implementation of ISO 50001 standard in more industrial companies (manufacturing industries). ► Implementation of obligatory energy audits.
	Results achieved and estimated outcomes		Achieved annual energy saving: ► 3 ktoe (35 GWh) in 2015 Expected annual energy savings: ► 14.6 ktoe (170 GWh) in 2025 ► 24.7 ktoe (288 GWh) in 2030 ► 37.2 ktoe (434 GWh) in 2035
	Estimated emission reductions		► 52 Gg CO_2-eq in 2025 ► 150 Gg CO_2-eq in 2030 ► 199 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,327.6 M€ Specific costs: ► -32 €/t CO_2-eq
	Implementing entity		► Ministry of Economy, Energy Agency of the Republic of Macedonia ► Private companies

Mitigation action: ***Energy management in manufacturing industries***	
Progress indicators:	▶ Energy savings (ktoe/GWh) ▶ Emissions reduction (Gg CO_2-eq)

Table 87. Introduction of efficient electric motors

Mitigation action: ***Introduction of efficient electric motors***		
Main objective: ***Efficient management of manufacturing processes in industry aiming to increased production at the same energy consumption and meeting the target set in the Energy Efficiency Action Plan***		
Description: ***Introduction of efficient electric motors in manufacturing industries***		
Information	**Type**	Technical
	Sector	Energy – Manufacturing industries and construction
	Relevant planning documents, legal and regulatory acts	Third Energy Efficiency Action Plan
	Gases	CO_2, CH_4, N_2O
	Methodology	Installation of efficient electric motors. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions	It is envisaged that the share of efficient electric motors will be 40% by 2035
	Steps taken or envisaged to achieve the action – **Steps taken**	New efficient electric motors installed in a number of companies.
	Steps taken or envisaged to achieve the action – **Steps envisaged**	Replacement of the existing electric motors with more efficient
Progress of implementation	**Results achieved and estimated outcomes**	Achieved annual energy saving: ▶ 1.4 ktoe (16 GWh) in 2015 Expected annual energy savings: ▶ 7.3 ktoe (84 GWh) in 2025 ▶ 10.9 ktoe (127 GWh) in 2030 ▶ 15.1 ktoe (176 GWh) in 2035
	Estimated emission reductions	▶ 51 Gg CO_2-eq in 2025 ▶ 117 Gg CO_2-eq in 2030 ▶ 134 Gg CO_2-eq in 2035
	Timeframe	2017 – 2035
	Costs (in 2030)	Costs for the Reference scenario: ▶ 1,332.4 M€ Costs for the Scenario with implemented measure: ▶ 1,330.2 M€ Specific costs: ▶ -19 €/t CO_2-eq
	Implementing entity	▶ Ministry of Economy, Energy Agency of the Republic of Macedonia ▶ Private companies
Progress indicators:		▶ Energy savings (ktoe/GWh) ▶ Emissions reduction (Gg CO_2-eq)

Energy -- Transport

Table 88. Biofuels 5%

Mitigation action: ***Biofuels 5%***

Main objective: ***Meeting the targets set in the Renewable Energy Action Plan***

Description: ***5% share of biofuels by 2020***

Information	**Type**		Regulatory
	Sector		Energy – Transport
	Relevant planning documents, legal and regulatory acts		► Strategy for Energy Development in the Republic of Macedonia ► Strategy for Utilization of Renewable Energy Sources in the Republic of Macedonia ► Renewable Energy Action Plan ► Biennial report on the progress of increased utilization of renewable energy sources
	Gases		CO_2, CH_4, N_2O
	Methodology		Adoption of Law and Action Plan on Biofuels. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		It is assumed that the implementation of the Directive for biofuels (2003/30/EC) will be postponed to 2025, or the share of biofuels will be 5% by 2020 and 10% by 2025, remaining at that level till 2035
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	► Adoption of Renewable Energy Action plan till 2025 ► Draft version of the Action Plan for Biofuels developed ► Draft version of the Law on Biofuels developed ► The process of drafting the Law on Renewable Energy Sources (RES) started (a working group established)
		Steps envisaged	► Adoption of the Law on Biofuels ► Adoption of the Law on RES ► Adoption of the Action Plan for Biofuels
	Results achieved and estimated outcomes		Expected share of biofuels in the total final energy consumption in transport: ► 5% in 2020 ► 10% in 2025, 2030 and 2035
	Estimated emission reductions		► 206 Gg CO_2-eq in 2025 ► 221 Gg CO_2-eq in 2030 ► 221 Gg CO_2-eq in 2035
	Timeframe		2017-2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,336.7 M€ Specific costs: ► 20 €/t CO_2-eq
	Implementing entity		► Ministry of Economy, Energy Agency of the Republic of Macedonia ► End-users
Progress indicators:			► Share of the biofuels in the total final energy consumption in transport (%) ► Emissions reduction (Gg CO2-eq)

Table 89. Biofuels 10%

Mitigation action: ***Biofuels 10%***

Main objective: ***Meeting the targets set in the Renewable Energy Action Plan***

Description: ***10% share of biofuels by 2020***

Information	**Type**		Regulatory
	Sector		Energy – Transport
	Relevant planning documents, legal and regulatory acts		► Strategy for Energy Development in the Republic of Macedonia ► Strategy for Utilization of Renewable Energy Sources in the Republic of Macedonia ► Renewable Energy Action Plan ► Biennial report on the progress of increased utilization of renewable energy sources
	Gases		CO_2, CH_4, N_2O
	Methodology		Adoption of Law and Action Plan on Biofuels. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		It is assumed that the Directive for biofuels (2003/30/EC) will be implemented by 2025, or the share of biofuels will be 10% by 2020, remaining at that level till 2035
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	► Adoption of Renewable Energy Action plan till 2025 ► Draft version of the Action Plan for Biofuels developed ► Draft version of the Law on Biofuels developed ► The process of drafting the Law on Renewable Energy Sources (RES) started (a working group established)
		Steps envisaged	► Adoption of the Law on Biofuels ► Adoption of the Law on RES ► Adoption of the Action Plan for Biofuels
	Results achieved and estimated outcomes		Expected share of biofuels in the total final energy consumption in transport: ► 10% in 2020, 2025, 2030 and 2035
	Estimated emission reductions		► 206 Gg CO_2-eq in 2025 ► 221 Gg CO_2-eq in 2030 ► 221 Gg CO_2-eq in 2035
	Timeframe		2017-2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,336.7 M€ Specific costs: ► 20 €/t CO_2-eq
	Implementing entity		► Ministry of Economy, Energy Agency of the Republic of Macedonia ► End-users
Progress indicators:			► Share of the biofuels in the total final energy consumption in transport (%) ► Emissions reduction (Gg CO2-eq)

Table 90. Increased use of the railway

Mitigation action: ***Increased use of the railway***

Main objective: ***Meeting the target set in the Energy Efficiency Action Plan***

Description: ***Increased use of the railway though awareness rising to use the railway for long-distance traveling and by improving the conditions of the companies***

Information	**Type**		Technical, information
	Sector		Energy – Transport
	Relevant planning documents, legal and regulatory acts		► Third Energy Efficiency Action Plan ► National Transport Strategy
	Gases		CO_2, CH_4, N_2O
	Methodology		Conducting campaigns and modernization of the railway. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		By 2035 2.1% of the passenger kilometers of cars, 5.7% of passenger kilometers of busses and 3.6% of tonnes kilometers of heavy duty vehicles will be realized by railway transport.
	Steps taken or envisaged to achieve the action	**Steps taken**	► 150 freight cars and six compositions consisting of a locomotive and passenger cars ordered by the Government as part of a project with the European Bank for Reconstruction and Development (EBRD). Some of these have already been received and put into use. ► Campaigns for cheaper/free driving of certain categories of passengers (young people, pensioners, etc.) carried out.
		Steps envisaged	► Arrival and putting into use of other commissioned wagons ► Implement promotional campaigns for raising public awareness ► Continuing the campaigns for cheaper/free driving ► Enabling additional conditions for companies
Progress of implementation	**Results achieved and estimated outcomes**		Expected annual energy savings, and increase of passenger and tonnes km, correspondingly: ► 5.8 ktoe (67 GWh), 324 pkm and 755 tkm in 2025 ► 10.3 ktoe (119 GWh), 431 pkm and 1,050 tkm in 2030 ► 15.6 ktoe (182 GWh), 541 pkm and 1,407 tkm in 2035.
	Estimated emission reductions		► 10 Gg CO_2-eq in 2025 ► 20 Gg CO_2-eq in 2030 ► 26 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,325.1 M€ Specific costs: ► -371 €/t CO_2-eq
	Implementing entity		► Government of the Republic of Macedonia ► Ministry of Transport and Communications ► Ministry of Economy, Energy Agency of the Republic of Macedonia ► JSC Macedonian Railway Transport ► End-users ► Private companies
Progress indicators:			► Energy savings (ktoe/GWh) ► Increase of passenger km in railway transport (pkm) ► Increase of tonnes km in railway transport (tkm) ► Emissions reduction (Gg CO_2-eq)

Table 91. Renewing the national car fleet

Mitigation action: ***Renewing the national car fleet***

Main objective: ***Reduction of the local air pollution and meeting the target set in the Energy Efficiency Action Plan***

Description: ***This measure consists of successively organized and well-planned steps for faster renewal of the vehicle fleet.***

Information	**Type**		Regulatory, policy, information
	Sector		Energy – Transport
	Relevant planning documents, legal and regulatory acts		► Third Energy Efficiency Action Plan ► National Transport Strategy
	Gases		CO_2, CH_4, N_2O
	Methodology		Introducing a Regulation that will prohibit the purchase of cars with a standard lower than EURO5. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		It is assumed that only new vehicles and vehicles not older than 8 years will be sold, i.e. vehicles that meet EU standards such as CO_2 emissions in 2020 of 95 g CO_2/km, and 70 g CO_2/km by 2025.
	Steps taken or envisaged to achieve the action	**Steps taken**	
		Steps envisaged	► Amendment of the following legislation: Rulebook for identification and/or identification and appreciation of vehicles technical condition, Rulebook for individual authorization of vehicles and Law for vehicles – the part for registration and technical inspection. ► Successive implementation of EURO standards for import of new EE vehicles.
Progress of implementation	**Results achieved and estimated outcomes**		Achieved annual energy savings: ► 6.5 ktoe (76 GWh) in 2015 (together with other road vehicles) Expected annual energy savings: ► 27 ktoe (315 GWh) in 2025 ► 45 ktoe (523 GWh) in 2030 ► 60 ktoe (670 GWh) in 2035
	Estimated emission reductions		► 83 Gg CO_2-eq in 2025 ► 139 Gg CO_2-eq in 2030 ► 185 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,312 M€ Specific costs: ► -147 €/t CO_2-eq
	Implementing entity		► Government of the Republic of Macedonia ► Ministry of Transport and Communications ► Ministry of Economy, Energy Agency of the Republic of Macedonia ► End-users
Progress indicators:			► Energy savings (ktoe/GWh) ► Emissions reduction (Gg CO_2-eq)

Table 92. Renewing the rest of the national road fleet

Mitigation action: ***Renewing the rest of the national road fleet (light duty and freight trucks and buses)***

Main objective: ***Reduction of the local air pollution and meeting the target set in the Energy Efficiency Action Plan***

Description: ***This measure involves introduction of a regulation that will enable renewal of the vehicle fleet of light duty and heavy goods vehicles and buses***

Information	**Type**		Regulatory, policy
	Sector		Energy – Transport
	Relevant planning documents, legal and regulatory acts		► Third Energy Efficiency Action Plan ► National Transport Strategy
	Gases		CO_2, CH_4, N_2O
	Methodology		Introducing a Regulation that will prohibit the purchase of cars with a standard lower than EURO6. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		It is assumed that only new vehicles (light duty and heavy goods vehicles and buses) that meet EU standards for exhaust fumes.
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	
		Steps envisaged	Successive implementation of EURO standards (EU new standard is a EURO 6, while in Macedonia is EURO 4) for import of new EE vehicles
	Results achieved and estimated outcomes		Achieved annual energy savings: ► 6.5 ktoe (76 GWh) in 2015 (together with passenger cars) Expected annual energy savings: ► 9.5 ktoe (111 GWh) in 2025 ► 24 ktoe (278 GWh) in 2030 ► 39.7 ktoe (462 GWh) in 2035
	Estimated emission reductions		► 27 Gg CO_2-eq in 2025 ► 65 Gg CO_2-eq in 2030 ► 122 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,325.9 M€ Specific costs: ► -100 €/t CO_2-eq
	Implementing entity		► Government of the Republic of Macedonia ► Ministry of Transport and Communications ► Ministry of Interior Affairs ► Ministry of Economy, Energy Agency of the Republic of Macedonia ► Private companies
Progress indicators:			► Energy savings (ktoe/GWh) ► Emissions reduction (Gg CO_2-eq)

Table 93. Increased use of bicycles, walking and introduction of parking policy

Mitigation action: ***Increased use of bicycles, walking and introduction of parking policy***

Main objective: ***Reduction of the local air pollution and meeting the target set in the Energy Efficiency Action Plan***

Description: ***Conducting campaigns/providing subsidies and systems for use of new or rented bicycles, walking, and introduction of parking policies that would reduce the use of cars in the city area***

Information	**Type**		Regulatory, technical, information
	Sector		Energy – Transport
	Relevant planning documents, legal and regulatory acts		► Third Energy Efficiency Action Plan ► Decisions made by municipalities to subsidize buying of new bicycles
	Gases		CO_2, CH_4, N_2O
	Methodology		Implementation of campaigns/subsidies, parking policies. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		► Introduction of an appropriate parking policy which would reduce the use of cars in the city area, and would contribute to increased use of bicycles. ► People, especially in smaller towns where a lot of them use cars for short distances, would increase their use of bicycles or walking
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	► Subsidies and campaigns for buying new bicycles implemented ► Systems for bicycles renting implemented ► Bicycles tracks constructed ► Zonal parking implemented ► New multi-level car parks constructed
		Steps envisaged	► Continue the implementation of the campaigns and subsidies for buying new bicycles and renting bicycles ► Continue the construction of new bicycles tracks
	Results achieved and estimated outcomes		Expected annual energy savings: ► 1 ktoe (11 GWh) in 2025 ► 1.3 ktoe (15 GWh) in 2030 ► 1.5 ktoe (18 GWh) in 2035
	Estimated emission reductions		► 3 Gg CO_2-eq in 2025 ► 4 Gg CO_2-eq in 2030 ► 5 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,328.6 M€ Specific costs: ► -970 €/t CO_2-eq
	Implementing entity		► Ministry of Economy, Energy Agency of the Republic of Macedonia ► Local self-government ► End-users
Progress indicators:			► Energy savings (ktoe/GWh) ► Emissions reduction (Gg CO_2-eq)

Table 94. Construction of the railway to Republic of Bulgaria

Mitigation action: ***Construction of the railway to the Republic of Bulgaria***

Main objective: ***Connecting the Republic of Macedonia with the Republic of Bulgaria and extending the export to external markets, not just in the neighboring countries but in the Southeast Europe and Turkey region, using the railway transport***

Description: ***Construction of the railway to Republic of Bulgaria***

Information	**Type**		Technical, policy
	Sector		Energy – Transport
	Relevant planning documents, legal and regulatory acts		► Work Program of the Government of the Republic of Macedonia ► National Transport Strategy
	Gases		CO_2, CH_4, N_2O
	Methodology		Construction of the railway. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		By 2035 up to 5% of the tonne kilometers (to the Republic of Bulgaria) will cross from heavy goods vehicles to the railroad transport
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	The railway is under construction
		Steps envisaged	Finishing the construction of the railway and putting it into operation
	Results achieved and estimated outcomes		Expected annual energy savings and increase of the tonnes km, correspondingly: ► 9.4 ktoe (110 GWh) and 371 tkm in 2025 ► 13.1 ktoe (152 GWh) and 532 tkm in 2030 ► 16.8 ktoe (196 GWh) and 692 tkm in 2035
	Estimated emission reductions		► 17 Gg CO_2-eq in 2025 ► 26 Gg CO_2-eq in 2030 ► 30 Gg CO_2-eq in 2035
	Timeframe		2017-2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,338.4 M€ Specific costs: ► 229 €/t CO_2-eq
	Implementing entity		► Government of the Republic of Macedonia ► Ministry of Transport and Communications ► Ministry of Economy, Energy Agency of the Republic of Macedonia
Progress indicators:			► Energy savings (ktoe/GWh) ► Increase of the tonnes km in the railway transport (tkm) ► Emissions reduction (Gg CO_2-eq)

*Table 95. Electrification of transport – electric passenger cars**

Mitigation action: ***Electrification of transport***

Main objective: ***Reduction of the local air pollution and meeting the target set in the Energy Efficiency Action Plan***

Description: ***This measure consists of successively organized and well-planned steps for faster renewal of the vehicle fleet, through introduction of electric vehicles***

Information	**Type**		Regulatory, policy, information
	Sector		Energy – Transport
	Relevant planning documents, legal and regulatory acts		Third Energy Efficiency Action Plan
	Gases		CO_2, CH_4, N_2O
	Methodology		Introducing a Regulation that will prohibit the purchase of cars with a standard lower than EURO6. Bottom-up modeling and least-cost optimization using the MARKAL model. IPCC Methodology.
	Assumptions		It is envisaged that: ► the share of electric vehicles and "plug-in" electric vehicles will be 10% by 2035 ► subsidies of 5000 € for purchasing an electric vehicle and 1000 € purchasing an"plug-in" electric vehicle will be introduced
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	► Chargers installed at specific locations in the City of Skopje
		Steps envisaged	► Development of studies for determining the best locations for installation of electric vehicles chargers from the aspect of the power grid. ► Successive implementation of EURO standards (EU new standard is a EURO 6, while in Macedonia is EURO 4) for import of new EE vehicles
	Results achieved and estimated outcomes		Expected annual energy savings: ► 5.6 ktoe (66 GWh) in 2025 ► 17.5 ktoe (204 GWh) in 2030 ► 21.8 ktoe (254 GWh) in 2035
	Estimated emission reductions		► 13.3 Gg CO_2-eq in 2025 ► 20.4 Gg CO_2-eq in 2030 ► 0 Gg CO_2-eq in 2035*
	Timeframe		2017-2035
	Costs (in 2030)		Costs for the Reference scenario: ► 1,332.4 M€ Costs for the Scenario with implemented measure: ► 1,334.0 M€ Specific costs: ► 76 €/t CO_2-eq
	Implementing entity		► Government of the Republic of Macedonia ► Ministry of Transport and Communications
Progress indicators:			► Energy savings (ktoe/GWh) ► Emissions reduction (Gg CO_2-eq)

*Although these vehicles are more efficient than fossil fuel vehicles, the emissions from this measure may increase, considering that the electricity in the power system is mainly produced from fossil fuels, therefore this measure should be implemented in parallel with the measures for electricity generation from RES.

AFOLU – Livestock

Table 96: Enteric Fermentation in dairy cows

Mitigation action: Enteric fermentation in dairy cows

Main objective: ***Decrease level of CH_4 emission from enteric fermentation in highly productive dairy cows***

Description: ***By modification of the feed composition and nutrition practice in dairy cows, the emission of CH_4 due to enteric fermentation can be reduced by 20%. It is foreseen that the number of dairy cows under intensive farming system will be increased form present 1% to 25% in 2035. Because of highly productive cows involved the CH_4 emission will also increase. But, with modification of feed content (adding carbohydrates, high quality forages and tannins) into TMR, the CH_4 emission will be decreased by 20%. The mitigation measure can be easily applied on dairy farms, by nutrition management. It is also cost effective; do not require additional subsidies or incentives. Practical training and demonstration for farmers will be sufficient***

Information	**Type**		Livestock, enteric fermentation in dairy cow
	Sector		AFLOU – Livestock
	Relevant planning documents, legal and regulatory acts		Law on nature protection (Environmental impact assessment). The IPARD Program contains the provisions
	Gases		CH_4
	Methodology		Feed composition and nutrition management in up to 25% of dairy cows. IPCC Methodology.
	Assumptions		► Increased number of highly productive dairy cows under intensive farming, ► Introduced modified TMR (Total Mixed Ration) and nutrition management
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	TMR with partly modified feed composition in already used on two intensive farms that account about 1% of the dairy cow population.
		Steps envisaged	► Development advisory package for TMR modified feed and nutrition management for the intensive dairy farms with more than 50 cows ► Incentives for dissemination of the advisory package to target farmers ► Monitoring of the effect of TMR modified feed and nutrition management, and further improvements
	Results achieved and estimated outcomes		25% from population of dairy cows have been applied TMR modified feed and nutrition management up to 2035.
	Estimated emission reductions		► 3 Gg CO_2-eq in 2025 ► 5.7 Gg CO_2-eq in 2030 ► 8.3 Gg CO_2-eq in 2035
	Timeframe		2017-2035
	Costs (in 2030)*		Costs for the Reference scenario: ► 0 M€ Costs for the Scenario with implemented measure: ► 0.01 M€ Specific costs: ► 1.8 €/t CO_2-eq
	Implementing entity		Ministry of Agriculture, Forestry and Water Economy
Progress indicators:			Farms (dairy cows as a percentage of the total population) used TMR modified feed and nutrition management on biannual base.

* Costs refer only to the investments

Table 97. Manure management in dairy cows

Mitigation action: Manure management in dairy cows

Main objective: ***Decrease level of NO_2 emission from manure management in highly productive dairy cows***

Description: ***By modification of the manure management in dairy cows, the emission of NO_2 can be reduced up to 30%. It is foreseen that the number of dairy cows under intensive farming system with more than 50 heads will be increased form present 1% to 25% in 2035. All those farms will need to apply improved manure management in order to reduce N loss, and N_xO emissions. Therefore, on farm manure management system needs to modify. The mitigation measure, consider on farm adaption on existing farms and moderate investments on newly established farms. It will require subsidies for adapting and incentives in farm design and construction***

Information	**Type**		Livestock, enteric fermentation in dairy cow
	Sector		AFLOU – Livestock
	Relevant planning documents, legal and regulatory acts		Law on nature protection (Environmental impact assessment). The IPARD Program contains the provisions
	Gases		N_2O
	Methodology		Modified manure management in up to 25% of dairy cows. IPCC Methodology.
	Assumptions		► Increased number of highly productive dairy cows under intensive farming, ► On farm modified manure management.
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	The process of modified manure management started on the existing large dairy farms, as a result of the implementation of the studies for environmental impact assessment (Permit A for alignment with the operational plan).
		Steps envisaged	► Adaption in manure management on intensive dairy farms with more than 50 cows, ► Design and construction of intensive dairy farms with more than 50 cows, ► Monitoring of the effect modified manure management in the intensive dairy farms with more than 50 cows.
	Results achieved and estimated outcomes		25% from population of dairy cows, belonging to intensive dairy farms with more than 50 cows have been applied modified manure management up to 2035.
	Estimated emission reductions		► 1.4 Gg CO_2-eq in 2025 ► 2.1 Gg CO_2-eq in 2030 ► 3.9 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)*		Costs for the Reference scenario: ► 0 M€ Costs for the Scenario with implemented measure: ► 0.05 M€ Specific costs: ► 25.1 €/t CO_2-eq
	Implementing entity		Ministry of Agriculture, Forestry and Water Economy
Progress indicators:			Farms (dairy cows as a percentage of the total population) used modified manure management on 2-5 years base.

*Costs refer only to the investments

Table 98. Manure management in swine farms

Mitigation action: Manure management in swine farms

Main objective: ***Decrease level of NO_2 emission from manure management in highly productive swine farms***

Description: ***By modification of the manure management in swine farms, the emission of NO_2 can be reduced up to 50%. It is foreseen that number of fatteners and number of fatteners per sow will increase, while the total number of sows will remain stable over period. Number of swine farms with more than 1,000 fatteners and/or 350 sows will also increase and they need to adapt improved manure management system, in order to reduce N loss. In 2035 is expected that 90% of fatteners will be produced on those farms, accounting for 75% of sow in the country. The mitigation measure, consider on farm adaption on existing farms and moderate investments on newly established farms. It will require subsidies for adapting and incentives in farm design and construction.***

Information	**Type**		Livestock, manure management in swine farms
	Sector		AFLOU – Livestock
	Relevant planning documents, legal and regulatory acts		Law on nature protection (Environmental impact assessment). The IPARD Program contains the provisions
	Gases		N_2O
	Methodology		Modified manure management in swine farms with more than 1,000 fatteners and/or 350 sows. IPCC Methodology.
	Assumptions		► Increased number of highly productive swine farms with more than 1,000 fatteners and/or 350 sows, ► On farm modified manure management.
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	The process of modified manure management started on the existing large swine farms, as a result of the implementation of the studies for environmental impact assessment (Permit A for alignment with the operational plan).
		Steps envisaged	► Adaption in manure management on intensive swine farms with more than 1,000 fatteners and/or 350 sows, ► Design and construction of intensive swine farms with more than 1000 fatteners and/or 350 sows, ► Monitoring of the effect modified manure management in the intensive swine farms with more than 1000 fatteners and/or 350 sows.
	Results achieved and estimated outcomes		Up to 2035, 90% of fatteners and 75% of sow will be kept on farms more than 1000 fatteners and/or 350 sows.
	Estimated emission reductions		► 0.3 Gg CO_2-eq in 2025 ► 0.4 Gg CO_2-eq in 2030 ► 0.4 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)*		Costs for the Reference scenario: ► 0 M€ Costs for the Scenario with implemented measure: ► 0.05 M€ Specific costs: ► 131.6 €/t CO_2-eq
	Implementing entity		Ministry of Agriculture, Forestry and Water Economy
Progress indicators:			Farms (fatteners and sows as a percentage of the total population) used modified manure management on 2-5 years base.

*Costs refer only to the investments

Table 99. Decreasing the number and damaged area by forest fires

Mitigation action: Decreasing the number and damaged area by forest fires

Main objective: ***Decreasing the damaged area by forest fires***

Description: ***Protection of the forest area by preventing the forest fires and the damages resulting from forest fires***

Information	**Type**		Regulatory, information
	Sector		AFOLU – Forestry
	Relevant planning documents, legal and regulatory acts		► Forestry Management Plans ► Forest information system (UKIM - Faculty of Forestry, MAFWE) ► Study on development of the forest road network in the Republic of Macedonia (UKIM - Faculty of Forestry, MAFWE)
	Gases		CO_2
	Methodology		Conducting information campaigns and implementing legal measures. IPCC Methodology.
	Assumptions		Reduce the area affected by forest fires averaging 1,000 ha/year
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	A communication system between PE "Macedonian Forests" and the Forest Police for timely information on the occurrence of fires established (built and equipped).
		Steps envisaged	► System control, upgrading the software and training staff for its operation ► Conducting promotional campaigns and procurement of fire-fighting equipment ► Activation of the centers for intensive capacity building, training of personnel and certification of products ► Providing permanent funding sources
	Results achieved and estimated outcomes		Decrease the damaged area by forest fires ► 11,000 ha in 2025 ► 16,000 ha in 2030 ► 21,000 ha in 2035
	Estimated increase of emissions absorption		► 1,154 Gg CO_2-eq in 2025 ► 1,189 Gg CO_2-eq in 2030 ► 1,223 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)*		Costs for the Reference scenario: ► 0 M€ Costs for the Scenario with implemented measure: ► 1 M€ Specific costs: ► 0.8 €/t CO_2-eq
	Implementing entity		► PE "Makedonski shumi" ► Ministry of Environment and Physical Planning ► Ministry of Agriculture, Forestry and Water Economy ► National parks ► Association of private forest owners
Progress indicators:			► Decrease of a damaged area by forest fires (ha/year) ► Increase of emissions absorption (Gg CO_2-eq)

*Costs refer only to the investments

Table 100. Change of quality of forests by afforestation of transitive forest land

Mitigation action: Change of quality of forests by afforestation of transitive forest land

Main objective: ***Improve the quality of the forests Change of quality of forests by afforestation of transitive forest land***

Description: ***Improve the quality of forests by afforestation of transitive forest land with higher quality tree species: coniferous, deciduous and mixed forests***

Information	**Type**		Regulatory, information
	Sector		AFOLU – Forestry
	Relevant planning documents, legal and regulatory acts		► Forestry Management Plans ► Forest information system (UKIM - Faculty of Forestry, MAFWE) ► Study on development of the forest road network in the Republic of Macedonia (UKIM - Faculty of Forestry, MAFWE)
	Gases		CO_2
	Methodology		Conducting information campaigns and implementing legal measures. IPCC Methodology.
	Assumptions		Change of the cat transitive forest land into coniferous, deciduous and mixed forests, 2,500 ha/year on the average. The share of coniferous, deciduous and mixed forests is based on their average shares in the last three years
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	Three breeding centers for production of forest seedlings developed and equipped
		Steps envisaged	► Activation of the centers for intensive capacity building, training of personnel and certification of products ► Providing permanent funding sources
	Results achieved and estimated outcomes		Increase of coniferous, deciduous and mixed forest area: ► 27,500 ha in 2025 ► 40,000 ha in 2030 ► 52,500 ha in 2035
	Estimated increase of emissions absorption		► 115 Gg CO_2-eq in 2025 ► 167 Gg CO_2-eq in 2030 ► 220 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)*		Costs for the Reference scenario: ► 0 M€ Costs for the Scenario with implemented measure: ► 2.5 M€ Specific costs: ► 14.9 €/t CO_2-eq
	Implementing entity		► PE "Makedonski shumi" ► Ministry of Environment and Physical Planning ► Ministry of Agriculture, Forestry and Water Economy ► National parks ► Association of private forest owners
	Progress indicators:		► Increase of coniferous, deciduous and mixed forest area (ha/year) ► Increase of emissions absorption (Gg CO_2-eq)

*Costs refer only to the investments

Table 101. Conversion of land use of field crops above 15% inclination

Mitigation action: ***Conversion of land use of field crops above 15% inclination***

Main objective: ***To reduce the intensity of soil erosion and loss of soil organic matter***

Description: ***Cultivation of land on inclined terrain causes intensive processes of soil erosion and mineralization of sol organic matter. This processes leads to intensive decomposition of soil organic matter and emission of soil carbon into atmosphere. Conversion of such areas into perennial grassland (pastures, meadows) will significantly decrease intensity of soil organic matter depletion and emission of soil carbon, and will lead to carbon sink. Areas above 15% inclination by law should not be cultivated and are not considered as agricultural land.***

Information	**Type**		Land management and land use change in the category of cropland
	Sector		AFOLU – Land
	Relevant planning documents, legal and regulatory acts		► Law on Agricultural Land ► Strategy for Agriculture and Rural Development ► Strategy for Consolidation of the Agricultural Land in the Republic of Macedonia ► National Action Plan for Combating Desertification in the Republic of Macedonia (draft version)
	Gases		CO_2
	Methodology		Land use change through conversion of almost 3000 ha of arable land that has been identified on inclined terrain above 15%, to grassland. IPCC Methodology.
	Assumptions		The conversion of land use, should: ► Stop the intensive process of erosion of the top soil layer which leads to loss of soil organic matter and its intensive ex-city mineralization, ► Stop on site mineralization of soil organic matter due to intensive processes of cultivation, ► Intensify carbon sink through accumulation of soil organic matter.
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	The effects of conversion of crop land to grass land has been monitored on two experimental fields in the past four years. Land Parcel Identification System has been established and will serve as a tool for control of the process of conversion.
		Steps envisaged	► Establishment of system for systematic control of land use and land use change on national level, ► Institutional support to primary producers with subsiding the process of conversion of crop fields into grassland, ► System for monitoring of influence of land use change on soil carbon sink.
	Results achieved and estimated outcomes		All 2,957 ha of field crops on inclined terrains above 15% slope, converted to grassland up to 2035.
	Estimated emission reductions		► 3.2 Gg CO_2-eq in 2025 ► 5.8 Gg CO_2-eq in 2030 ► 6.2 Gg CO_2-eq in 2035
	Timeframe		2017-2035
	Costs (in 2030)*		Costs for the Reference scenario: ► 0 M€ Costs for the Scenario with implemented measure: ► 0.08 M€ Specific costs: ► 13.7 €/t CO_2-eq
	Implementing entity		Ministry of Agriculture, Forestry and Water Economy
Progress indicators:			► Area converted on yearly base,

Mitigation action: ***Conversion of land use of field crops above 15% inclination***	
	► Percentage of soil organic matter increase and carbon sink per ha

*Costs refer only to the investments

Table 102. Contour cultivation of cropland on inclined terrains (5-15%)

Mitigation action: ***Contour cultivation of cropland on inclined terrains (5-15%)***		
Main objective: ***To reduce erosion of top soil and conservation of soil organic mater*** *Description:* ***Downslope cultivation of cropland usually causes intensive processes of soil erosion. Field experiments showed that the quantity of eroded sediment is multiply higher if compared to contour cultivation. This eroded sediment is reach with SOM which in such circumstances is rapidly mineralized, due to what significant quantity of soil carbon is released into atmosphere. Contour cultivation means that all agro-technical operations should be across the slope. This measure is easy to be implemented, since it does not requires any special technical capacities and know-how. In practice, farmers usually are not aware of its importance and influence of the overall soil fertility. With a systematic campaign for increasing the awareness of the farmers this measure can be widely adopted.***		
Information	**Type**	Land management and land use change in the category of cropland
	Sector	AFOLU – Land
	Relevant planning documents, legal and regulatory acts	► Law on Agricultural Land ► Strategy for Agriculture and Rural Development ► Strategy for Consolidation of the Agricultural Land in the Republic of Macedonia ► National Action Plan for Combating Desertification in the Republic of Macedonia (draft version)
	Gases	CO_2
	Methodology	Land cultivation system change from downslope to contour cultivation on 14,000 ha of arable land on inclined terrains (>5%). IPCC Methodology.
	Assumptions	Main assumptions of implementing contour cultivation are: ► Decreasing of soil erosion processes of the top soil layer and SOM loss with contour ploughing of inclined cropland, ► Increasing of soil carbon with preservation of SOM in the top soil layer,
Progress of implementation	**Steps taken or envisaged to achieve the action** – **Steps taken**	► Contour cultivation tested in practice of two experimental sites, ► Contour cultivation promoted among farmers within several national and international Projects
	Steps envisaged	► Incorporation of contour cultivation as a agro-ecological measure into strategic documents, ► Promotion of contour cultivation among farmers, ► Institutional support to primary producers with subsiding the process of adoption of the system of contour cultivation, ► System for monitoring of influence of land use change on soil carbon sink.
	Results achieved and estimated outcomes	Implementing of contour cultivation on 14,000 ha of cropland on inclined terrains up to 2035.
	Estimated emission reductions	► 19.1 Gg CO_2-eq in 2025 ► 28 Gg CO_2-eq in 2030 ► 37 Gg CO_2-eq in 2035
	Timeframe	2017 – 2035
	Costs (in 2030)*	Costs for the Reference scenario: ► 0 M€ Costs for the Scenario with implemented measure:

Mitigation action: ***Contour cultivation of cropland on inclined terrains (5-15%)***		
		▶ 0.05 M€ Specific costs: ▶ 1.9 €/t CO_2-eq
	Implementing entity	Ministry of Agriculture, Forestry and Water Economy
Progress indicators:		▶ Area in ha with contour cultivation, ▶ Percentage of soil organic matter increase and carbon sink per ha ▶ Quantity of reduced soil sediment loss in t/ha

*Costs refer only to the investments

Table 103. Perennial grass in orchard and vineyards on inclined terrains (>5%)

Mitigation action: Perennial grass in orchard and vineyards on inclined terrains (>5%)			
Main objective: ***Reducing of soil erosion and increasing of SOM in vineyards and orchards on inclined terrains (5-15% slope)*** *Description:* ***In vineyards and orchard on locations where rows are oriented downslope, as a result of intensive classical system of cultivation, a intensive processes of soil erosion and depletion of SOM occurs, which lead to intensive emissions of soil carbon. Simple change of cultivation system with establishment of perennial grass, can significantly mitigate the process of SOm loss and emissions of soil carbon. The measure is easy to be implemented with low initial cost.***			
Information	**Type**		Land management and land use change in the category of cropland
	Sector		AFOLU – Land
	Relevant planning documents, legal and regulatory acts		▶ Law on Agricultural Land ▶ Strategy for Agriculture and Rural Development ▶ Strategy for Consolidation of the Agricultural Land in the Republic of Macedonia ▶ National Action Plan for Combating Desertification in the Republic of Macedonia (draft version)
	Gases		CO_2
	Methodology		Establishing of perennial grass between rows in vineyards and orchards for replacement of classical type of land cultivation system, on a inclined terrains (5-15%). IPCC Methodology.
	Assumptions		Main assumptions of implementing the measure of establishing perennial grass in vineyards and orchards on inclined terrains are: ▶ Decreasing of soil erosion processes of the top soil layer and SOM loss when classical type of cultivation system with deep plowing is replaced with perennial grass and no-tillage system, ▶ Increasing of soil carbon with accumulation of SOM in the top soil layer due to mulching of moved biomass and accumulation of biomaterial in the root zone of the perennial grass.
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	▶ Perennial grass in vineyards and orchards as a cover crop tested in practice in two regions, ▶ Perennial grass in vineyards and orchards as a agro-ecological measure promoted among farmers within several national and international Projects
		Steps envisaged	▶ To foresee cover crops in perennial plantations (vineyards and orchards) as a agro-ecological measure into strategic documents, ▶ To promote the effects of cover crops among vine and fruit growers, ▶ Institutional support to primary producers with subsiding the process of implementing the measure ▶ System for monitoring of influence of land use change on soil carbon sink,
	Results achieved and estimated outcomes		Implementing of grass land as cover crop on 10,630 ha of vineyards and 1,250 ha of orchards up to 2035

Mitigation action: Perennial grass in orchard and vineyards on inclined terrains (>5%)

	Estimated emission reductions	▶ 4.5 Gg CO_2-eq in 2025 ▶ 8.5 Gg CO_2-eq in 2030 ▶ 12.2 Gg CO_2-eq in 2035
	Timeframe	2017 – 2035
	Costs (in 2030)*	Costs for the Reference scenario: ▶ 0 M€ Costs for the Scenario with implemented measure: ▶ 0.05 M€ Specific costs: ▶ 6.2 €/t CO_2-eq
	Implementing entity	Ministry of Agriculture, Forestry and Water Economy
Progress indicators:		▶ Area in ha of vineyards and orchards under perennial grass, ▶ Percentage of soil organic matter increase and carbon sink per ha ▶ Quantity of reduced soil sediment loss in t/ha

*Costs refer only to the investments

Waste – Solid Waste Disposal

Table 104. Closure of existing landfills

Mitigation action: ***Closure of existing landfills***

Main objective: ***Environmental protection and meeting the highest European standards***

Description: ***Rehabilitation of the existing landfills and illegal ("wild") dumpsites with very high, high and medium risk in each of the five waste management regions. This rehabilitation includes covering on the existing non-compliant landfills, supplemented by gas extraction and flaring.***

Information	**Type**		Technical
	Sector		Waste – Solid waste disposal
	Relevant planning documents, legal and regulatory acts		▶ National Waste Management Plan ▶ Strategy for Waste Management in the Republic of Macedonia ▶ Regional Waste Management Plans (Northeast, Southeast, Pelagonia, Polog and Skopje region) – final and draft versions
	Gases		CO_2, CH_4
	Methodology		Covering on the existing non-compliant landfills, supplemented by gas extraction and flaring, which will convert the CH_4 emissions into CO_2 emissions. Modelling using the custom-made software tool in excel, performing calculations based on the IPCC Methodology.
	Assumptions		Closing of the landfills by waste management regions in the following order: ▶ Skopje – 2020 ▶ East and Northeast – 2020 ▶ Polog – 2022 ▶ Southeast – 2024 ▶ Pelagonia and Southeast – 2024
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	▶ Regional waste management plans developed ▶ EU funds provided for construction of a regional landfill for the East and Northeast planning region provided, construction of six transfer stations and closing of all non-compliant landfills.
		Steps envisaged	▶ Obtaining funds for the other regions ▶ Starting the construction of the new regional landfill for the East and Northeast planning region
	Results achieved and estimated outcomes		Expected annual burned emissions of CH_4: ▶ 17.2 kt CH_4 in 2025 ▶ 15.1 kt CH_4 in 2025 ▶ 13 kt CH_4 in 2025
	Estimated emission reductions		▶ 316 Gg CO_2-eq in 2025 ▶ 275 Gg CO_2-eq in 2030 ▶ 237 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)		Costs for the Reference scenario: ▶ 0 M€ Costs for the Scenario with implemented measure: ▶ 0.60 M€ Specific costs: ▶ 2 €/t CO_2-eq
	Implementing entity		▶ Ministry of Environment and Physical Planning ▶ Public municipal enterprises for waste management ▶ State Environmental Inspectorate ▶ Inter-Municipal Waste Management Board ▶ Authorized Inspectors of Environment (Municipalities)
Progress indicators:			▶ Burned emissions of CH_4 (kt) ▶ Emissions reduction (Gg CO_2-eq)

Table 105. Mechanical and biological treatment (MBT) in new landfills with composting

Mitigation action: ***Mechanical and biological treatment (MBT) in new landfills with composting***

Main objective: ***Environmental protection and meeting the highest European standards***

Description: ***Opening of new regional landfills in all waste management regions with installed system for mechanical and biological treatment and composting.***

Information	**Type**		Technical
	Sector		Waste – Solid waste disposal
	Relevant planning documents, legal and regulatory acts		► National Waste Management Plan ► Strategy for Waste Management in the Republic of Macedonia ► Regional Waste Management Plans (Northeast, Southeast, Pelagonia, Polog and Skopje region) – final and draft versions
	Gases		CO_2, CH_4
	Methodology		Opening of new regional landfills in all planning regions with installed system for mechanical and biological treatment and composting. Modelling using the custom-made software tool in excel, performing calculations based on the IPCC Methodology.
	Assumptions		Opening of the regional landfills in the following order: ► Skopje – 2020 ► East and Northeast – 2020 ► Polog – 2022 ► Southeast – 2024 ► Pelagonia and Southeast – 2024
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	► Regional waste management plans developed ► EU funds provided for construction of a regional landfill for the East and Northeast planning region provided, construction of six transfer stations and closing of all non-compliant landfills.
		Steps envisaged	► Obtaining funds for the other regions ► Starting the construction of the new regional landfill for the East and Northeast planning region
	Results achieved and estimated outcomes		Amount of compost: ► 80 kt in 2025 ► 82 kt in 2030 ► 83,5 kt in 2035
	Estimated emission reductions		► 5 Gg CO_2-eq in 2025 ► 52 Gg CO_2-eq in 2030 ► 89 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 0 M€ Costs for the Scenario with implemented measure: ► 2.8 M€* Specific costs: ► 54 €/t CO_2-eq
	Implementing entity		► Ministry of Environment and Physical Planning ► Public municipal enterprises for waste management ► State Environmental Inspectorate ► Inter-Municipal Waste Management Board ► Authorized Inspectors of Environment (Municipalities)
Progress indicators:			► Amount of compost (kt) ► Emissions reduction (Gg CO_2-eq)

*The costs include the profit from the sale of compost

Table 106. Sorting waste paper

Mitigation action: ***Sorting waste paper***

Main objective: ***Environmental protection and meeting the highest European standards***

Description: ***Installation of containers for collection of selected waste, mainly paper***

Information	**Type**		Technical
	Sector		Waste – Solid waste disposal
	Relevant planning documents, legal and regulatory acts		► National Waste Management Plan ► Strategy for Waste Management in the Republic of Macedonia ► Regional Waste Management Plans (Northeast, Southeast, Pelagonia, Polog and Skopje region) – final and draft versions
	Gases		CO_2, CH_4
	Methodology		Installation of containers for collection of selected waste. Modelling using the custom-made software tool in excel, performing calculations based on the IPCC Methodology.
	Assumptions		Gradual reduction of the paper share in the total amount of waste from 22% to 12% by 2035.
Progress of implementation	**Steps taken or envisaged to achieve the action**	**Steps taken**	► Regional waste management plans developed ► Containers for waste selection installed in several cities in Macedonia, mostly in Skopje. ► Private companies – digitalization of information (bills) realized
		Steps envisaged	► Installation of containers for waste selection in all cities in Macedonia. ► Promoting the reduction of paper consumption and dematerialization of the information using ICT (Information and Communication Technologies)
	Results achieved and estimated outcomes		Expected annual amount of paper waste: ► 110 kt in 2025 ► 93 kt in 2030 ► 76 kt in 2035
	Estimated emission reductions		► 5 Gg CO_2-eq in 2025 ► 19 Gg CO_2-eq in 2030 ► 38 Gg CO_2-eq in 2035
	Timeframe		2017 – 2035
	Costs (in 2030)		Costs for the Reference scenario: ► 0 M€ Costs for the Scenario with implemented measure: ► 0.14 M€ Specific costs: ► 7 €/t CO_2-eq
	Implementing entity		► Ministry of Environment and Physical Planning ► Public municipal enterprises for waste management ► State Environmental Inspectorate ► Inter-Municipal Waste Management Board ► Authorized Inspectors of Environment (Municipalities)
Progress indicators:			► Amount of paper waste (kt) ► Emissions reduction (Gg CO_2-eq)

Annex 7: Pipeline of IPA-Funded Activities

The table below provides information on projects identified as needing support in the energy, transport and environmental sector that are planned for financing under new EU/IPA programming for the period 2014-2020.

Financial support needs in terms of EU/IPA Planned projects in the programming period 2014-2020[1]

Activity/project	Status (ongoing/ planned/ completed)	Overall support needed (a) (in million EUR)	Support received (b) (in mil. EUR)	Additional support needed (c) (in mil. EUR)
Law and Strategy on Climate Change	planned	1.5		
Construction of WWTP for Skopje and supervision activities	planned	120		
Construction of the selected infrastructure facilities, closure of the noncompliance landfills/dumpsites and supply of equipment for handling and transferring of waste in the East and Northeast regions.	planned	24		
Construction of waste management facilities in Pelagonia Region and supervision activities	planned	20		
Construction of waste management facilities in Southwest Region and supervision activities	planned	20		
Construction of waste management facilities in Polog Region and supervision activities	planned	20		
Construction of waste management facilities in Vardar Region and supervision activities	planned	20		
Construction of WWTP and upgrading and extension of the sewage network in Debar and supervision activities	planned	9.5		
Construction of WWTP and upgrading and extension of the sewage network in Gostivar and supervision activities	planned	23.5		
Construction of WWTP and upgrading and extension of the sewage network in Kavadarci and supervision activities	planned	12.5		
Construction of waste management facilities in Southeast Region and supervision activities	planned	20		
Construction of WWTP and upgrading and extension of the sewage network in Stip and supervision activities	planned	9.5		
Construction of WWTP and upgrading and extension of the sewage network in Veles and supervision activities	planned	16.5		
Clean-up Activities for Alpha-HCH, Beta- HCH and Lindane Contaminated Sites at OHIS	planned	35		

[1] Source: http://cfcd.finance.gov.mk/?page_id=852 , http://www.sep.gov.mk/

Activity/project	Status (ongoing/ planned/ completed)	Overall support needed (a) (in million EUR)	Support received (b) (in mil. EUR)	Additional support needed (c) (in mil. EUR)
Excavation and on or off site remediation of the chromium dumpsite in Jegunovce	planned	12.7		
Excavation and off site remediation of the lead, zinc and cadmium dumpsite in Veles	planned	23.6		
Sanation and recultivation of the lead and zinc dumpsite in Probishtip.	planned	4.2		
Excavation and slag recycling of the dumpsite in Zelezara, Skopje	planned	8		
Development of new natural friendly forms for accommodation in national parks Mavrovo, Pelister and Galicica	planned	5.05		
Construction of bio-corridors of roads and railways in R. Macedonia	planned	2.5		
Construction of wastewater treatment plants in towns with a population of 2.000 to 15.000 inhabitants (Centar Zupa)	planned	6		
Construction of wastewater treatment plants in towns with a population of 2.000 to 15.000 inhabitants (Demir Kapija)	planned	6		
Construction of wastewater treatment plants in towns with a population more than 15.000 inhabitants (Lipkovo)	planned	2		
Construction of wastewater treatment plants in towns with a population more than 15.000 inhabitants (Tearce,)	planned	2		
Construction of wastewater treatment plants in towns with a population more than 15.000 inhabitants (Negotino)	planned	2		
Construction of Wastewater Treatment Plants for Settlements with Population over 2,000 in the Strumica River Basin District – Novo Selo	planned	2		
Construction of Wastewater Treatment Plants for Settlements with Population over 2,000 in the Strumica River Basin District – Vasilevo	planned	2		
Construction of Wastewater Treatment Plants for Settlements with Population over 2,000 in the Strumica River Basin District- Bosilovo	planned	2		
Interconnection (South West of Macedonia) Bitola(Macedonia) – Elbasan (Albania), the Republic of Macedonia's part and 400/110Kv SS Ohrid	planned	63.7		

Activity/project	Status (ongoing/ planned/ completed)	Overall support needed (a) (in million EUR)	Support received (b) (in mil. EUR)	Additional support needed (c) (in mil. EUR)
Main gas pipeline section 3 branch Stip-Hamzali Main gas pipeline section 4 Hamzali-Stojakovo (border with Greece) , Main gas pipeline section 13 Hamzali – Novo Selo (border with Republic of Bulgaria)	planned	71		
Central Heating In Bitola, Novaci, And Mogila – Stage I	planned	47		
Main gas pipeline section 1 Klechovce–Negotino, part Stip-Negotino	planned	17		
Main gas pipeline section 5 Skopje- Tetovo-Gostivar-Kichevo	planned	50		
Hydro Power Plant Boskov Most (Boskov Most, Tresonce village, near city of Debar)	planned	143.9		
Hydropower Plant Cebren	planned	338.4		
Wind Park Bogdanci - 2nd phase	planned	21		
Main gas pipeline section 2 Negotino- Bitola	planned	40		
Main gas pipelines: - Branch to Tetovo - branch to TEC Negotino - branch to Kavadarci	planned	10		
Main gas pipeline sections II phase: Sveti Nikole-Veles - Branch to Gevgelija - Branch to DemirKapija - Matka – Gracani - Vrshakovo-Kocani-Razlovci - Branch to TEC Oslomej - Branch to Probistip - Klechovce-Sopot - Kicevo-Ohrid - Ohrid-Struga-Kafasan	planned	80		
Lukovo Pole and intake of Korab waters (NP Mavrovo, Rostuse, Gostivar)	planned	83.7		
Hydro Power Plant Galiste (Crna River)	planned	200		
Hydro Power Plant Spilje II	planned	21.1		
Modernization of Thermal power plant Oslomej (Oslomej, Kicevo)	planned	125.4		
400/110 kV substation Kumanovo	planned	15		
Modernization and rehabilitation of REK Bitola phase III – reduction of SOx and dust, expanded to include the impact of all harmful emissions	planned	80		
110 kV in-out connection to 110 kV OHTL HPP Vrutok – SS Skopje 1	planned	1.87		
Revitalization/reconstruction of 110 kV transmission lines	planned	5.82		

Activity/project	Status (ongoing/ planned/ completed)	Overall support needed (a) (in million EUR)	Support received (b) (in mil. EUR)	Additional support needed (c) (in mil. EUR)
400 kV interconnection Skopje 5 - New Kosovo	planned	6		
TenovoKozjak Hydro Power Project (Channel from Tenovo to Kozjak Storage)	planned	6		
Combined cycle gas power plant Energetika (Skopje, adjacent to ELEM's existing plant Energetika)	planned	120		
Hydro Power System Vardarska Dolina (Vardar river valley)	planned	1,062		
Hydro Power Plant Globocica II	planned	30		
TESLA gas pipeline system	planned	415		
Construction of the Beljakovce-border rail section with Bulgaria	planned	470		
Construction of road section Gostivar- Kicevo	planned	280		
Construction of road section Drenovo - Interchange Gradsko	planned	35		
Construction works of the railway section Kicevo – Border with Albania	planned	470		
Construction of road section Skopje - Kosovo border	planned	70		
Rehabilitation of road section Negotino - DemirKapija	planned	9		
Rehabilitation of road section Prilep - Raec Bridge	planned	4.78		
Rehabilitation of road section Gevgelija - Greece border (Bogorodica)	planned	1.15		
Rehabilitation of road section Medzitlija (Greece Border) - Interchange Krklino	planned	1.94		
Rehabilitation of road Interchange Krklino - Prilep	planned	2.85		
Reconstruction of road section from Katlanovo to Petrovec	planned	NA		
Rehabilitation of road section Gradsko - Negotino	planned	4.4		
Rehabilitation of road section Veles - Gradsko	planned	4.59		
Rehabilitation of road section Miladinovci - Skopje	planned	5.49		
Rehabilitation of road section Tetovo - Gostivar	planned	5.59		
Rehabilitation of road section Kumanovo -Rankovce	planned	9		
Rehabilitation of road section Skopje - Tetovo	planned	9.93		
Construction and supply of ITS on Coridor X	planned	20		

Activity/project	Status (ongoing/ planned/ completed)	Overall support needed (a) (in million EUR)	Support received (b) (in mil. EUR)	Additional support needed (c) (in mil. EUR)
Rehabilitation of Local roads with an amount of 0.5-1 MEUR for each local road	planned	1		
Construction of Regional roads with an amount up to 10MEUR for each project	planned	10		
Construction of railway section along the corridor X Dracevo – Veles	planned	550		
Reconstruction of road section from Kriva Palanka to Deve Bair	planned	NA		
Construction of road section Trebeniste - Struga	planned	45		
Construction of road section Struga - Kjafasan	planned	80		
Revitalization of existing HPPs	2012-2015	70		
Construction of LHPPs, Chebren and Galiste	2012-2019	519		
Construction LHPPs Boskov Most	2012-2016	70		
Construction of LHPPs Lukovo Pole with HPP Crn Kamen	2010-2014	45		
Construction of LHPP Gradec	2014-2021	156		
Construction of SHPPs (100 MW)	/	200		
Geothermal energy	/	60		
WPPs (230 W)	/	230		
Photovoltaic system (20MW)	/	80		
Solar System for hot water (80000 households)	/	60		
TPP-HP using waste biomass and TPP using biogas (20MW)	/	30		
Revitalization of the equipment in the TPP Bitola, TPP Oslomej and TPP Negotino	2010-2012 2014-2017 2010-2012	260		
Revitalization of the existing HPP	2012-2015	67		
CHP using natural gas	2010-2014	250		
TPP Bitola 4, TPP Mariovo and TPP Negotino, lignite fired	2014-2018 2020-2024	1,120		
Development of the transmission grid	Planned	109.3		
Activities in the heating infrastructure	/	56.3		
Gasification	/	240		

Annex 8: Overview of Climate Change Projects

Table 107: Overview of the climate related projects in the period 2014 – 2017

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
EUREMPlus: Boost energy efficiency in manufacturing SMEs by extending European Energy Manager Training and Network	European EnergyManager training program comprising courses, self-learning and practical work, combined with access to the European alumni network for continued knowledge exchange.	31.10.2015	EU	64,212	64,212	0
Initiative to Enchance Public Dialogue on Sustainable Use of Energy	To create the ground and conditions for effective use of energy at local level through increased understanding and cooperation among local government units, business community, public and other relevant stakeholders.	15.06.2015	IPA-CBC	249,070	249,070	0
Triggering the market uptake of energy performance contracting trough street lighting refurbishment projects	Creates demand and supply for EPC projects in 9 regions by providing regional EPC facilitation services. These services deliver information and specific support to municipalities and (potential) ESCOs. The project partners aim to implement 36 EPC street lighting projects in the project's lifetime.	01.04.2017	EU	93,962	93,962	0

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Construction of new motorway section Demir Kapija - Smokvica, as a part of the Pan European Corridor X	The construction works of a new motorway section from Demir Kapija to Smokvica as part of the Pan-European Corridor X. Beside the earth works on cuts and embankments the works incude construction of two double tube tunnels above 1km. length, six bridges, two interchanges, five overpasses and seven underpasses.	07/27/2012-22/08/2018 (Works)	EU	252,177,813	59,376,726	192,801,087
Construction of Waste Water Treatment Plant (WWTP) and rehabilitation and extension of priority sewerage network in Municipality of Radovish LOT 1	Design and construction of Waste Water Treatment Plant for 25,000 PE, rehabilitation and extension of the priority sewerage network of 4.7 km, and supply and installation of one (1) pumping station in the Municipality of Radovish under the FIDIC 1999 Yellow Book Conditions of Contract.	04/28/2016-20/10/2018	EU	7,232,696	6,147,791	1,084,904
Construction of Waste Water Treatment Plant in Kichevo - LOT 2	The contract shall cover the design and construction of waste water treatment plant for 32 000 p.e. and construction of the main collector with 4 km length in the municipality of Kichevo under the FIDIC 1999 'Yellow Book' conditions of contract.	24.02.2016	EU	8,309,900	7,063,415	1,246,485

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Construction of Waste Water Treatment Plant in Prilep	Design and construction of municipal Waste Water Treatment Plant (WWTP) meeting the requirements of Annex I of the Urban Waste Water Treatment Directive (91/271/EEC) for 95.000 People Equivalent, in accordance with FIDIC conditions of contract (Yellow Book). The works include design, civil works, mechanical works, electrical works, access road and bridge, training of staff and commissioning.	05/08/2014-22/06/2017	EU	11,601,329	9,466,684	2,134,644
Construction of Waste Water Treatment Plant in Strumica - LOT 3	The contract shall cover the design and construction of waste water treatment plant in Strumica for 53 419 p.e. and extension of the existing main collector by 375 m under the FIDIC 1999 'Yellow Book' conditions of contract,	24.02.2016	EU	8,293,052	7,049,094	1,243,958
Construction of wastewater treatment plant and rehabilitation and extension of the priority sewerage network in the Municipality of Radovish - LOT 1	The contract shall cover the design and construction of waste water treatment plant for 25 000 p.e., rehabilitation and extension of the priority sewerage network of 4,7 km and supply and installation of 1 pumping station in the municipality of Radovish under the FIDIC 1999 'Yellow Book' conditions of contract,	12.02.2016	EU	7,232,696	6,147,791	1,084,904

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Construction works for renewal with reconstruction of the railway section Bitola-Kremenica, as part of XD of Corridor X	Reconstruction of the non-electrified single –track railway section Bitola-Kremenica of a length of app. 17 km, as part of Xd of Corridor X in accordance with FIDIC1999 conditions of contract ('Red Book'). The contractor shall ensure that the construction work is in accordance with all the requirements in the detailed design, technical standard for quality and quantities, work progress, implementation of the environmental criteria during the reconstruction and defect liability period.	19.12.2014 - 30.01.2018	EU	22,795,134	19,375,864	3,419,270
District Heating Bitola	Construction of district heating system in Bitola Production of hot water from the existing thermal power plant REK Bitola). Construction of transport and main hot water pipeline, construction of hot water station and district heating network.	2016 - 2020	KfW	55,800,000	46,800,000	9,000,000

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Green Future for our kids	The projects operational objectives are thermal and hydro insulation of the kindergarten in Rusinovo vilage, municipality of Berovo; switch to eco pellets as a source of heating at the kindergarten and use of solar energy; switch to gas as a source of heating at the Gianni Rodari kindergrten; joint development of an education programme for children and their parents for building responsible and active attitude to the renewable energy sources and to the preservation of natural resources.	14.05.2014 - 14.05.2016	EU	595,800	595,800	0
Municipal Climate Change Strategies Project	Strengthen civil society and raise awareness, boost activism, and bolster local resilience to global climate change.	26.09.2012-17.02.2016	USAID	3,518,681	3,300,000	218,681
National and Regional Road Rehabilitation	To enhance the connectivity of selected national and regional roads, primarily to Corridors X and VIII, and to improve Public Enterprise for State Roads' capacity for road safety and climate resilience.	01.11.2016 - 9.30.2019	World Bank	70,980,000	70,980,000	

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Reconstruction and upgrading of the motorway section Smokvica-Gevgelija, as part of Corridor X	Reconstruction and upgrading of app. 10.1 km of the motorway section from Smokvica to Gevgelija (app. 6.7 from on the left and 3.4 km on the right carriageway side). Works will include activities related to reconstruction and widening of the road in those sub-sections where it wasn't built previously. The widening of the carriageway will be done in the grass strip between the two carriageways. The scope of the planned works also includes marking of the pavement and installation of traffic signs.	07/28/2015-7/11/2016 (+12 months DNL up to 7/11/2017)	EU	4,984,681	4,236,979	747,702
Reduction of the CO2 emission in the Municipal Primary School "Goce Delchev" in Bosilovo by replacing fossil fuel with biomass	Replace the two oil boilers with boilers which operate on pellet as an energy source in order to generate heat	01/01/2017 31/12/2017	GEF	28,750	9,540	19,210
Refurbishmet of the Public Building Stock Towards nZEB	Public building stock state-of-the-art assessment: country specific evaluation of the energy consumptions and CO2 emissions; reference building definition; a common framework for the definition of nZEB concept for public buildings.	01.03.2014 - 31.08.2016	EU	121,382	121,382	0
Rehabilitation of the motorway section Veles-Katlanovo, as part of Corridor X	Rehabilitation of the motorway section Veles-Katlanovo, as part of Corridor X	26.06.2014	EU	6,809,079	5,787,718	1,021,362

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Supply of appropriate equipment to exchange and manage information and monitoring for water, waste, air management, nature and climate change (Lot 2 - Vehicles)	Supply, delivery, unloading, installation, putting into operation, testing and training of equipment to exchange and manage information and monitoring for water, waste, air management and nature for the Ministry of Environment and Physical Planning and National Hydro-meteorological Service - LOT 2	11/11/2016-03/10/2018	EU	47,040	35,280	11,760
Supply of appropriate equipment to exchange and manage information and monitoring for water, waste, air management, nature and climate change (Lot 4 - Air Quality Management)	Supply, delivery, unloading, installation, putting into operation, testing and training of equipment to exchange and manage information and monitoring for water, waste, air management and nature for the Ministry of Environment and Physical Planning and National Hydro-meteorological Service - LOT 4 - Air quality management	01/10/2017-05/10/2018	EU	297,675	223,256	74,419
Waste water Treatment Plant Gevgelija	Construction of the Waste Water Treatment Plant for Gevgelija, with financial contribution of Switzerland (Euro 6'800'000), Greece (Euro 1'860'000) and Macedonia (Euro 500'000)	2010 - 2017	Switzerland	8,160,000	8,160,000	0

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Wastewater Treatment Plant in Kocani	Through construction of a WWTP and a main collector for wastewater, the project will contribute to the sustainable development of the Kocani region and protection of the natural resources. The project will also strengthen the capacities of the Public Utility through application of the SECOs' Policy Paper on Corporate Development of Public Utilities.	2014 - 2019	Switzerland	22,909,091	22,909,091	0
Catalyzing market transformation for industrial energy efficiency and accelerate investments in best available practices and technologies in the Former Yugoslav Republic of Macedonia	The project contributes to accelerating the transformation of the Macedonian market for industrial energy efficiency towards the increased use of, and demand for, best available practices and technologies such as energy management systems in line with ISO 50001, and a greater offer in terms of related consultancy services. During the project lifetime, annual GHG emissions reductions of 133,000 tonnes of CO2eq are anticipated.	31.12.2014 - 31.01.2019	GEF	560,042	560,042	0
Clean Energy Investment Project	Support the Government of Macedonia's efforts to increase investment in energy generation from renewable sources, and reduce Macedonia's total final energy consumption and greenhouse gas emissions.	15.04.2015 - 31.07.2017	USAID	2,300,000	2,300,000	

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Conversion from HCFC – 141b in HFCs in the Manufacture of polyurethane foam for the commercial refrigeration units, sandwich panels and insulated doors		31.12.2016	UNIDO	136,955	136,955	
Development of the National Water Study	Support the development of the National Water Study, which is considered as a framework to complete planning system for implementation of national and EU water supply and waste water collection and treatment relevant requirements.	02/22/2016-08/22/2017	EU	2,100,000	1,785,000	315,000
Wind Park Bogdanci		7.2015	KfW	66,600,000	57,480,000	9,120,000
From Trash to Cash: Sustainable Development and Economic Empowerment of Informal Waste Collectors trough Waste Recycling in the Cross – Border Region of Albania and Macedonia	The project aim is to contribute to the Sustainable Development and Economic Empowerment of Informal Waste Collectors trough Waste Recycling in the Cross – Border Region of Albania and Macedonia.	11.11.2013 - 30.04.2015	EU	227,598	227,598	0

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Further strengthening of the capacities for effective implementation of the acquis in the field air quality	To improve air quality by supporting the implementation of the air quality related legislation including Directive 2008/50/EC on ambient air quality and cleaner air for Europe and Directive 2004/107/EC relating to arsenic, cadmium, mercury, nickel and polycyclic hydrocarbons in ambient air.	03/30/2015-01/01/2017	EU	1,320,000	1,254,000	66,000
HCFC phase-out management plan		31.12.2020	UNIDO	82,000	82,000	
Improvement of the Solid Waste Management Services in the Polog Region, Phase 1 (in a process of approval)	The first phase of the project will support preparation of local and regional waste management plans, preparation of designs and tender documents for short term measures and setting up the organisational and financial scheme for regional solid waste management services. The overall objective of the project (phase 1 and 2) is to contribute to the protection of human health and environment, as well as to the responsible utilisation of natural resources in the Polog region.	2017 - 2019	Switzerland	2,181,818	2,181,818	0

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Improving of the energy efficiency of Municipality of Mavrovo and Rostushe	To create conditions for reducing climate change in the rural municipalities of Polog – Municipality of Mavrovo and Rostushe through improved energy efficiency in street lighting, awareness raising and capacity building of stakeholders involved in issues related to energy efficiency.	01/01/2017 31/12/2017	GEF	49,440	24,720	24,720
Increased rural economic development in cross border region by empowering agriculture through using waste straw for energy production/ STRAWPOWER	Increasing rural economic development in the cross border region, through the use of waste straw for energy production. Installation and operation of pilot heating installations powered on straw pellets, will show that using agricultural waste (straw) for production of (carbon neutral) fuel is economically (and environmentally) justified and can generate significant extra incomes for farms.	06/30/2015-03/31/2017	EU	167,220	142,137	25,083
Industrial Management Project	The envisaged activities will improve Macedonia's competitiveness and energy security and reduce greenhouse gas emissions via greater clean energy investments, primarily through the introduction of a systematic energy management approach in the industrial sector	13.01.2013 - 13.01.2016	United States of America	1,298,812	1,298,812	

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Macedonia's First Biennial Update Report	This First Biennial Update Report (FBUR) on Climate Change (CC) consolidates sectoral analyses on Greenhouse Gas (GHG) emissions and provides transparency for Macedonia's progress with mitigation actions and their effects.	28.02.2015	GEF	427,461	321,461	106,000
Macedonia's Second Biennial Update Report	This First Biennial Update Report (FBUR) on Climate Change (CC) consolidates sectoral analyses on Greenhouse Gas (GHG) emissions and provides transparency for Macedonia's progress with mitigation actions and their effects.	2017 - 2017	GEF	425,900	352,000	73,900
MultiEE (Facilitating multi-level governance for Energy Efficiency) Horizon 2020	To improve the consistency and quality of energy efficiency policy planning and implementation on different administrative levels in the beneficiary countries.	06.07.2017	EU	124,584	124,584	

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Preparation of necessary documentation for upgrading the WWTP in Vranishta, extension of the collector system for Ohrid Lake and separation of the foal and storm priority water network in the Cities of Ohrid and Struga	The specific objective of this assignment is preparation of necessary documentation for upgrading the WWTP in Vranishta, extension of the collector system for Ohrid Lake and separation of the foul and storm priority water network in the Cities of Ohrid and Struga. This assignment comprises preparation of Feasibility Study, Cost-Benefit Analysis (CBA), design documentation and Volume 3, Volume 4 and Volume 5 of the tender dossier (TD) for the works contract for upgrading the WWTP in Vranishta, extension of the collector system for Ohrid Lake and separation of the foul and storm priority water network in the Cities of Ohrid and Struga.	12.11.2014	EU	341,484	290,261	51,223
Preparation of necessary documents for establishing of an Integrated and Financially Self-sustainable Waste Management System in Pelagonia, Southwest, Vardar and Skopje Regions	The project purpose is to support the establishment of an integrated regional waste management system in Pelagonia, Southwest, Vardar and Skopje Regions.	12/22/2015-12/22/2017	EU	4,296,000	3,651,600	644,400

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Preparation of project documentation for Improvement of the Wastewater Collection and Treatment Infrastructure on the Municipality of Kichevo	The objective of the contract is to improve municipal wastewater infrastructure in comilance with the Directive 91/271/EEC throught preparation of project documentation for the wastewater collection and treatment infrastructure in the Municipality of Kicevo.	10.07.2014	EU	336,456	285,988	50,468
Preparation of project documentation for imrpovement of the Wastewater collection and treatment infrastructure in the Municiplity of Radovish	The objective of the contract is to improve municipal wastewater infrastructure in comilance with the Directive 91/271/EEC throught preparation of project documentation for the wastewater collection and treatment infrastructure in the Municipality of Radovish.	30.05.2014	EU	298,728	253,919	44,809
Preparation of project studies, design and tender documentation for establishing of an integrated and financially self-sustainable waste management system in East and Northeast Region	To contribute, via the development of integrated and financially self-sustainable waste management systems in selected regions of the country, to the sustainable and continuous improvement of the quality of the natural environment of the regions and of the country, in order to reach EU standards, especially in relation to public health and environmental protection.	12/17/2015-04/20/2017	EU	1,170,000	994,500	175,500

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Preparation of regional waste management plans and strategic environmental assessments for east and north-east regions	The project purpose is to support the planning process for an integrated regional waste management system through preparation of Regional Waste Management Plans and Strategic Environmental Assessment (SEA) in East and North- East Region.	05.04.2013	EU	1,368,000	1,162,800	205,200
Preparation of studies (FS, EIA, CBA), design documentation and tender dossiers for wastewater collection and treatment investment projects in Municipalities of Veles and Shtip	This assignment comprises preparation of Feasibility Studies (FSs), Environmental Impact Assessments (EIAs), Cost-Benefit Analysis (CBAs), Sludge Management Plan, Design Documentation on a level of Detailed Designs (DDs) and Outline Designs (ODs), as well as preparation of Volume 3, Volume 4 and Volume 5 of the Tender Dossiers for construction of wastewater collection and treatment infrastructure.	11/18/2016-05/29/2016	EU	1,799,880	1,529,898	269,982
Preparation of studies (FS,EIA,CBA) design documentation and tender dossiers for wastewater collection and treatment investment project in the Municipality of Strumica, Bitola and Tetovo	To assist the Ministry of Environment and Physical Planning in preparation of wastewater collection and treatment investment projects in the municipalities of Strumica, Bitola and Tetovo.	07/22/2014-03/22/2017	EU	3,843,600	3,267,060	576,540

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Preparation of technical and tendering documentation for closure of noncompliant landfills/dumpsites for the East and Northeast region	The specific objective of this assignment is preparation of technical and tendering documentation for closure, rehabilitation and after care of municipal non-compliant landfills and dumpsites in East and North-East Regions.	25.12.2014	EU	323,272	274,781	48,491
Preparation of technical and tendering documentation for closure of noncompliant landfills/dumpsites for the East and Northeast region	To further contribute towards achieving an integrated and financially self-sustainable waste management system in East and Northeast Regions. The purpose of the project is preparation of technical and tendering documentation for closure, rehabilitation and after care of municipal non-compliant landfills and dumpsites in East and North-East Regions.	12/29/2014-04/30/2016	EU	323,272	274,781	48,491
Preparation of technical specifications for supply of equipment for waste collection and transferring of waste for East and Northeast region	The purpose of this assignment is preparation of technical specifications and related supporting documents for supply of equipment for waste collection and transferring of waste in East and Northeast Regions.	26.12.2014	EU	219,415	186,503	32,912

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Preparation of technical specifications for supply of equipment for waste collection and transferring of waste for East and Northeast region	Achievement of an integrated and financially self-sustainable waste management system in East and Northeast Regions. The purpose of the project is Preparation of technical specifications and related supporting documents for supply of equipment for waste collection and transferring of waste in East and Northeast Regions	12/29/2014-04/30/2016	EU	219,415	186,503	32,912
Preparation of Terms of reference (ToR) for the Service Contract for TA for reform in the system for water supply, collection and treatment at local level	The specific objective of the project is providing of technical assistance for preparation of Terms of Reference for the Service Contract for reform in the system for water supply, collection and treatment at local level in the City of Skopje and in the Municipalities of Strumica, Bitola, Tetovo, Gostivar, Kavadarci and Debar.	20.02.2013	EU	67,589	57,450	10,138
Programme for Energy Efficiency and Renewable Energies Phase II		31.12.2014	EBRD (European Bank for Reconstruction and Development)	2,880,000	2,880,000	
Promotion of energy efficiency in buildings and protection of the environment		13.08.2013 - 13.02.2015	EU	261,887	261,887	

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Protection of the environment through the promotion of biomass for substitution of fossil fuels in heating and power generation / Biofoss	Protection of environment and its resources, promotion of the conformity with the European Union and the national energy targets for 2020 and contribution towards the global effort to confront the climate change.	07/14/2015-12/28/2016	EU	162,616	138,223	24,392
Public Institutions - Energy Efficiency (Kriva Palanka)	This project is part of the Programme for Cross-Border Cooperation between the Republic of Macedonia and the Republic of Bulgaria.	22.04.2014 - 21.02.2015	EU	170,789	145,170	25,618
Reform in the system for water supply, collection and treatment at local level	To support the reform in the existing system, concerning organizational, managerial, financial and operational aspects at local level (City of Skopje and in the Municipalities of Tetovo, Gostivar, Bitola, Kavadarci, Strumitsa, Debar, Radovish, Kichevo, Berovo and Kumanovo) in order to enable an effective and efficient management of the water supply, collection and waste-water treatment. A total of 1 million citizens will be impacted by the results of the project.	12/22/2015-12/21/2017	EU	2,220,000	1,887,000	333,000

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Refurbishment of the Public Building Stock	The main objectives of the RePublic_ZEB project are: to support the South-Eastern European countries in capacity building and rising EE (Energy Efficiency) awareness of the nearly Zero-Energy Buildings (nZEB) policy	31.08.2016	EU	121,382	84,968	36,415
Soil degradation assessment and rehabilitation strategies for sustainable land use planning / TERRA MED	Developing a master plan with an aim to create a healthy and sustainable environment, to address degradation of soil ecosystems and the pollution of the soils due to human mismanagement.	10/16/2015-01/15/2017	EU	203,850	173,273	30,578
Strenghtening capacities for implementation of the environmental legislation at local level	The overall objective of the project is to contribute to improved environmental protection, monitoring and implementation of the national environmental legislation in the country, at both central and local level	2014 - 2015	EU	1,560,000	1,500,000	60,000
Strengthening the administrative capacities for implementation of Waste Framework Directive (WFD) and Special Waste Streams Directives (WEEED, WBAD and WPD)	To strengthen the administrative capacity and undertake measures for implementation of Waste Framework Directive (WFD) and Special Waste Streams Directives (WEEED, WBAD and PPWD) through further development of implementation of the legislation and provision of trainings.	10/01/2016-10/31/2018	EU	1,212,631	1,152,000	60,631

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Strengthening the administrative capacities on central and local level for transposition and implementing new Industrial Emissions Directive	To increase the effectiveness of the country´s preparation for EU accession and to ensure efficiency of the EU programme in the country. Project purpose: To strengthen administrative capacities of the Ministry of Environment and Physical Planning/Administration of Environment and Local-self Government Units, for transposition and implementation of new Industrial Emissions Directive 2010/75/EU (IED).	10/01/2015-01/01/2017	EU	1,080,000	1,026,000	54,000
Support in identification, assessment and selection of eligible projects for IPA Regional Development Component - part Environment	The specific objective is to provide assistance to develop the capacities of the Ministry of Environment and Physical Planning for developing sound and sustainable pipeline of investment projects, and to apply this capacity in the waste water collection and treatment and waste management area.	09.12.2010	EU	125,741	106,880	18,861
Sustainable energy thematic network of cross-border local authorities / ENERGYNET	Overall objectives: A) Thematic networking of local authorities on the topic of Sustainable Energy. B) Introduction in the participating five municipalities of the sustainable energy planning.	05/13/2015-12/26/2016	EU	321,222	272,631	48,591

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Technical assistance for strengthening the institutional capacities for approximation and implementation of environment legislation in the area of water management.		01.2014-20.12.2015	EU	2,040,000	2,040,000	
Technical assistance for supporting the Operating Structure of Ministry of Environment and Physical Planning in implementation of the OPRD 2007-2013 - LOT6	Provision of technical assistance (expert help) to the IPA structure staff within the MoEPP to review and assess the quality of the draft technical and tendering projects' documentation - Project Studies (Feasibility Studies, Cost Benefit Analysis, and Environmental Impact Assessments), Design Documentation and Tender Dossiers to be prepared by the on-going projects under Measure 3.1 and Measure 3.2 from the OPRD 2007-2013.	04/20/2015-11/06/2016	EU	334,592	284,404	50,189
Themis Network		12.01.2015 - 11.08.2016	Austrian Development Cooperation	1,200,000	1,200,000	
Towards the future - Study on the potential and utilization of renewable energy sources in the cross border region		18.06.2015	IPA-CBC	176,884	150,351	26,533

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Skills Development and Innovation Support Project	The objective of the project is to improve transparency of resource allocation and promote accountability in higher education, enhance the relevance of secondary technical vocational education, and support innovation capacity in the country.	2017	World Bank/IBRD	24,000,000	24,000,000	
Improving energy management at Macedonian Industry	Main aim is reducing energy consumption and improving energy and environmental performances in small and medium enterprises from food processing industry in Macedonia.	2013-2014	Norwegian Embassy in Belgrade	41,597	41,597	0
Promotion of waste management and energy efficiency practices in the Cross -border region	The project aims to promote waste management and energy efficiency practices in small and medium enterprises (SMEs) in the cross border region, in order to reduce the negative impacts of their economic activities.	2014-2015	IPA-CBC	51,411	7,712	43,699

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Reducing CO2 and financial saving through replacement of fossil fuel with renewable energy source in kindergarten in Pehchevo	Rebuilding the boiler room and warehouse for storing pellets as well as purchase and installation of boiler system that runs on pellets wood biomass and its connection to the existing central heating system in the kindergarten 7 Septemvri, Pehchevo, Training for the members of Eco Committee and kindergarten teachers through organized theoretical and practical lectures for energy efficiency and use of renewable energy sources sun and biomass.	2014-2015	GEF	48,543	20,000	28,543
Reduction of the CO2 emission in the Municipal Primary School "Goce Delchev" in Bosilovo by replacing fossil fuel with biomass	To replace the two oil boilers with boilers which operate on pellet as an energy source in order to generate heat. Apart from the reduction of the pollution caused by the greenhouse gases, financial resources will also be saved, which can afterwards be used by the school or the local self-government in Bosilovo for similar initiatives or problems.	2017	GEF	28,750	9,540	19,210

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
CO2 reduction as a result of the replacement of the street lighting	This project offers new technology for the generation and storage of low-carbon energy, supplying of economical street lamps that through their use reduces greenhouse gases, generate new revenue through energy savings and dramatically reduces maintenance costs.	2017-2018	GEF	26,540	10,300	16,240
Promoting the protection of plant diversity, energy efficiency and education in the Botanical Garden at the Faculty Natural Sciences and Mathematics	Financial assistance for the reconstruction of at least one of the glasshouses in the Botanic Garden, hence providing suitable conditions for the plants' development.	2017-2017	GEF	49,866	24,785	25,081
Stronger CSO for a participatory transposition and implementation of the EU 2020 climate and energy package	To build capacities of CSOs on the implementation and use of the EU 2020 climate and energy package, EIA and SEA procedures; to establish cooperation between CSOs and decision makers involved in the adoption of the EU 2020 climate and energy package; to ensure democratic preparation and adoption of the strategies/plans/programs and projects regarding EU 2020 climate and energy package, with civil sector ownership and interest for full implementation.	2016-2017	EU	336,600	336,600	0

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Strengthen-ing administra-tive capacities for energy sector at Ministry of Economy and Energy Agency	To improve the regulatory framework for competitive, transparent and non-discriminatory energy markets, and as part of it several bylaws in the field of electricity and natural gas, that is to say, the supply rules for electricity and natural gas for a supplier of last resort, the market rules for natural gas, the network rules for transmission and distribution of electricity and natural gas, and the rules for monitoring of the operations of energy markets and more are being drafted and reviewed	2013-2015	EU	2,013,600	1,812,240	201,360
Build Up Skills	The Build Up Skills project in Macedonia, FYR defines the path that needs to be followed in the next seven years for the upgrade of skills and qualifications of the building workers in the practical application of EE and RES measures as the national energy targets for 2020 could be met.	07.06.2012 - 07.02.2014	EU	214,864	214,864	0
Build Up Skills BEET - Builders' Energy Efficiency Training	The BUILD UP Skills BEET project aimed at introducing voluntary qualification schemes as well as 5 different training programmes to build up the energy efficiency skills of building sector workers. The project focused on the 5 following occupational fields: 1) building envelope, 2) glassing, 3) roofing, 4) energy infrastructures/electrical	18.07.2014 – 18.03.2016	EU	490,831	490,831	0

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
	installations and 5) HVAC systems.					
Strengthening the technical higher education for climate change and renewable energy sources in Macedonia and Kosovo		2016	German Cooperation	33,600	33,600	0
Education and employment opportunities for young people in times of climate change and energy transition		2015	German Cooperation	16,632	16,632	0
Inspiring youth to engage in building a democratic, environmentally friendly and climate resilient society		2016	France	4,200	4,200	0
Youth on bikes		2015	Government of Republic of Macedonia	6,000	0	6,000
Reducing youth carbon footprint 2		2015-2016	France	15,600	15,600	0

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Reducing youth carbon footprint		2015	France	12,286	12,286	0
Citizen initiative for education climate change and energy efficiency education		2017	EU	9,846	9,846	0
Youth Exchange: Wake Up - Take Action		2016	Norwegian National Agency Aktiv Ungdom	27,168	27,168	0
Open regional fund for souteast europe-Energy Efficiency	The regional networks supported by the Open Regional Fund – Energy Efficiency (ORF-EE) independently share their experiences of implementing energy efficiency measures and address issues of common interest. In so doing, they contribute towards the more effective implementation of energy efficiency policies in their respective countries.	2008-2017	German Cooperation	240,000	240,000	
REACH-Reducing energy consumption with changing habits		01.03.2014 - 01.03.2017	EU Community Programmes	134,519	134,519	

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Improving energy efficiency for the low-income housing sector in Macedonia	To increase the standard of living in collective housing units in Macedonia through demonstration projects on energy efficiency improvements that significantly decrease energy consumption and operating cost.	April 2011 - April 2014	USAID	1,500,000	1,500,000	
Stabilizing GHG Emissions from Road Transport through doubling of Global Vehicle Fuel Economy	To support the development of national fuel economy policies in 20 countries, 6 countries through GEF-5 STAR Allocations and 14 without GEF funding, using existing tools developed with GEF-4 support (examples are the fuel economy baseline calculation methodology and online GFEI toolkit). In addition, to support coordination of the 20 country projects at the regional level to ensure that results are disseminated to other countries within the region. This will result in reduced vehicle fleet CO2 emissions in these 20 countries inline with the Global Fuel Economy Initiative's target of a 50% improvement of the overall global fleet fuel economy by 2050.	May 2015 - June 2018	GEF	212,000	132,000	80,000
Support to the Energy Regulatory Commission for the Introduction of the EU Legislation on Efficient		December 2011 - December 2014	Kingdom of Norway	1,380,000	1,140,000	240,000

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Energy Market in the Republic of Macedonia						
Resilient Skopje		2014 - 2015	UNDP	63,253	37,567	25,686
Bioenergy villages (BioVill) - Increasing the market uptake of sustainable Bioenergy	The objective of the BioVill project is to transfer and adapt experiences gained in countries where bioenergy villages already exists (Germany and Austria) to countries with less examples in this sector (Slovenia, Serbia, Croatia, Macedonia and Romania). The project fosters the development of the bioenergy sector in selected target countries by strengthening the role of locally produced biomass as a main contributor for energy supply on local level, considering opportunities of market uptake or expansion for local farmers, wood producers or SMEs.	March 2016-March 2019	EU	2,388,000	2,388,000	0
Integrated Internet based information system for energy management (DTK Smart-tek DOO)		15.12.2016-14.12.2017	Fund for innovations and technology development (FITD) and company's own funding	42,312	0	42,312

Project	Description	Dates	Donor	Budget USD	Donors Contribution USD	National Contribution USD
Termo-liquid isolation (Metalotehnika DOO)		01.02.2016-20.02.2017	Fund for innovations and technology development (FITD) and company's own funding	102,857	0	102,857
Modular lightening arrester		22.06.2015-21.06.2016	Fund for innovations and technology development (FITD) and company's own funding	40,452	0	40,452
Waste water treatment for aerobic granulates-Granulis		01.03.2016-30.11.2017	Fund for innovations and technology development (FITD) and company's own funding	171,264	0	171,264
Production line for purified waste glass granulate		01.02.2016-31.07.2017	Fund for innovations and technology development (FITD) and company's own funding	180,226	0	180,226
			0	632,865,393	404,843,499	228,021,894

Table 108. Description of support for the preparation of the BUR

Reporting period:		**2014 – 2017**							
Funding source		*Description of support, including the national contribution, in million USD*							
		Preparation of BUR				*Climate change activities contained in the BUR*			
		Finan-cial	*Capacity - Building (Capacity Building + Technical support)*	*Technology support*	*Technology transfer*	*Financial*	*Capacity-Building(Capacity Building + Technical support)*	*Technology support*	*Technology transfer*
Multilateral sources									
1	**EU**					0.717	4.017		
2	**IPA CBC**						0.399		
3	**EU Community Programmes**						0.135		
4	**GEF**		0.673			0.049	0.717		
5	**UNDP**						0.038		
Subtotal		0.673				6.071			
Total		**6.745**							

Annex 9: Climate Change Research Activities in Macedonia

Table 109: Macedonian research related to climate change mitigation and MRV (2012-2017)

Publication	Sector	Scope
Pavlina Zdraveva, Teodora Obradovic Grncarovska, Natasa Markovska, Elena Gavrilova, Emilija Poposka, Igor Ristovski, (2014): "Building a sustainable greenhouse gases inventory system in Macedonia", Management of Environmental Quality: An International Journal, Vol. 25 Issue: 3, pp.313-323, https://doi.org/10.1108/MEQ-11-2013-0131	MRV	Climate policy
P. Zdraveva, T. Obradovikj Grncharovska*, N. Markovska, E. Gavrilova, E. Poposka, I. Ristovski: Building a sustainable greenhouse gases inventory system in Macedonia. Management of Environmental Quality, An international Journal, Volume 25, Number 3, 2014	MRV	Climate policy
Grncarovska Obradovic Teodora, Markovska Natasa: Mainstreaming climate change mitigation into national sectoral policies, Policy Paper FYR of Macedonia. LOCSEE (Low Carbon South East Europe), November 2014	Mitigation	Climate policy
Gjoshevski Ivan: Decarbonising the Macedonian Economy Evaluating Consistency and Coherence of Climate and Energy Policies. Thesis for the fulfilment of the Master of Science in Environmental Management and Policy. The International Institute for Industrial Environmental Economics. Lund, Sweden, September 2016.	Mitigation	Climate policy
Atanas Kochov, Sara Srebrenkoska: CALCULATION OF CARBON FOOTPRINTING FOR PERSONS, HOUSEHOLDS AND ORGANISATIONS. International Conference "Green development, infrastructure, technology (GREDIT) 2016", 30 March – 02 April, 2016 Skopje, Macedonia.	Mitigation	Cross cutting
Dominik Rutz[1], Rainer Janssen[1], JuanManuel Ugalde[1], Morten Hofmeister[2], Per Alex Soerensen[2], Linn Laurberg Jensen[2], Christian Doczekal[3], Richard Zweiler[3], Tomislav Puksec[4], Neven Duic[4], Borna Doracic[4], Rok Sunko[5], Blaž Sunko[5], Natasa Markovska[6], Meri Karanfilovska[6], Nikola Rajkovic[7], Ilija Batas Bjelic[7], Anes Kazagic[8], Alma Ademovic-Tahirovic[8], Izet Smajevic[8], Slobodan Jerotic[9], Bojana Mladenović[9], Emir Fejzovic[10], Amra Babić[10], Milada Mataradzija[10], Mitja Kolbl[11], Tomi Zrinski[11]: SMALL, MODULAR AND RENEWABLE DISTRICT HEATING & COOLING GRIDS FOR COMMUNITIES IN SOUTH-EASTERN EUROPE, IN EUBCE 2016 - 24TH EUROPEAN BIOMASS CONFERENCE AND EXHIBITION 2016: AMSTERDAM.	Mitigation	Energy
Aleksandar Dedinec, Borko Jovanovski, Andrej Gajduk, Natasa Markovska, Ljupco Kocarev: Analysis of renewable energy sources and electric vehicle penetration into energy systems predominantly based on lignite. DOI: 10.1140/epjst/e2015-50099-y, February 2016.	Mitigation	Energy

Publication	Sector	Scope
Aleksandar Dedinec [a]*, Verica Taseska-Gjorgievska [a], Natasa Markovska [a], Teodora Obradovic Grncarovska b, Neven Duic c, Jordan Pop-Jordanov [a], Gligor Kanevce [a], Gary Goldstein [b], Steve Pye [b], Rubin Taleski [c]: Low emissions development pathways of the Macedonian energy sector. Elsevier, Renewable and Sustainable Energy Reviews, Volume 53, January 2016, Pages 1202-1211.	Mitigation	Energy
Aleksandar Dedinec [a]*, Verica Taseska-Gjorgievska [a], Natasa Markovska [a], Teodora Obradovic Grncarovska [b], Neven Duic [c], Jordan Pop-Jordanov [a], Rubin Taleski [d]: Towards post-2020 climate change regime: Analyses of various mitigation scenarios and contributions for Macedonia. Elsevier EnergyVolume 94, 1 January 2016, Pages 124-137.	Mitigation	Energy
Aleksandar Dedinec, Aleksandra Dedinec, Natasa Markovska: OPTIMIZATION OF HEAT SAVING IN BUILDINGS USING UNSTEADY HEAT TRANSFER MODEL. THERMAL SCIENCE, volume 19, issue 3, (2015)	Mitigation	Energy
Antonio Jovanovski[1] , Dame Dimitrovski[2]: USE OF NATURAL GAS AS CONTRIBUTION TO THE REDUCTION OF POLLUTION AND INCREASING ENERGY EFFICIENCY. International Conference "Green development, infrastructure, technology (GREDIT) 2016", 30 March – 02 April, 2016 Skopje, Macedonia.	Mitigation	Energy
Biljana Petrevska[1] , Vlatko Čingoski[2]: CAN MACEDONIAN HOTELS BE GREEN: THE EVIDENCE OF HOTEL "FLAMINGO" – GEVGELIJA, MACEDONIA. International Conference "Green development, infrastructure, technology (GREDIT) 2016", 30 March – 02 April, 2016 Skopje, Macedonia.	Mitigation	Energy
Done Tashevski, Igor Shesho, Dame Dimitrovski: BINARY CO-GENERATION POWER PLANT WITH SOFC – ENVIRONMENTAL ASPECTS. International Conference "Green development, infrastructure, technology (GREDIT) 2016", 30 March – 02 April, 2016 Skopje, Macedonia.	Mitigation	Energy
Martina Dimoska, Nikolco Gošev, Anita Grozdanov, Mirko Todorovski: SMART SOLES, SHOE SOLES THAT PRODUCE ELECTRICITY. International Conference "Green development, infrastructure, technology (GREDIT) 2016", 30 March – 02 April, 2016 Skopje, Macedonia.	Mitigation	Energy
Lazarevska A. M., Mladenovska D., 2016: "Multi-criteria assessment of natural gas supply options – The Macedonian case", International Journal of Contemporary Energy, Vol. 2, No. 1, pp 54-62 (2016) (DOI: 10.14621/ce.20160107)	Mitigation	Energy
Mladenovska D., Lazarevska A. M., 2016: "The impact of socio-economic indicators in assessing natural gas supply alternatives - Macedonian case", in Budzianowski W. M. (Ed.), Conf. Proc. – Book of Abstracts, Renewable Energy Sources - Research and Business (RESRB) 2016, June 22-24, 2016, Wrocław, Poland, pp. 67-68, (ID. RESRB2016.0027)	Mitigation	Energy

Publication	Sector	Scope
Lazarevska A. M., Filkoski R., Mladenovska D., Tanchevski G., Gjurchinoski Z., Grozdanov A., Nacevski G., Gechevski G., Chebotareva Zh., Trajkovski Lj., Petrovska A., Matteini M., 2016: "What are the feasible impacts towards a more Energy Efficient and Low Carbon industry via implementing Energy Management Systems?", Proc. International Conference & Workshop REMOO-2016: "Science and Engineering for Reliable Energy", 18-20 May 2016, Budva, Montenegro, ID.1.51.	Mitigation	Energy
Mladenovska, D., Lazarevska A. M., 2015: "Decision making concept for creating policies related to natural gas supply chain in Macedonia", Proc. 10th Conference on Sustainable Development of Energy, Water and Environment Systems, 2015, Dubrovnik, Croatia (electronic CD version)	Mitigation	Energy
Lazarevska A. M., Kochov A., 2015: "To what extent can lighting refurbishment contribute to environmental protection via sound energy management?", Proc. V Regional Conference "Industrial Energy and Environmental Protection (IEEP) in South Eastern Europe (SEE)", Zlatibor, Serbia, June 24–27, 2015 (electronic CD version)	Mitigation	Energy
Lazarevska, A. M., Mladenovska, D., 2015: "What is the potential for introducing low carbon technologies via diversification of the natural gas supply in the R. Macedonia?", invited lecture for the JRC Support to Low Carbon Society, JRC Conference, 9 Sep, 2015, University Ss Cyril and Methodius, Skopje	Mitigation	Energy
D. MLADENOVSKA[a] *, A. M. LAZAREVSKA[b] , M. KOCHUBOVSKI[c]: ASSESSING ALTERNATIVES FOR NATURAL GAS SUPPLY IN MACEDONIA VERSUS ENVIRONMENTAL INDICATORS. Journal of Environmental Protection and Ecology 18, No 2, 632–640 (2017).	Mitigation	Energy
Gligor Kanevče, Aleksandar Dedinec, Aleksandra Dedinec: OPTIMAL USAGE OF BIOMASS FOR ENERGY PURPOSES TOWARD SUSTAINABLE DEVELOPMENT - A CASE OF MACEDONIA. THERMAL SCIENCE, volume 20, issue 11, (2016).	Mitigation	Energy
V. Strezov: System Approach to Sustainable Biofuel Production. 1st South East European Conference on Sustainable Development of Energy, Water and Environment Systems, 29 June - 3 July, 2014, Ohrid, Macedonia.	Mitigation	Energy
Aleksandra Dedinec[1] , Igor Tomovski[2] , Ljupčo Kocarev[1]: OPTIMIZATION MODEL FOR VARIABLE RENEWABLE ENERGY SOURCES GENERATION: MACEDONIAN CASE STUDY. Contemporary Materials (Renewable energy sources), VI–2 (2015). pp. 204 – 212.	Mitigation	Energy
Markovska, Natasa; Dedinec, Aleksandar; Taseska-Gjorgievska, Verica; Obradovic Grncarovska, Teodora; Duić, Neven; Pop-Jordanov, Jordan; Kanevce, Gligor: Towards post-2020 climate change regime: Comparative assessment of various scenarios and contributions. 1st South East European Conference on Sustainable Development of	Mitigation	Energy

Publication	Sector	Scope
Energy, Water and Environment Systems, 29 June - 3 July, 2014, Ohrid, Macedonia.		
Markovska, Natasa; Taseska-Gjorgievska, Verica; Dedinec, Aleksandar; Obradovic Grncarovska, Teodora; Duić, Neven; Pop-Jordanov, Jordan; Kanevce, Gligor: EU 2030 climate targets - a perspective of an EU candidate country. 1st South East European Conference on Sustainable Development of Energy, Water and Environment Systems, 29 June - 3 July, 2014, Ohrid, Macedonia.	Mitigation	Energy
Suzana ZIKOVSKA, Slave ARMENSKI ENERGY AND ENVIRONMENTAL EFFECTS OF APPLICATION OF COMBINED COGENERATION NATURAL GAS FOR HEATING OF BITOLA. INTERNATIONAL SYMPOSIUM "ENERGETICS 2016", 6-8 October 2016, Ohrid, Macedonia.	Mitigation	Energy
Dusko Villarov, Shpresa Durguti: THERMO PP - HEAT, EXPANDING CONSUMPTION, ENERGY EFFICIENCY NIGHT WITH ACCUMULATOR OF HEAT. INTERNATIONAL SYMPOSIUM "ENERGETICS 2016", 6-8 October 2016, Ohrid, Macedonia.	Mitigation	Energy
Konstantin Dimitrov, Sashe Panevski, Jasminka Dimitrova Kapac, Ognen Dimitrov: DE-CARBONIZATION OF THE ELECTRICITY SECTOR, UTOPIA OR CHALLENGE FOR MACEDONIA?. INTERNATIONAL SYMPOSIUM "ENERGETICS 2016", 6-8 October 2016, Ohrid, Macedonia.	Mitigation	Energy
Mirko STOJANOVSKI, Caterina BUKRSHLIEVA, Darinka MITEVA: STATIONS FOR COMPRESSED NATURAL GAS (CNG) IN MACEDONIA. INTERNATIONAL SYMPOSIUM "ENERGETICS 2016", 6-8 October 2016, Ohrid, Macedonia.	Mitigation	Energy
N. Bakreska Kormushoska[1] , A. Kochov[2] , G. Cvetkoski[1]: IMPLEMENTATION OF RECP IN CEMENT INDUSTRY – USJE CEMENT PLANT CASE STUDY. International Conference "Green development, infrastructure, technology (GREDIT) 2016", 30 March – 02 April, 2016 Skopje, Macedonia.	Mitigation	IPPU
Maja Peceva, Tashko Rizov, Atanas Kochov: CHEMICAL LEASING AS A NEW BUSINESS MODEL CONTRIBUTING TO SUSTAINABLE INDUSTRIAL DEVELOPMENT. International Conference "Green development, infrastructure, technology (GREDIT) 2016", 30 March – 02 April, 2016 Skopje, Macedonia.	Mitigation	IPPU
Lazarevska A. M., Bakreska Kormushoska N., Kochov A., 2015: "Complementarity and Overlapping among Energy Performance Indicators as part of the Sustainable Development and RECP Indicators in Cement Industry", International Journal of Contemporary Energy, Vol. 1, No. 1, pp 20-26 (2015) (DOI: 10.14621/ce.20150203)	Mitigation	IPPU

Publication	Sector	Scope
D. DIMITROVSKI, V. DJINLEV, M. M. DIMITROVSKI, Z. SAPURIC: Determining Hot Carbon Monoxide (CO) Emissions from Passenger Vehicles as a Parameter for Multisectoral Decision Making Process. Journal of Environmental Protection and Ecology, Vol. 16, No. 4 (2015).	Mitigation	Transport
Mile Dimitrovski: AIR POLUTION FROM TRANSPORT IN URBAN AREAS – CASE STUDY SKOPJE. International Conference "Green development, infrastructure, technology (GREDIT) 2016", 30 March – 02 April, 2016 Skopje, Macedonia.	Mitigation	Transport
Dario Gechevski, Radmil Polenakovik, Valentina Gecevska: INFLUENCE OF REVERSE LOGISTICS AND GREEN LOGISTICS AS PART OF SUPPLY CHAIN TO ENVIRONMENTAL SUSTAINABILITY. International Conference "Green development, infrastructure, technology (GREDIT) 2016", 30 March – 02 April, 2016 Skopje, Macedonia.	Mitigation	Transport
Atanas Kochov[1] , Kjosevski Stevan[1] , Marina Malish Sazdovsk[a2] , Latif Latifi[3]: CHALLENGES OF INTRODUCING ELECTRIC VEHICLES IN REPUBLIC OF MACEDONIA. International Conference "Green development, infrastructure, technology (GREDIT) 2016", 30 March – 02 April, 2016 Skopje, Macedonia.	Mitigation	Transport
Aleksandar Dedinec [a],* Natasa Markovska [a], Igor Ristovski [b], Gjogi Velevski [c], Verica Taseska Gjorgjievska [a], Teodora Obradovic Grncarovska [b], Pavlina Zdraveva [c]: Economic and environmental evaluation of climate change mitigation measures in the waste sector of developing countries. Journal of Cleaner Production 88 (2015) 234-241.	Mitigation	Waste
Dedinec, Aleksandar, Markovska, Natasa, Ristovski, Igor, Velevski, Gjogi, Gjorgjievska, Verica Taseska, Grncarovska, Teodora Obradovic, Zdraveva, Pavlina Economic and environmental evaluation of climate change mitigation measures in the waste sector of developing countries. Elsevier, Journal of cleaner production 2015 v.88 pp. 234-241.	Mitigation	Waste
Z. SAPURIC, D. DIMITROVSKI, M. DIMITROVSKI, M. KOCHUBOVSKI: European Union Regulations and Standards of Waste Management and Its Implementation in FYR Macedonia. Journal of Environmental Protection and Ecology, Vol. 16, No.2 (2015).	Mitigation	Waste
Zoran Sapuric, Filip Ivanovski: Opportunities for the improvement of waste management in landfill 'Drisla' in Skopje. 6th INTERNATIONAL CONFERENCE "Protection of Natural Resources and Environmental Management: The main Tools for Sustainability"(PRONASEM), 10-11 November, Bucharest, Romania	Mitigation	Waste
F. Ivanovski[1] , Z. Šapurić[1] , D. Dimitrovski[2]: RELATIONS BETWEEN WASTE INFRASTRUCTURE AND PACKAGING WASTE RECYCLING: A CASE STUDY OF CITY OF SKOPJE. International Conference "Green development, infrastructure, technology (GREDIT) 2016", 30 March – 02 April, 2016 Skopje, Macedonia.	Mitigation	Waste

Publication	Sector	Scope
Vesna Miloshevska, Borka Kovacevikj, Bojan Muratovski: UTILIZING OF LANDFILL GAS AS ENERGY SOURCE. International Conference "Green development, infrastructure, technology (GREDIT) 2016", 30 March – 02 April, 2016 Skopje, Macedonia.	Mitigation	Waste
Gj. Sherovska: MUNICIPAL WASTE MANAGEMENT IN SKOPJE: OPPORTUITIES AND PERSPECTIVES. International Conference "Green development, infrastructure, technology (GREDIT) 2016", 30 March – 02 April, 2016 Skopje, Macedonia.	Mitigation	Waste
Vladimir Arsov[1] , Marko Dimitrovski[2] , Vančo Donev[3]: RANKING OF THE CRITERAI FOR MULTICRITERIAL MODELING OF THE SISTEMS FOR MUNICIPAL SOLID WASTE MANAGEMENT IN URBAN AREAS. International Conference "Green development, infrastructure, technology (GREDIT) 2016", 30 March – 02 April, 2016 Skopje, Macedonia.	Mitigation	Waste
Tashko Rizov, Petrika Janeku, Atanas Kochov: IMPLEMENTATION OF LOW CARBON TECHNOLOGIES IN THE MACEDONIAN AGRO INDUSTRY. International Conference "Green development, infrastructure, technology (GREDIT) 2016", 30 March – 02 April, 2016 Skopje, Macedonia.	Mitigation	Agriculture
D. Dimitrovski, M. Vilarova, E. Gavrilova: Some aspects of air quality planning for the city of Tetovo. 6th INTERNATIONAL CONFERENCE "Protection of Natural Resources and Environmental Management: The main Tools for Sustainability" (PRONASEM), 10-11 November, Bucharest, Romania	Mitigation	Air quality
Kristina Petrovska, Fana Hristovska, Aneta Kitevska: Estimating GHG emissions from "Bunardere" landfill in Municipality of Veles", Third International Climate Change Conference 2016, Skopje, Macedonia	MRV	Waste
Ristovski Igor, Milosevska Vesna, Filkoska Tanja, Blinkova Martina, Macanovski Ivan, Lazarevska: Methodology to include indirect green-house gas emissions in inventories, mitigation options on both national and local level, Third International Climate Change Conference 2016, Skopje, Macedonia	MRV	Cross sectoral
Antonio Jovanovski, Aleksandar Trpkovski "Opportunities for young people in times of climate change and energy transition" - Macedonia, Kosovo, Serbia and Croatia	Mitigation	Cross sectoral

Annex 10: Capacity building activities undertaken

Table 110: Support received for capacity building events, including training, seminars, conferences, and workshops (2014-2017)

Mitigation and GHG Inventory
✓ Conference "Deploying an Alternative Fuels Infrastructure for Transport in the EU" as a part of the Project "Stabilizing GHG Emissions from Road Transport through doubling of Global Vehicle Fuel Economy", 14-18 November 2016, Ljubljana Slovenia. Organized by JRC EU, REC and UNEP.
✓ A Series of Renewable Energy Forums (15.04.2013-31.07.2017) as a mechanism for bringing together renewable energy project developers, investors, local associations, ministries, agencies, and international donors to generate new initiatives and act as a feedback channel for legal proposals. The Forums were part from the "Clean Energy Investment Project" funded by USAID and implemented by Winrock International. Project for supporting the Government of Macedonia's efforts to increase investment in energy generation from renewable sources, and reduce Macedonia's total final energy consumption and greenhouse gas emissions.
✓ 8 workshops to increase the public's knowledge and awareness of the impact of climate change on the agricultural sector in Macedonia. (08.03.2012 – 07.03. 2015). Project "Adaptation to climate change in agriculture" funded by USAID and implemented by Rural Development Network of the Republic of Macedonia.
✓ Final phase of Integration of Environmental Education in Macedonian Educational System 2013 – 2015. The purpose of the project is integration of environmental education in the Macedonian educational system. (01.09.2013- 31.12.2015). Funded by Switzerland.
✓ Strengthening the administrative capacity of the energy department in the Ministry of Economy and the Energy Agency. (06/2013- 06/2015). Consultancy services for training and education. IPA Funded.
✓ Towards the future - Study on the potential and utilization of renewable energy sources in the cross-border region. (19.12.2013 - 18.06.2015) IPA funded. At least 10 managers from public utilities and 20.000 inhabitants from the Municipalities from the Southeast planning region of R. Macedonia and the Southwest region of R. Bulgaria were acquainted with the Renewable Energy Sources through public awareness campaigns implemented on both sides of the border
✓ ECRAN: Regional Training Seminar on assessment of GHG Inventories in the Forestry and Other Land Use. 15-16 April 2015, Sarajevo
✓ ECRAN: Regional Training Seminar on National Systems for GHG inventories (and projections)14-16 October 2015, Zagreb
✓ ECRAN Workshop: Report on the Regional Training Seminar on the assessment of GHG inventories in Waste. 24-25 November 2015, Sarajevo
✓ ECRAN: Regional Training Seminar on National Systems for GHG inventories (and projections). 28-29 June 2016, Podgorica.
✓ ECRAN: Regional Training Seminar on the assessment of GHG inventories in agriculture. 21-22 June 2016, Zagreb

MRV
✓ MultiEE (Facilitating multi-level governance for Energy Efficiency) Horizon 2020: Regional Conference Organized by GIZ, MACEF and Energy Agency of the Republic of Macedonia. "Energy efficiency data treatment" – Skopje, 06.07.2017.
✓ ECRAN Workshop: OPERATING A COMPETENT AUTHORITY. 13 – 15 October 2015, Vilnius, Lithuania
✓ ECRAN: Advanced Technical Training Programme on Verification in the scope of the EU ETS. 12-13 April 2016, Belgrade.

Climate policies
✓ 5TH CONGRESS OF ECOLOGISTS OF THE REPUBLIC OF MACEDONIA WITH INTERNATIONAL PARTICIPATION, Ohrid, Macedonia. 19th -22nd October 2016. Organized by Macedonian Ecological Society.
✓ Third International Climate Change Conference, Skopje (03-05.02.2017). Organized by USAID, and Mileukontakt Macedonia.
✓ GREDIT Conference (Green Development, Infrastructure, Transport) 2016. (30.03.2016-02.04.2016). Organized by BENA (Balkan Environmental Association) & University Ss Cyril and Methodius, Skopje.
✓ Conference "JRC SUPPORT TO LOW CARBON SOCIETY. ENERGY POLICY (Modelling low carbon energy scenarios) and Climate Change. Organized by JRC & Faculty of Mechanical Engineering Skopje. (09.09.2015) Skopje, Macedonia.
✓ Macedonia's First Biennial Update Report: (completed on 28.02.2015). Support received from UNDP
✓ Reduce Energy use and Change Habits. (REACH) - (project participants: Macedonia, Croatia, Slovenia and Bulgaria). Empowering fuel-poor households (vulnerable consumers) to take actions to save energy and change their habits, and establishing fuel poverty as an issue requiring tailor-made policies and measures at the local, national and EU level. (01.03.2014-01.03.2017). A number of educational events have been performed. Final meeting: 28.02.2017 in Zagreb.
✓ Development of the ENV.net in West Balkans and Turkey: giving citizens a voice to influence the environmental process reforms for closer EU integration: (31.01.2014 - 31.05.2015). Funded by EU Programmes.
✓ ECRAN Workshop on Quantitative Models and Scenario Development in Climate and Energy Policy (support mission to Module 4)05-06 July 2016, Podgorica, Montenegro
✓ ECRAN Regional Workshop on climate legislation in relation to transport (cars and vans, labelling, renewables and fuel quality) Tirana, 13-14 April 2016.
✓ ECRAN Workshop Contributions to the Global Climate Agreement II – practical preparations.18 March 2015, Tirana.
✓ European Commission JRC: EU-AU-IIASA Evidence and Policy Event, (30 August to 2 September 2016, Ispra, Ital

Technical training
✓ Road-transport & Emissions Modelling (REM) workshop. Sustainable transport and e-mobility modelling workshop organized by JRC & Faculty of Mechanical Engineering Skopje. (10-11.09.2015) Skopje, Macedonia.
✓ Technical training under the "Catalysing market transformation for industrial energy efficiency and accelerate investments in best available practices" project. Component 2 involves training for local IEE consultants on: energy management systems (EMS) in line with ISO 50001; steam system optimisation (SSO); and compressed-air system optimisation (CASO). Collaboration between consultants and partner enterprises takes place in so-called energy management teams, which participate in one-year energy management capacity-building programmes. Trainings in the area of EMS and SSO were completed in 2015, while CASO training will be completed in 2018.
✓ "Conversion from HCFC – 141b in HFCs in the Manufacture of polyurethane foam for the commercial refrigeration units, sandwich panels and insulated doors", UNIDO Project (01.01.2014 -31.12.2016). Training of the technicians in refrigeration process and preparation of manuals and guidelines.
✓ EUREMPlus: Boost energy efficiency in manufacturing SMEs by extending European Energy Manager Training and Network. (01.05.2013- 31.10.2015). Funded by EU and Economic Chamber of Nuremberg, Germany.
✓ Promotion of energy efficiency in buildings and protection of the environment (PEEBPE) 4th IPA Seminar on the topic: "ENERGY AUDIT IN BUILDINGS" was held in Bitola, at the premises of Business Academy Smilevski – BAS, on 19/06/2014.
✓ Closing Event of the project «From Trash to Cash: Sustainable Development and Economic Empowerment of the Informal Waste Collectors through Waste Recycling in the Cross Border Region with Albania and Macedonia. 28th September, Korce Albania.
✓ Environment and Climate Regional Accession Network (ECRAN) Modelling: Support mission to Module 1. 16-17 March 2015, Tirana.
✓ ECRAN Practical hands on assistance on quantitative models and scenario development to be used to assess climate and energy policy options and to set emission targets. 01-03 April 2015, Belgrade, Serbia
✓ ECRAN Regional Training Workshop on SEA/EIA in industrial sector and the 3rd Training of Trainers (ToT) session.21-23 September 2016, Skopje, Macedonia.

Climate finance
✓ European Commision. JRC: Workshop on Investment Vehicles and Financial Instruments supporting Technology Transfer and Innovation. Focus on the Danube Region and the Western Balkans countries. 1-2 March 2017, Belgrade, Serbia

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