7th National Communication
3rd Biennial Report Support Project

SEVENTH NATIONAL COMMUNICATION OF TURKEY UNDER THE UNFCCC

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SEVENTH NATIONAL COMMUNICATON OF TURKEY

Under the United Nations Framework Convention on Climate Change
Republic of Turkey Ministry of Environment and Urbanization

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ABBREVIATIONS

A-AWOS	Airport Automatic Weather Observation Station
AFAD	Disaster and Emergency Management
AFWS	Agricultural Frost Warning System
AKD	American Culture Association
ALADIN	Aire Limite Adaptation Dynamique Développement International
APECS	Arctic Association of Polar Early Career Scientists
AROME	Applications of Research to Operations at Mesoscale
ARPEGE	Action de Recherche Petite Echelle Grande Echelle
ATCM	Antarctic Treaty Consultative Meeting
AWOS	Automatic Weather Observation Station
BIST	Borsa Istanbul
BMU	The German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
BSC-DREAM8b	Barcelona Supercomputing Center-DREAM8b
CCAMCB	Climate Change and Air Management Coordination Board
CDE	General Directorate of Combating Desertification and Erosion, Ministry of Agriculture and Forestry
CDP	Carbon Disclosure Project
CEO	Chief Executive Officer
CFC	Chlorofluorocarbon
CGW	Global Conference on Global Warming
CHE	Council of Higher Education
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2 eq.	Carbon Dioxide Equivalent
DEKOSIM	Marine Ecosystem and Climate Research Center
DKM	Nature Conservation Centre
DMS	Drought Monitoring System
DSİ	State Hydraulic Works State Hydraulic Works (Devlet Su İşleri)
ECMWF	European Centre for Medium-Range Weather Forecasts
ECMWF-IFS	European Centre for Medium-Range Weather Forecasts-Integrated Forecasting System
ECMWF-EPS	European Centre for Medium-Range Weather Forecasts- Ensemble Prediction System
ECO	Economic Cooperation Organization
EESP	Energy Efficiency Strategy Paper
EMCC	Eastern Mediterranean Climate Center
EMEP	EMEP: Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP)
EEA	European Environment Agency
EMRA	Energy Market Regulatory Authority
ESCoP	Educators Supporting Collaboration on Polar Regions Project
EU	European Union
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
EuroGOOS	European Global Ocean Observing System
FAO	Food and Agriculture Organization
FFGS	Flash Flood Guidance System
F-gases	Fluorinated Gases
FMS	Flow Monitoring Stations
GAW	Global Atmospheric Watch
GCOS	Global Climate Observation System

GDF	General Directorate of Forestry
GDP	Gross Domestic Product
GDRE	General Directorate of Renewable Energy, Ministry of Energy and Natural Resources
GFDL	Geophysical Fluid Dynamics Laboratory Model
GHG	Greenhouse Gas
GME	Global Model
GNSS	Global Navigation Satellite Systems
GOS	Global Observation System
GOOS	Global Ocean Observation System
GWh	Gigawatt Hour
HadGEM	Hadley Centre Global Environment Model
HCFC	Hydrochlorofluorocarbon
HPMP	Hydrofluorocarbons Phase Out Management Plan
IKI	International Climate Initiative
ICG/NEAMTWS	Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-eastern Atlantic, the Mediterranean and connected seas
IPA	Instrument for Pre-Accession Assistance
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
ISMEK	Istanbul Vocational Course
ITU	Istanbul Technical University
ITU PolReC	Polar Research Center of İstanbul Technical University
KALMER	Calibration Center
Kt	Kilo tons
LAEF	Limited-Area Ensemble Forecasting
LDTS	Lightning Detection and Tracking System
LOS	Lake Observation Stations
LULUCF	Land Use, Land Use Change and Forestry
M-AWOS	Marine Automatic Weather Observation Station
MBI	Market-Based Instrument
MENR	Ministry of Energy and Natural Resources
METCAPPLUS	Meteorological Communication and Applications Package
METU-3	Middle East Technical University-3
METU-IMS	Middle East Technical University, Institute of Marine Sciences
MEWS	Meteorological Early Warning System for Forest Fires
Mha	Million hectares
MM5	Mesoscale Model 5
MNE	Ministry of National Education
MONGOOS	Mediterranean Operational Network for the Global Ocean Observing System
MoCT	Ministry of Culture and Tourism
MoEU	Ministry of Environment and Urbanization
MoIT	Ministry of Industry and Technology
MOS	Meteorological Observation Stations
MoTI	Ministry of Transport and Infrastructure
MPI	Max Planck Institute
MRV	Monitoring, Reporting and Verification
Mt	Million tons
MToe	Million tons of oil equivalent
MW	Megawatt
MWe	Megawatt electricity
MWt	Megawatt thermal
N_2O	Nitrous Oxide

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NE	Not Estimated
NCCS	National Climate Change Strategy
NGO	Non-Governmental Organization
NMVOC	Non-Methane Volatile Organic Compounds
NO	Not Occurred
NOx	Nitrogen Oxides
NOAA	United States National Oceanographic and Atmospheric Administration
NPP	Nuclear Power Plant
OPCC	One Planet City Challenge
OSCAR	Observing Systems Capability Analysis and Review tool
PCP	Representative Concentration Pathway
PMR	Partnership for Market Readiness
PNI	Percent of Normal Index
PolReC	Polar Research Center
PolSTeam	Polar Research Team
PWV	Precipitable Water Vapour
R&D	Research and development
RCC	Regional Climate Centers
RegCM	The Regional Climate Model system
RTC	Regional Training Center
SCAR	Scientific Committee on Antarctic Research
SFM	Sustainable Forest Management
SO2	Sulphur Dioxide
SOS	Snow Observation Stations
SPI	Standardized Precipitation Index
SRN	Surface Radiation Network
TAIEX	Technical Assistance and Information Exchange Program
TCCC	Turkey Climate Change Congress
TEMA	The Turkish Foundation for Combating Soil Erosion, for Reforestation and the Protection of Natural Habitats
TSMS	Turkish State Meteorological Service
TUDES	Turkish National Sea Level Monitoring Network
TurkStat	Turkish Statistical institute
TURSAB	Association of Turkish Travel Agencies
TÜBİTAK	The Scientific and Technological Research Council of Turkey
TÜRKAK	Turkish Accreditation Agency
TWG	Thematic Working Group
TWh	Terawatt Hour
UCLG	United Cities and Local Governments
UCLG-MEWA	UCLG Middle East and West Asia Section
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
UN-ECE CLRTAP	Convention on Long-range Transboundary Air Pollution
USAID	United States International Development Agency
WG	Working Group
WIGOS	WMO Integrated Global Observing System
WMO	World Meteorological Organization
WOUDC	World Ozone and Ultraviolet Radiation Data Centre
WRF	Weather Research and Forecasting
WW3	Wave Watch 3
WWF	World Wide Fund for Nature

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FOREWORD

Climate change is one of the most significant problems faced by humanity which threatens our future extensively unless response measures are taken today.

For this reason, urgent measures need to be taken at global, regional as well as local scale and cooperation should be enhanced in order to fight against climate change.

Our country is determined to contribute to post 2020 climate response efforts at global level in line with its capabilities as long as the Paris Agreement stays transparent, comprehensive, fair and equitable. It is a priority for all of us in the new climate process to best align our country's position and to protect its interests.

In the framework of Paris Agreement, we have set and will achieve our target for greenhouse gas emissions reduction up to 21 percent compared to the Business-As-Usual Scenario by 2030.

We have defined Turkey's national vision within the scope of National Climate Change Strategy as "becoming a country fully integrating climate change policies with its development policies, disseminating energy efficiency, increasing the use of clean and renewable energy resources, actively participating in the efforts for tackling climate change within its special circumstances and providing its citizens with a high quality of life and welfare with low-carbon intensity".

We have issued National Climate Change Action Plan in order to ensure implementation of National Climate Change Strategy and to identify climate change-related targets and actions. In 2011-2023 Action Plan, in total 541 actions and responsible institutions have been identified in the fields of Energy, Industry, Agriculture, Forestry, Buildings, Transport, Waste and Adaptation to Climate Change.

Special importance is attached to responding climate change when preparing 2018-2022 Strategy Document for our Ministry. One of our priority targets in this context is to prepare Local Climate Change Action Plans for metropolitan municipalities until 2023. Judging by the rate of population, 30 metropolitan municipalities make up of approximately 83% of the country population.

Acceleration of Turkey's efforts on the national level in responding climate change has had its repercussions on institutional, legal and policy frameworks over the recent years in various ways. In this respect, sectoral climate change policies have been developed to promote greenhouse gas emission reduction and to increase resilience against climate change impacts.

This process of taking significant steps will be maintained in the future as well thanks to the young population, strong public structure and the dynamism of the private sector present in our country.

The Seventh National Communication on Climate Change is prepared in line with the liabilities of our country under United Nations Framework Convention for Climate Change, to which it is a party. A product of participatory approach, it is a very comprehensive report presenting the current status of our country in the field of climate change.

I believe that this report will provide significant contribution in the future of our country and in this vein, I would like to thank those who exerted efforts primarily the staff of our Ministry, United Nations Development Programme Country Office Turkey and representatives of all stakeholder institutions.

Murat KURUM
Minister of Environment and Urbanization

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EXECUTIVE SUMMARY

This document represents Turkey's 7th National Communication required under the United Nations Framework Convention on Climate Change, as reaffirmed by UNFCCC decision 9/CP.16 and UNFCCC decision 2/CP.17. Turkey has submitted its First National Communication in 2007 and the Sixth National Communication in 2016.

7th National Communication includes updated information regarding institutional, legal and political developments since the submission of the 6th National Communication. Also, the 7th National Communication covers several topics extending the content of the 6th National Communication in each Chapter, including the parts where the recommendations given in the Review Report for the 6th National Communication have been addressed.

1.1 NATIONAL CIRCUMSTANCES RELEVANT TO GREENHOUSE GAS EMISSIONS AND REMOVALS

Turkey's population was 56.47 million in 1990, it reached 79.81 million in 2016. The population is estimated to reach about 104.8 million in 2050. The population density for 2016 is 104 person/km^2. The urban population increases while a decline is observed in the rural population since 1990. In 2016, 87.9% of the population lived in urban areas, and 12.1% of the population inhabited in rural areas

The surface area of Turkey is 783562 km^2 and approximately 11.4% of this area is occupied by lakes and marshlands. 28.8% is forest land, 35.8% is cropland, 19% is grassland, 5% is settlements and other land.

Turkey is situated between the subtropical zone and temperate zone. Turkey is surrounded by sea on three sides, extension of the mountains and diverse nature of the landscape result in significant differences in climatic conditions from one region to the other. In the coastal regions of Turkey, milder climate is experienced due to the influence of the sea, and continental climate characteristics are seen in the inner parts of Turkey.

The Turkish economy generally demonstrated growth in 1990-2016 period excepting economic crisis years of 1994, 2001, and 2008. Turkey's Gross Domestic Product (GDP) was 862.74 billion US Dollars in 2016. The per capita GDP in 2016 was US$ 10.883. The annual foreign trade volume showed a similar trendas the GDP growth. Turkey had an overall trade volume of approximately 341 billion US $ in 2016, where 143 billion US $ camefrom exports and 199 billion US $ from imports.

Total primary energy supply increased from 52.5 Mtoe in 1990 to 136.2 Mtoe in 2016. The share of fossil fuels in total primary energy supply was 87.3%, and the share of renewables was 12.4% in 2016. Final energy consumption of Turkey increased from 42.2 Mtoe in 1990 to 104.5 Mtoe in 2016. Industrial sector and building sector are the highest energy consuming sectors. Industrial sector accounted for 32%, residential, commercial and institutional sector 32%, transportation 25%, agriculture 4% of Turkey's final energy consumption.

Installed power capacity increased from 16.3 GW in 1990 to 79.5 GW in 2016. Annual electricity production grew from 57.5 TWh to 274.4 TWh in the same period. Coal and natural gas had the highest share in total electricity generation in 2016 with 33.7% and 32.5% respectively. Share of hydro power was 24.5%, other renewables were 8.6% and liquid fuels were 0.7%.

The share of the Turkish industrial sector in the GDP was 20-25%. Manufacturing industry had the highest share among the total industrial sector with 82% share of turnover and 92% of share in the number of employees. Energy consumption of industrial sector increased from 13.6 Mtoe to 33.3 Mtoe during 1990-2016 periods. Emission intensity of the sector decreased considerably from 2.4-ton CO_2-eq/Toe to 1.8-ton CO2-eq/Toe in the same periods.

The transport sector was responsible for 25.6% (26.8 million Toe) of Turkey's final energy consumption in 2016. Road transport was responsible for 92.9% of energy consumption in transportation sector and domestic aviation was responsible for 5.3%.

Waste generation has been increasing continually in Turkey over the last few decades. However, significant improvement has been achieved in waste management since 1994. Waste disposal shifted from open dumps to sanitary landfill sites. 61% of the municipal waste that was collected has beendisposed to sanitary landfills in 2016. Energy production from landfill gas and biogas from wastewater treatment has increased especially overthe last 5 years.

Total agricultural land declined during 1990-2016 periods, and the share of agriculture sector in GDP also decreased

in the same period. Turkey has 23.7 million hectares arable land; and the share of agriculture in GDP was 6.2% in 2016. Turkey has experienced a decline in the number of sheep and goats but an increase in cattle population since 1990. In 2016, the total number of cattles was approximately 14 millions and the number of sheep and goats was around 31.5 and 10.4 millions, respectively.

In Turkey, forests are managed according to the sustainable forest management principles, and the country is one of the few countries in the world that have increased their forest areas. The forest area increased from 20.20 million ha in 1973, to 22.57 million ha in 2016. Restoration and reforestation activities have been conducted since 1995. 48.2 kha area was reforested only in 2016.

Turkey is the 6thmost popular tourist destination in the world, attracting more than 30 million tourists annually, with an increasing trend. Turkey had 444 blue-flag beaches in 2016. Also, currently there are 22 blue-flag marinas in Turkey. There has been a rapid increase in the number of tourists coming to Turkey. The tourism sector has developed over the last 3 decades, with an increase in the annual number of tourists from approximately 5.4 million in 1990 to 31.4 million in 2016 and generating 22.1 billion US $ of income in year 2016.

Turkey's consumable surface and ground water potential is 112 billion m^3 per year. Utilization rate of the current 112 billion m^3 of available fresh water resources is still around 48.2%. The amount of water available per capita per year in Turkey is about 1,403 m^3. 40 billion m^3 of the available water is used for irrigation, 7 billion m^3 is used for drinking water and 7 billion m^3 is used in the industry. 39 billion m3 (72.2%) of the consumed water is supplied from surface waters and 15 billion m^3 (27.8%) from groundwater

1.2 INVENTORY OF GREENHOUSE GAS EMISSIONS AND SINKS

According to the latest GHG inventory of Turkey, total GHG emissions were 496.1 Mt of CO_2 equivalents (CO_2 eq.) excluding the LULUCF sector and 428.0 Mt CO_2 eq. including the LULUCF sector in 2016. This represents 135.4 increase as compared to 1990 level. In overall 2016 GHG emissions without LULUCF, the energy sector had the largest portion with 72.8%. The energy sector was followed by the industrial processes and other product use (IPPU) sector with 12.6%, the agriculture with 11.4% and the waste with 3.3%.

The highest portion of the total GHG emissions without LULUCF is CO_2 emissions. The share of CO_2 emissions in total CO_2-eq. emissions were 81.2% in 2016. The share of CH_4 emissions was 11%, share of N_2O emissions were 6.4% and the share of F-gases emissions were 1.3% in the same year.

There has been an increasing trend in the total GHG emissions of Turkey over the period from 1990-2016. However, for years 1994, 1999, 2001 and 2008 GHG emissions decreased due to economic crisis in those years. CO_2 equivalent emissions per capita increased to 6.3 tonnes in 2016 from 3.8 tonnes in 1990.

While GDP increased by 208.4% between 1990 and 2016, the total greenhouse gas emissions increased by 135.4%. Energy intensity and Carbon intensity of the economy decreased in the same period (15.8% and 24% respectively). Also, total CO_2 removal by sinks increased 135.4%, those figures indicate that Turkey has made significant progress to lower its carbon emissions while achieving its economic growth.

Energy

Energy sector is the major source of Turkish anthropogenic GHG emissions. Overall in 2016 GHG emissions (excluding LULUCF), the energy sector had the largest portion with 72.8%. Total emissions from the energy sector for 2016 were estimated to be 361 Mt CO_2 eq. Of which 352.7 Mt CO_2 eq. is coming from fuel combustion and 8.3 Mt CO_2 eq. is related to fugitive emissions from fuels.

Fuel combustion emissions are the major source of energy sector GHG emissions, and responsible for 97.7% of the whole energy sector GHG emissions. Energy industries were the main contributor of GHG emissions from fuel combustion with 41%. It is followed by transportation sector with 23.2%, manufacturing industries with 16.9%, residential, commercial and institutional sector with 16.1% and, agriculture, forestry and fishing sector with 2.8%.

Total fugitive emissions for 2016 were 8.3 Mt CO_2 eq., representing 1.67% of total GHG emissions (excluding LULUCF). Oil and natural gas systems contributed 32.5%, solid fuels account for the remaining 67.5% of fugitive emissions.

Industrial Processes and Product Use

GHG emissions from industrial process and product use, was 22.9 4 Mt CO_2 eq. in 1990 and increased to 62.4 Mt CO_2 eq. in 2016. It is contributed 12.6% to the total anthropogenic GHG emissions in Turkey in 2016.

Mineral industry and non-energy products from fuels and solvent use sectors have the biggest share in total IPPU sector emissions in 2016 with 67.2% and 18.3% respectively. IPPU sector is responsible from 13.6% of total CO_2 emissions and the only source of F-gas emissions. 97.8 % of total IPPU sector emissions is CO_2 emissions. Main sources of CO_2 emissions are from mineral production with 76.8% (cement production is 65.4%) and metal production with 20.9% (iron and steel production are 20.4%) in 2016. Cement production and iron and steel production has 7.2% and 2.2% shares in the total national GHG emissions, respectively.

Agriculture

Total GHG emissions from agriculture sector was 56.5 Mt CO_2 eq. in 2016 which is 11.4% of total GHG emissions Total GHG emissions from agriculture sector was 56.5 Mt CO_2 eq. in 2016 which is 11.4% of total GHG emissions (excluding LULUCF). There is 33.2% increase in agriculture sector GHG emissions as compared to 1990 level.

Main source of agriculture sector GHG emissions are enteric fermentation, agricultural soils and manure management. Figure 3.17 shows GHG emissions from agriculture sector. In 2016, 47.7% of the agriculture sector GHG emissions was from enteric fermentation, 38.2% was from agricultural soils, 11.2% from manure management, 2.3% was from urea application and 0.7% was from rice cultivation and combustion of agricultural residues in the fields.

Agriculture sector is responsible for 55.5% of total CH_4 emissions, and 77.6% of total N_2O emissions in 2016. Methane emissions mainly originating from enteric fermentation while N_2O emissions released from agricultural soils

Land Use, Land Use Change and Forestry (LULUCF)

In 2016, the LULUCF sector acted as a CO_2 sink for −68.1 Mt CO_2 eq. It was 28.9 Mt CO_2 eq. in 1990 (135.4% increase). Although removals from LULUCF sector constituted 13.7% of total GHG emissions of Turkey (excluding the LULUCF) both in 1990 and 2016, its share was in the range of 10.2-14.2% between years 1990-2016.

The largest sink was forest land with 60.4 Mt CO_2 eq in 2016 and removals is 12.2% of total GHG emissions (without LULUCF). It is followed by harvested wood products with 10.6 Mt CO_2 eq. (2.1% of total GHG emissions).

Waste

Total GHG emissions from waste sector was 16.2 Mt CO_2 eq. in 2016 which constituted 3.3% of total GHG emissions (excluding LULUCF). There is 45.9% increase in waste sector GHG emissions as compared to 1990 level.

Main source of waste sector's GHG emissions are solid waste disposal and wastewater discharge and treatment. In 2016, 72.2% of the waste sector GHG emissions was from solid waste disposal and is 27.7% was from wastewater discharge and treatment.

Waste sector is responsible from 25.8% of total CH_4 emissions, and 6.5% of total N_2O emissions in 2016. Methane emissions mainly originating from solid waste disposal site while N_2O emissions released from wastewater discharge and treatment.

1.3 POLICIES AND MEASURES

Turkey's overall Climate Change Policy is framed with several cross-cutting and sectoral policies, strategies and action plans that are based on the National legislation in relevant sectors. The main policy documents that are dedicated only to Turkey's Climate Change policies are National Climate Change Strategy (NCCS) (2010-2023), and National Climate Change Action Plan (2011-2023) that is based on NCCS. Also, the 10th Development Plan, covering the 2014-2018 period, is a significant document, since the term "Green Growth" was first introduced to Government Policies in several areas like energy, industry, agriculture, transport, construction, services and Urbanization. The National Climate Change Strategy, National Climate Change Action Plan and the 10th Development Plan create a base for all cross-cutting and sectoral climate change policies and measures.

As many other countries, energy sector has the highest GHG emission share compared the others. Therefore, policies and measures to reduce GHG emissions in the energy sector have higher focus in the INDC with clear renewable energy generation targets, particularly in the power sector. Therefore, Turkey's Energy Policy gives top priority to utilizing renewable energy sources to the maximum extent, while decreasing import dependency by improving security of supply. Renewable Energy Sources Support Mechanism (YEKDEM) and By-Law on Renewable Energy Resource Areas (YEKA) have significantly contributed to the acceleration of renewable energy investments especially for wind and solar power. Energy efficiency in buildings and industry have also been addressed through several policies and legislation. Also, as indicated in several policy documents Nuclear Power will become one of the mechanisms to provide supply security and alsoreduce GHG emissions.

Over the recent years, Turkey has invested in sustainable transport projects such as extending railroad network and implementing Smart City concept in the Metropolitan areas in order to increase energy efficiency in the transport sector which also has a significant share in national GHG emissions. Also, Turkey complies with international decisions given by IMO and ICAO which target at reducing maritime and aviation GHG emissions.

Although Turkey has ambitious targets for increasing agricultural productivity, there are also policies and plans that support reduction of GHG emissions from the sector. The policies in the agriculture sector vary from extending the farmer database to specific areas, to provide financial support programme for farmers who implement smart agricultural techniques, all of which directly or indirectly contributes to reducing GHG emissions. Policy documents such as National Forestry Programme (2004-2023) and National Strategy and Action Plan to Combat Desertification (2015-2023) also indicate short, mid and long-term targets which can lead to extension and improvement of existing forest areas which contributes to the extension of the carbon sinks in Turkey. There has been an increasing interest in investments for power generation from sanitary landfills over the last decade, which paved the way to increased levels of renewable power generation from waste.

1.4 PROJECTIONS AND TOTAL EFFECT OF POLICIES AND MEASURES

On September 30th2015, the Republic of Turkey submitted its Intended Nationally Determined Contribution (INDC) to UNFCCC towards achieving the ultimate objective of the Convention, which is set out in its Article 2 and clarifying information, in accordance with decisions 1/CP.19 and 1/CP.20. In this section, the projections of greenhouse gas emissions by 2030 are based on two scenarios: Business-As-Usual Scenario and Mitigation Scenario. The Mitigation (With Measures) Scenario suggests approximately 246 Mton CO_2-e of emission reduction compared to Business-as-Usual (Without Measures) Scenario by year 2030 which corresponds to up to %21 reduction, under the condition that Turkey could use international financial, technological, technical and capacity building support finance from the Green Climate Fund, recalling the related COP Decisions[1].

1.5 VULNERABILITY ASSESSMENT, CLIMATE CHANGE IMPACTS AND ADAPTATION

A large part of Turkey is located in the dry summer subtropical Mediterranean climate zone. Therefore, Turkey is among medium-high risk countries in terms of both present climate, climate change and variability, and future climate, considering that Mediterranean Basin has been indicated as one of the most vulnerable regions in the world to the impacts of climate change (IPCC, 2007).

According to the observations and data of the Turkish State Meteorological Service (TSMS), temperatures increase while precipitation decreases during the summer months in Turkey. The (TSMS) took the years between 1971 and 2017 as the reference period and determined the annual mean temperature value across Turkey as 13.2°C for the period between 1971 and 2000 and 13.5°C for the period between 1981 and 2010. There have been positive temperature anomalies in the mean temperatures of Turkey since 1994 (except for 1997 and 2011).

1) 26/CP.7, 1/CP.16, 2/CP.17 and 1/CP.18

In general, there is an increasing trend that also affects maximum and minimum temperatures across the country. However, there are two complex patterns in precipitation changes. Although the mean annual total precipitation decreases, the amounts of one-day maximum precipitation increase. According to the results of studies, the numbers of summer days, warm days, warm nights and tropical nights increased while decreases were observed in the numbers of frosty days, cool days and cool nights. The growing season length increased except for the coastal regions that are already high. This result indicates a significant increase in Turkey's temperatures.

Various climate index trends were determined using the data of 109 stations of the TSMS for the period between 1960 and 2010 in Turkey. According to TSMS, it was observed that the annual total precipitation increased in the North of Turkey while it showed a decreasing trend in the Aegean, Mediterranean and Southeastern Anatolia regions and that the maximum number of rainy days, the number of wet days and one-day maximum precipitation showed an increasing trend at many stations outside the Aegean and Southeast Anatolian regions.

The TSMS produces regional climate projections for Turkey until 2100 using the dynamic downscaling method, in accordance with the scenarios used in the IPCC 5th Assessment Report, Working Group 1 report. Of the global models used under the CMIP5 project, regional climate projections were generated using dynamic downscaling method in the RegCM4 model of the HadGEM outputs. 1971-2000 period was taken as reference and a projection for years 2016-2099 was made. To produce high-resolution climate projections which will be used in regional climate change adaptation and impact assessment studies, products of coordinated regional climate model studies (Coordinated Regional Climate Downscaling Experiment, CORDEX) supported by the World Climate Research Programme were used. When it is evaluated together with the results of the outputs for all of the scenarios, while some differences can be seen depending on the scenario, it is generally seen that the temperatures will rise by 2-3°C in average and the precipitation will significantly reduce. It is estimated that across Turkey, there will be a significant increase in the number of consecutive dry days, the number of days with frost will decrease and the average temperature in the basins will how an upward trend until 2099.

Climate change impacts are already being felt in Turkey. The most noticeable consequences are warmer winters, drier and hotter summers, changes in biodiversity, and retreat of glaciers in the mountains. Climate change has impact on terrestrial, marine and freshwater ecosystems and increases the overall strain on the environment. Social and economic losses caused by weather and climate-related extreme events and disasters have been increasing along with a significant spatial and inter-annual variability in Turkey. The nature, intensity and impact power of extreme weather and climate events and disasters closely depend on economic, social, geographical, demographic, cultural, institutional and governance, environmental and ecological factors, as well as exposure (aspect) and vulnerability levels varying at spatial and temporal scales. The climate of Turkey is expected to undergo significant changes over the coming decades.

Since the submission of the 6th National Communication, Turkey has made progress in the studies on adaptation to climate change. This progress has been made at the national level, in local administrations, and in different sectors. The Ministry of Environment and Urbanization supports municipalities and district authorities in their studies and conducts various capacity building and support activities on climate change adaptation. In addition to public institutions, organizations both in private and voluntary sectors make significant contributions to climate change adaptation studies. Provinces and regions have admitted the need for adaptation either through independent plans or strategies, or as a part of larger climate change plans or strategies, and have made investments to support adaptation initiatives. Several projects concerning climate change adaptation and related issues have been conducted.

1.6 FINANCIAL, TECHNOLOGICAL AND CAPACITY-BUILDING SUPPORT

As referred in its 1st and 5th National Communication, Turkey not being among the Annex II countries, is not responsible for providing support to developing countries according to Articles 4.3, 4.4, 4.5 of the UNFCCC, and Article 11 of the Kyoto Protocol. Turkey, although listed in Annex I to the Convention, is a developing country according to both the World Bank and International Monetary Fund classifications. Indeed, while Turkey is an OECD member and it is among the countries that may benefit from Official Development Assistance (ODA).

1.7 RESEARCH AND SYSTEMATIC OBSERVATION

This chapter gives detailed information on research activities regarding mitigation, adaptation, technology development and transfer, education and capacity building Key stakeholders such as state institutions, academia and non-governmental organizations have been involved in intensive studies on different issues of climate change. State institutions and academic institutions perform studies on climate change at international and national levels. Non-governmental organizations have focused on the studies on awareness and adaptation. In this chapter, the programs which are in accordance with the national policy framework and especially with the climate conditions are discussed for the study. This chapter also includes the basic national achievements and projects in the field of climate change research and systematic observations.

Meteorological observations and forecasts provide data and services to be used in many areas, such as monitoring climate and climate changes, forestry, wind and solar energy studies, planning of cities and facilities, especially agriculture, transportation, national defense, health, and tourism. To make meteorological observation systems widespread across Turkey and increase forecasting capability of weather forecasting models early warning systems are among the priority targets. The development of information infrastructure for the quality control of meteorological data and instant dissemination to users, increasing R&D studies in the field of meteorology and meteorological visibility in the international arena, and the studies on providing correct and reliable information to the public constitute the strategic objectives.

TSMS is one of the leading institutions in Turkey regarding the use of advanced and up-to-date technology. Meteorological radars, automatic meteorology observation stations, upper atmosphere observation systems, lightning detection and tracking systems, meteorological satellites, satellite communication and ground receiving systems, high-performance supercomputer constitute essentialtechnological resources of the TSMS.

Meteorological studies require a strong communication infrastructure both on the national and global scale. Countries share their observation and measurement data with other countries. The TSMS collects, produces and distributes meteorological observation and measurement data in accordance with its national needand international responsibilities through its strong communication infrastructure.

Along with the state-of-the-art observation systems that have become widespread across the country and allow observations to be made automatically with electronic devices, faster, more accurate, continuous and timely observation data are obtained and presented to users.

The TSMS in Turkey cooperates with the WMO (World Meteorological Organization), of which it is a member. Through this international partnership, the TSMS is actively involved in all WMO programs. Some of these programs can be listed as the Global Observation System (GOS), the Global Climate Observation System (GCOS), Surface Radiation Network (SRN) and Global Atmospheric Watch (GAW). The Global Observation System consists of the combination of surface observations, marine observations, high-level observations, and observations made by air vehicles, satellites, and radars. Essentially, the GOS has been designed to combine international data collection systems developed internationally and separately (such as Global Upper Atmosphere Observation Systems, Global Climate Observation Systems, Global Synoptic Observation Systems, etc.). The TSMS shares internationally the airport observations (73 stations), upper atmosphere observations (6 stations), climatic observations (GCOS 7 stations and Regional Basic Climate Network 61 stations), synoptic observations (Regional Basic Synoptic Network 74 stations) and ozone observations (GAW 1 station) on behalf of Turkey. In total, the number of stations sharing data internationally (some stations share more than one data) is 148 (WMO WIGOS OSCAR). The GCOS consists of surface network and upper atmosphere network. The stations in GCOS are similar to the stations in GOS. 7 stations from Turkey (Rize, Istanbul, Kastamonu, Sivas, Van, Isparta, Finike) are GCOS stations.

Turkey was recognized as the Regional Training Center (RTC) of the WMO in 2001. Main duties of the Regional Training Center includeorganization of training, seminars, and conferences regarding the meteorology and related fields at international and domestic levels.

The TSMS currently has three Regional Training Centers (RTC) in Ankara, Istanbul, and Alanya. Since 2001, the TSMS has organized more than 100 certified training programs and trained more than 1000 international participants.

The RTC organized courses and training programs in many subjects including, Upper Atmosphere Observation Systems, Calibration, Radar and Satellite Meteorology, Aviation and Satellite Meteorology, Agricultural Meteorology, Climate Applications and Climate Change, Weather Forecasting, and Numerical Weather Forecasting.

1.8 EDUCATION, TRAINING AND PUBLIC AWARENESS

Observed impacts of climate change in Turkey such as landslides, floods, droughts and increased frequency of extreme weather events and the consequences on the ecologic and economic systems, have pulled attention to climate change. Also, the efforts of state, sub-state and private institutions have significantly contributed to the increase of public awareness regarding climate change the last decade. Several public awareness activities are conducted nationwide and locally regarding the fight against the climate change for various sectors and target groups.

On the state level, several projects are being implemented in order to increase public awareness on climate change among various stakeholder groups such as various levels of educational system, local authorities, experts, businesses and many others. Turkish State Meteorological Service (TSMS) provide information on scientific findings of climate and climate change and projections. TSMS also has a vital role of providing an early warning system to the public informing about expected climatic events through the website and smart phone application.

private institutions have a complementary role to the state institution's efforts by reaching many other stakeholder groups in many areas and sectors. Also, climate change has been pulling the attention of the media over the recent years which resulted with several TV documentaries, regular TV programmes and several writers in newspapers and magazines. Private sectors such as business associations and engineering chambers provide technical trainings for experts and engineers, while NGOs provide awareness raising actives for public. Also, local governments implement several projects that both target at reducing GHG emissions while increasing public awareness.

SEVENTH NATIONAL COMMUNICATION
OF TURKEY UNDER THE UNFCCC

2

NATIONAL CIRCUMSTANCES RELEVANT TO GREENHOUSE GAS EMISSIONS AND REMOVALS

2.1 GOVERNMENT STRUCTURE

The Republic of Turkey is a parliamentary democracy. The 600 members of the parliament (Grand National Assembly of Turkey-GNAT) are elected for five-year terms. GNAT is the legislative authority. President holds executive power, appoints vice presidents and ministers and lead the central administration. The President is elected by the public for a five-year term and is limited to a maximum of two terms.

There are 16-line ministries, which includes Ministry of Justice, Ministry of Foreign Affairs, Ministry of the Interior, Ministry of National Defense, Ministry of Treasury and Finance (Former Ministry of Finance), Ministry of Energy and Natural Resources, Ministry of Industry and Technology (former Ministry of Science, Industry and Technology), Ministry of Trade (former Ministry of Customs and Trade and former Ministry of Economy), Ministry of Environment and Urbanization, Ministry of National Education, Ministry of Health, Ministry of Transport and Infrastructure (former Ministry of Transport, Maritime Affairs and Communication), Ministry of Culture and Tourism, Ministry of Family, Labor, and Social Services, Ministry of Agriculture and Forestry (former Ministry of Food, Agriculture and Livestock and Ministry of Forestry and Water Affairs), Ministry of Youth and Sports.

The central government makes political decisions related to the climate change such as the climate change strategy, as well as energy, transportation and waste policies. It also executes relevant legal regulations. There are 81 provinces in Turkey. The representatives of the central government in the provinces are the governorates under the Ministry of Interior. The governors who occupy the head of the provincial administrations are assigned by the central government. The representatives of the local administration in the provinces are determined through local elections.

Mayoral elections occur every five years. There are 30 metropolitan municipalities in Turkey. In addition to infrastructure services, such as transportation, water supply and sewerage, the municipalities are responsible for energy efficiency, waste disposal and environmental planning. In this context, the municipalities have an important role in the development and implementation of climate change policies at the local scale.

The Ministry of Environment and Urbanization (MoEU) is responsible for the formation and implementation of environmental policy in Turkey,and is also the focal point for the UNFCCC. In this context, climate change policies are determined and executed by Climate Change and Air Management Coordination Board (CCAMCB) under the coordination of the MoEU with the participation of relevant ministries and institutions. The CCAMCB, which is composed of senior representatives of the relevant institutions and organizations and is responsible for the determination and execution of the national climate policy. The CCAMCB is also responsible for the preparation of the national communications of Republic of Turkey for UNFCCC and for the development of relevant studies, and execution of relevant obligations. Under the CCAMCB, seven technical working groups have been established for the execution of the studies related to climate change and air management.,

2.2 POPULATION PROFILE

While the population of Turkey was 56.47 million in 1990, it reached to 79.81 million in 2016. It is anticipated that the population will reach to 88.84 million by the year 2025 and 104.75 million by 2050 with an approximate annual increase rate of 1% during the period between 2018 and 2025 and with a decreasing annual growth rate in 2025-2050. Despite the increase in population experienced since 1990, a significant decrease was observed in population growth rate for the 1990-2016 period. (Table 2.1) (TurkStat_a).

According to 2016 data, 87.9% of the population lived in urban areas, and 12.1% of the population inhabited in rural areas. The average age was 31.4, with an average age for men and women 30.8 and 32 respectively. The working age population was between 15 and 64, comprised 68% of the whole population. 23.7% of the population was 0-14 years and 8.3% was over 65 or older. Population density in 2016 was 104 person/km2 (TurkStat_b).

Increasing population especially in urban areas has a significant effect on the increased demand for housing, energy and transportation in urban areas of Turkey. An increase in greenhouse gas emissions is expected alongside the increase in population. Furthermore, since most of the population resides in urban areas, the policies and actions of local authorities is particularly important in influencing emission increase.

Table 2. 1 Population of Turkey

	1990	2000	2010	2015	2016
Population (millions)	56.47	67.8	73.72	78.74	79.81
Annual growth rate of population (‰)	17.2	14.2	15.9	13.4	13.5
Population density (person/km^2)	74	88	96	102	104
Urban population (% of total)[1]	51.3	59.2	71	87.6	87.9
Rural Population (% of total)[2]	48.7	40.8	29.0	12.4	12.1

Source: TurkStat_a,b

1 "Urban population" is defined as population of the localities which has population 20.001 and over

2 "Rural population " is defined as population of the localities which has population 20.000 and below.

2.3 GEOGRAPHICAL PROFILE

Turkey is situated between the Northern latitudes of 36°- 42° and eastern longitudes of 26°- 45°. It is surrounded by Georgia, Armenia, Nakhichevan and Iran in the east; Bulgaria and Greece in the west; Syria and Iraq in the south; and by the Black, Mediterranean, Aegean and Marmara Seas in three directions. Turkey acts as a bridge between Asia and Europe with the straits of Istanbul and Dardanelles. Turkey has 2,875 km of land borders and 8,333 km of sea borders. This geography renders Turkey vulnerable to potential sea level rise due to climate change.

The surface area of Turkey is 783562 km2 and approximately 11.4% of this area is occupied by lakes and marshlands. 28.8% is forest land, 35.8% is cropland, 19% is grassland, 5% is settlements and other land (UNFCCC CRF tables_2018 NI submission). Turkey has a diversity of freshwater systems including a 1,263 km length of the Euphrates River and 523 km length of the Tigris River. There are many natural lakes and artificial lakes of various sizes. Turkey is a mountainous country with an average altitude of 1,141 meters (MoEU 5thNC).

Turkey's rich biodiversity is in part due to hosting a wide range of ecosystems including forests, mountains, steppe, wetlands, coastlines and seas, as well as its location at the intersection of the three bio-geographical regions: the European-Siberian (Paleo-boreal European Forest); Mediterranean; and Iran-Turan. This impressive diversity of ecosystems and habitat is home to a significant diversity of species. For example, Turkey contains approximately 19000 invertebrate species, of which approximately 4,000 are endemic. Approximately 1,500 vertebrate species have been identified to-date, including more than 100 endemic species. In terms of plant diversity, while there are only 12,500 gymnosperm and angiosperm plant species in the whole of the European continent, Turkey accommodates approximately 11,000 species. Approximately one-third of these are endemic to Turkey (IUCN, 2018). Climate change has the potential to pose a significant threat to the biological diversity of Turkey.

2.4 CLIMATE PROFILE

Turkey is situated between the subtropical zone and temperate zone. Turkey is surrounded by sea on three sides, extension of the mountains and diverse nature of the landscape results in a significant difference in climatic conditions from one region to the other. In the coastal regions of Turkey, milder climates are experienced due to the influence of the sea. The North Anatolian Mountains and the Taurus Mountains prevent the sea affects to penetrate the inner parts of the country. Therefore, continental climate characteristics are seen in the inner parts of Turkey. According to the Thorthwaite climate classification, the climate types as shown in Figure 2.1 can be distinguished.

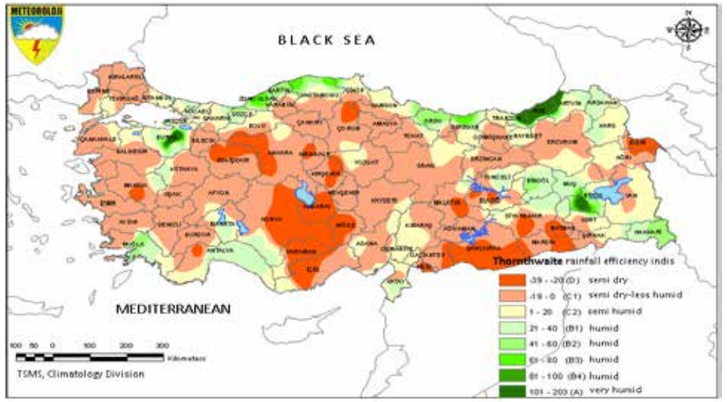

Figure 2. 1 Climate zones of Turkey according to Thornthwaite climate classification
Source: Turkish State Meteorological Service (TSMS), 2018

Turkey receives the most of its rainfall in winter and spring. In summer, the amount of precipitation decreases while the temperature and evaporation increases. This reveals presence of water shortage in summer in the country except for the Black Sea Region (Figure 2.2).

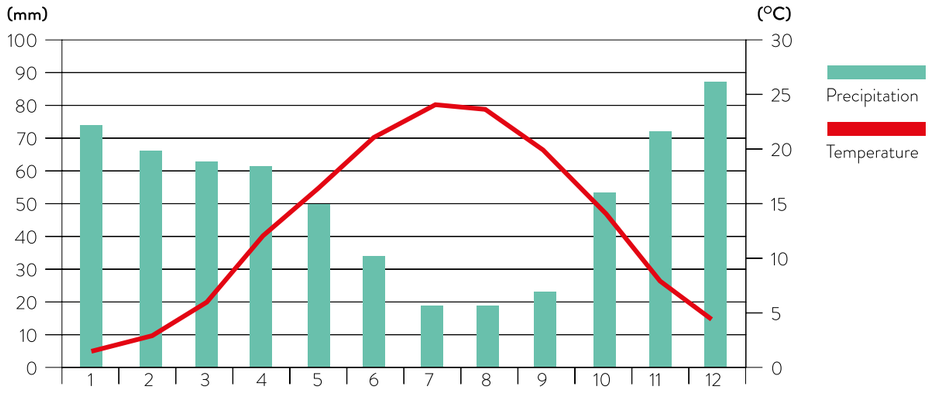

Figure 2. 2 Climate diagram of Turkey
(Source: TSMS, 2018)

Turkey's long-term average temperature of 1981-2010 period indicates that highest mean temperature was observed in the Mediterranean region, and the lowest mean temperature was observed in Northeast region of the country (Figure 2.3). When the temperature changes between 1970 and 2017 were examined, it is demonstrated that the temperature increases from 1994 onwards, except for 1997 and 2011 (Figures 2.4). 2010 was the warmest year. The average temperature increased from 13.2 ° C in 1971 - 2000 period to 13.5 ° C between 1981 and 2010 (TSMS, 2018).

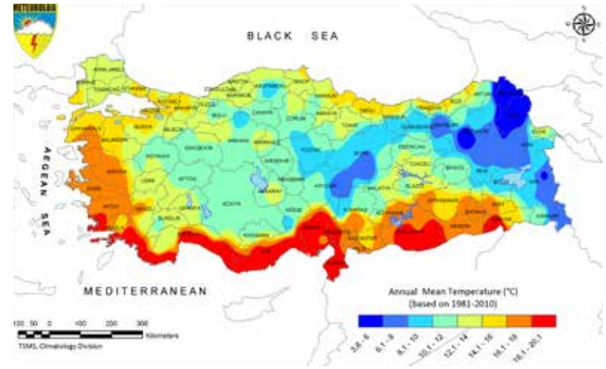

Figure 2. 3 Turkey Annual Mean Temperature Distribution (1981-2010)
(Source: TSMS, 2018)

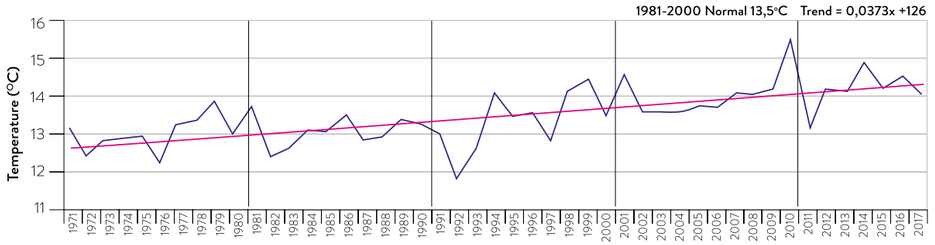

Figure 2. 4 Annual mean temperatures in Turkey, (1971-2017)
(Source: TSMS, 2018)

Annual long-term mean precipitation of Turkey was 574.0 mm (Figure 11). The highest precipitation was observed in Eastern Black Sea regions (Rize and Artvin) while lowest precipitation was observed in the Central, Southeastern and Northeastern Anatolian regions (Şanlıurfa and Iğdır). Average rainfall distribution for 1981-2017 period indicates that irregular precipitation was experienced in Turkey. (Figures 2.5 and 2.6) (TSMS, 2018). This affects agriculture and energy generation, and also impact water resource management, including irrigation, drinkingwater and other hydrologic systems and operations.

Figure 2. 5 Annual mean areal precipitation distribution in Turkey (1981-2010)
(Source: TSMS, 2018)

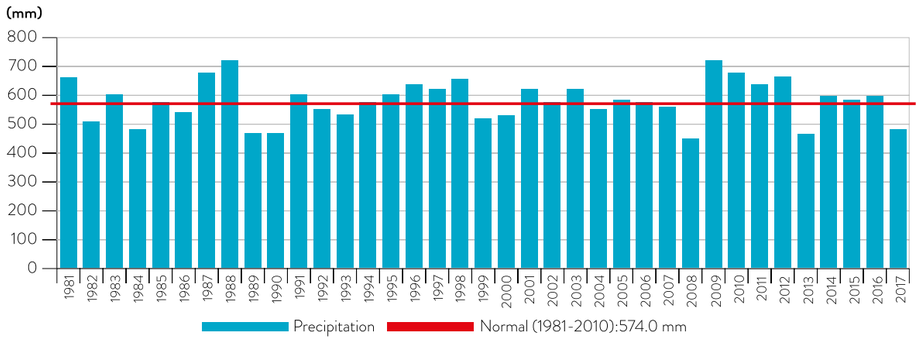

Figure 2. 6 Annual average precipitation in Turkey, 1981-2017
(Source: TSMS, 2018)

The number of meteorological extreme events has been increasing particularly since 2000. A total of 654 and 598 meteorological natural disasters were reported in 2016 and 2017 respectively (Figure 2.7).

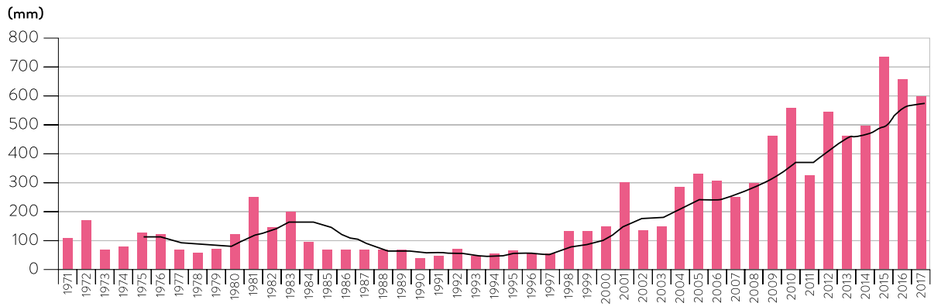

Figure 2. 7 Number of meteorological extreme events in Turkey, 1971-2017 (except heat & cold waves)
(Source: TSMS, 2018)

Distribution of meteorological extreme events in 2017 were; storm and tornado 36%, heavy rainfall and 31% flooding, 16% hail, 7% heavy snow, 4% lightning, 2% avalanche , 2% frost, and 2% others (Figure 2.8).

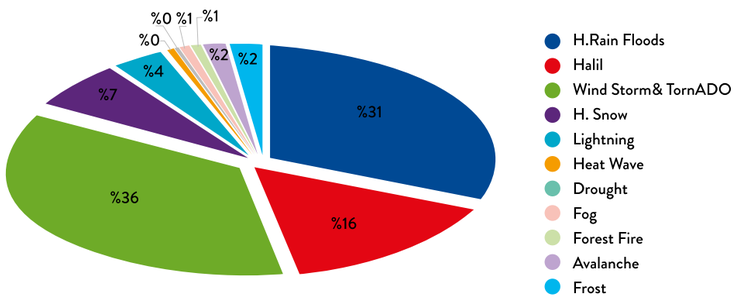

Figure 2. 8 Meteorological extreme events in 2016
Source: TSMS, (2018)

2.5 ECONOMIC PROFILE

Since 1990, the macroeconomic outlook of Turkey's economy has varied based on regional and global conditions. The Turkish economy demonstrated growth in 1990-2013 period excepting economic crisis years of 1994, 2001, and 2008. Decreasing trend was observed in GDP during 2014-2016 period (Figure 2.9).

Turkey's Gross Domestic Product (GDP) was 862.74 billion US Dollars in 2016. The per capita GDP in 2016 was USD 10,883. Manufacturing industry had the highest contribution in GDP with 16.6% in 2016. It is followed by wholesale and retail trade with 11.4%, construction with 8.6%, real estate activities and 7.7%, transport and storage and 7.6% agriculture, forestry and fishing with 6.2% (TurkStat_c, 2018).

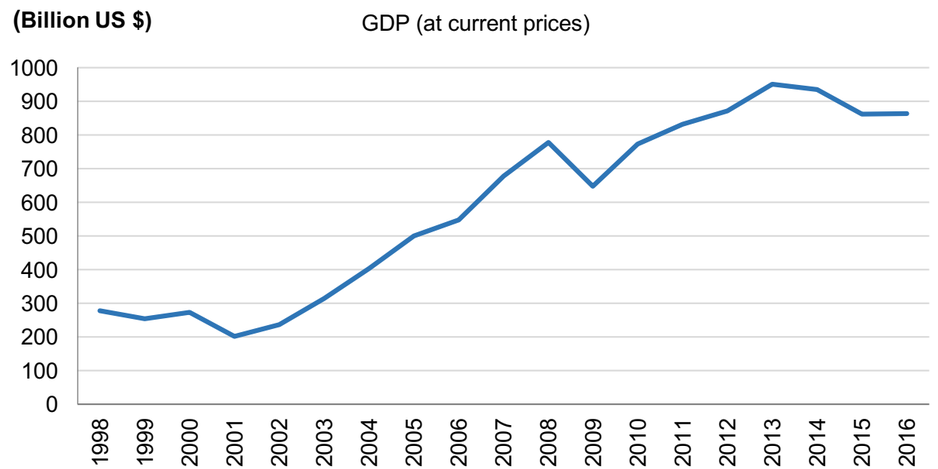

Figure 2. 9 GDP (at current prices), 1998-2016. Data source: TurkStat_c, 2018

According to the targets of the Medium-Term Programme (MTP) 2019-2021, Turkey aims to grow 2.3%, 3.5% and 5 % for successive three years. With regard to the estimates of OECD, Turkey will be one of the fastest growing economies in the period of 2015-2025 with the average annual growth rate of 4.9 %. Economic growth is the main driver of Turkish anthropogenic GHG emissions. GHG emissions is expected increase in parallel to the GDP growth in the next decade.

Turkey had an overall trade valueof 341 billion USD in 2016, 143 billion USD coming from exports and 199 billion USD from imports. Turkish foreign trade value has grown in the periods between 1990-2013 except economic crisis years of 1994, 2001 2009. Both the imports and exports values of Turkeyincreased. The value of trade decreased in the period between 2014-2016. Foreign trade deficit increased from 9.3 billion USD in 1990 to 56.1 billion USD in 2016. The highest 3 value of export in 2016 was vehicles railway or tramway rolling-stock, boilers, machineries and mechanical appliances and precious stones, precious metals and pearl. The highest 3 volume of import in 2016 was boilers, machineries and mechanical appliances, mineral fuels, minerals oils and products, and electrical machinery and equipment (TurkStat _d, 2018).

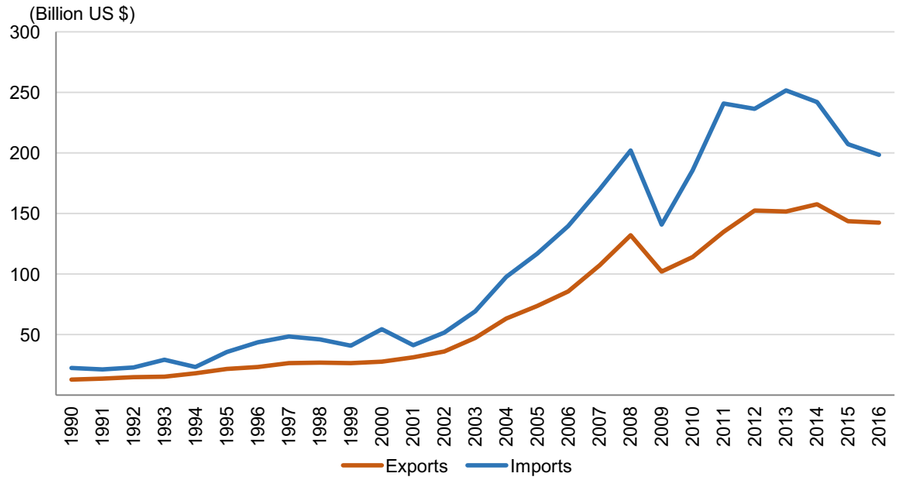

Figure 2. 10 Foreign trade, 1990-2016. Data source: TurkStat_d, 2018

2.6 ENERGY

2.6.1 Primary Energy

Production from Primary Energy Resources

Turkey has the highest rate of growing energy demand among OECD countries over the last 15 years. According to the targets of the Medium-Term Program (MTP) 2019-2021.Growing economy, population increase, urbanization has led to an increased demand of energy. The domestic energy resources of Turkey, especially in terms of oil and natural gas reserves are quite limited and are not adequate to meet the national demands. Turkey was able to meet only around 26 % of its total energy demand from its own domestic resources in 2016. Turkey is dependent on imported fuels, and 91.3% of the oil supply and 99.7% of the natural gas supply wasimported. Energy import dependency is increasing due to the growing energy demand. Likewise, Turkey has been only second to China in terms of highest rate of growing demand for electricity and natural gas in the world since the year 2002. The projections by the Ministry of Energy and Natural Resources indicate that this trend will remain the same in medium and long term.

Total primary energy supply was 52.5 Mtoe in 1990 and increased to 136.2 Mtoe in 2016 (with 160% increase). The share of fossil fuels in total primary energy supply was 82% in 1990, and 87.3% in 2016.The share of renewables, on the other hand, was 12.4% in 2016 (MENR, 2017).The primary energy supply is given in Figure 2.11.

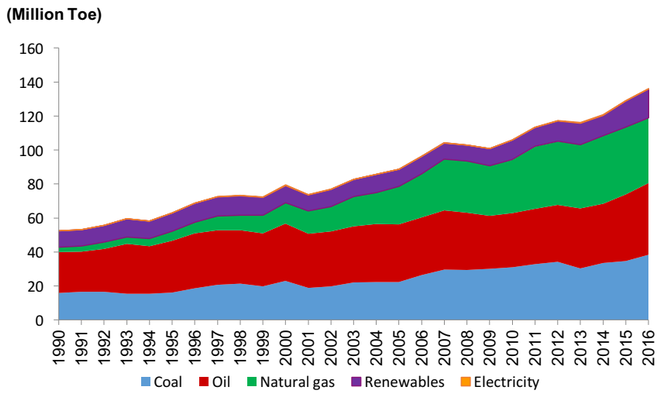

Figure 2. 11 Primary Energy Supply 1990-2016. Data source: MENR, 2017

Total installed power capacity of Turkey increased fourfold since 1990 and reached to 78.497 GW in 2016. It is expected to reach 114GW by 2023 .The share of domestic resources in total installed power capacity was 56.6% in 2016.

Consumption of Primary Energy Sources

Final energy consumption of Turkey increased from 42.2 Mtoe in 1990 to 104.6Mtoe in 2016. Although energy consumption has risen from 1990 to 2016, in periods of economic crisis (i.e. 1994, 2001 and 2008) clear decreases were observed especially for industrial sector (Figure 2.12). Industrial sector and construction sector are the highest energy consuming sectors and accounts for around 65 to70% of final energy consumption.[2] In 2016, 32% Industrial sector accounted for, residential, 32% commercial and institutional sector, 25% transportationand 4% agriculture (MENR, 2017), (Figure 2.13).

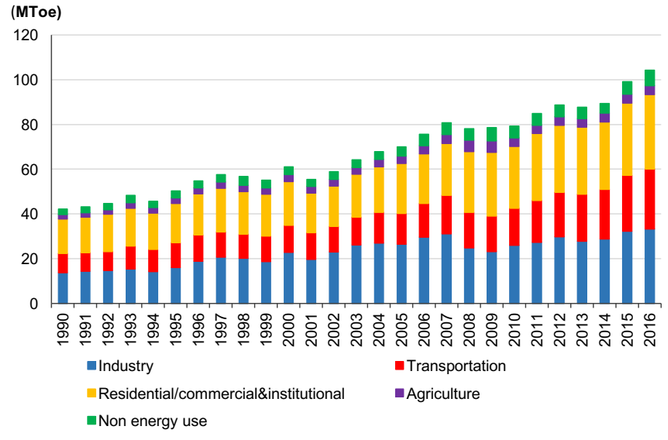

Figure 2. 12 Final energy consumption by sector, 1990-2016. Data source: MENR, 2017

[2] *Ministry of Energy and Natural Resources, General Directorate of Energy Affairs (MENR- GDEA), 2018*

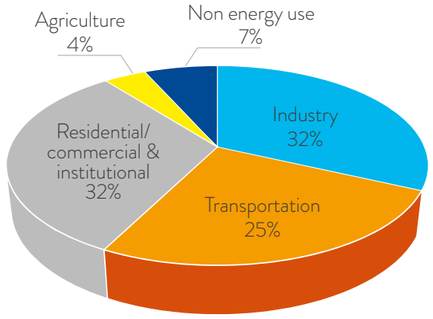

Figure 2. 13 Distribution of final energy consumption by sectors, 2016. Data source: MENR, 2017

2.6.2 Renewable Energy Sources

In 2016, 12% (16.9 Million TOE) of Turkey's total primary energy supply was met by renewable energy sources. As of the end of 2016, 17% of the renewable energy supply in Turkey was from biomass sources, 34% from hydraulic sources, 36% from geothermal sources, 8% from wind, and 5% from solar energy (MENR, 2017) (Figure 2.14).

In terms of power generation, renewable energy installed capacity reached to 34582 MW (44.1% of total installed capacity) in 2016. More than 90% of the renewable energy was generated from the hydraulic sources and wind (TEİAŞ_a,b 2018). Turkey has an important renewable energy sources potential, however; an important part of this potential is not yet utilized.

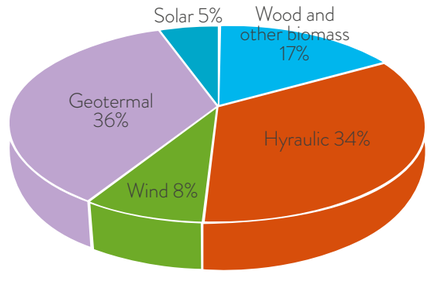

Figure 2. 14 Renewable energy by energy resources, 2016. Data source: MENR, 2017

Wind Energy

According to the Wind Energy Potential Atlas, the potential of Turkey is 48.000 MW, 38.000 MW of which is onshore while 10.000 MW is offshore (GDRE, 2018). Wind power-based electricity generation facilities in Turkey have been increased. The wind power plant capacity which used to be 18.9 MW in 2002 reached to 5751 MW in 2016 (TEİAŞ_a, 2018).

In order to make maximum use of Turkey's wind power potential, to ensure integration of more wind farms and to be able to predict the electricity power to be generated from wind, a regulation published in 2013 introduced the condition of connecting wind power plants to Wind Power Monitoring and Forecasting System (RITM). In this framework, 151 wind power plants with a capacity of over 10 MW have been connected to the RITM (99% of the installed power ofthe total installed power was 6543 MW). Power generation of operational WPPs can be simultaneously monitored and power generation for 48 hours can be forecasted. Moreover, the activities with the aim of reducing forecast error ratio for the electricity generated from wind are in progress within the scope of the RITM Project (GDRE, 2018).

Solar Energy

Turkey, judging by its geographical location on the globe, is situated in one of the most advantageous regions in terms of benefiting from solar energy, which is called the solar belt. According to Turkey's Solar Energy Potential Atlas (GEPA) prepared by the GDRE, total annual insolation time is 2.737 hours (total of 7.5 hours per day) and total annual solar energy derived is 1.527 kWh/ m2 (total of 4.2 kWh/ m2 per day) (GDRE, 2018).

Geothermal Energy

Geothermal energy is a significant domestic and renewable energy source for Turkey due to its intensive tectonic movements. Theoretically speaking, the geothermal potential of Turkey is 31.500 MWt and 12% of this potential is again theoretically expected to be suitable for electricity generation. Judging by the temperature of current springs and falls in Turkey, 58% of geothermal energy is used for heating purposes (greenhouse, residential areas, plants, etc), 30% for thermal tourism, and 12% for electricity generation.

The heat potential in Turkey is estimated to be 16.098 MWt, out of which 3.322 MWt is used for heating purposes. However, the utilization of available resources is observed to be around 20%, given the total potential. In Turkey, there are 19 settlement units which use geothermal energy in the heating systems, which corresponds to approximately an equivalent of central heating for 115.000 houses.

Even though the technical potential for generating electricity from geothermal sources is estimated to be 4000 MW, the total installed power in Turkey reaches to 832 MW as of the end of 2016 (GDRE, 2018).

Hydraulic Energy

Turkey's gross theoretical hydropower potential is 433 billion kWh. However, as it is not possible to use the whole potential with the existing technologies, technically feasible potential is about half of this amount(which is at 216 billion kWh). Further limitation is the fact that each facility that can technically be constructed may not be very cost friendly. Therefore, the more realistic potential is closer to 180 billion kWh/year. Turkey has about 2.3% of the world's economically viable hydropower potential and about 17% of Europe's total potential.

As of the end of 2016, there were 594 hydropower plants, with the total capacity of 26678MW. This is the equivalent of 34% of the total capacity. In 2016, hydroelectricity production has been increased to 67.2 billion kWh which means 24.5% of our electricity production was obtained from hydropower. additional hydropower plants are currently under construction, further helping Turkey to meet the potential for enhanced hydropower development (DSI, 2018)

Biomass Energy

Until 2011 there were only a few biomass plants, producing energy from waste water , the number of plants generating energy from various biomass sources reached 72 with the total capacity of 404 MWe as of the end of 2016 (GDRE, 2018).

According to the data from the Energy Market Regulatory Authority, the installed bioethanol capacity in Turkey is 152.0 million litters with three active facilities. The total amount of bioethanol production in the year of 2017 was 78.864,39 tons. In addition, the biodiesel capacity in Turkey is 230,000tons and the total amount of biodiesel production in the year of 2017 was 65.603,50 tons according to the data of Energy Market Regulatory Authority.

The Biomass Energy Potential Atlas (BEPA) prepared by the General Directorate of Renewable Energy (GDRE) for identifying biomass potential of Turkey. According to the Atlas, the biomass potential is identified, in theory, as 44.1 million Toe.

Electricity Sector

According to the latest national greenhouse gas inventory, the total CO_2 emission released by the energy sector in 2016 was 361 million tons of CO_2 eq., 136.2 million tons of this is attributable to the electricity sector. Installed power capacity increased from 16318 MW in 1990 to 79497 MW in 2016. Annual electricity production grew from 57.5 TWh to 274.4 TWh in the same period.

Coal and natural gas had the highest share in total electricity generation in 2016 with 33.7% and 32.5% respectively. Share of hydro power was 24.5%, other renewables were 8.6% and liquid fuels was 0.7% (TEİAŞ_b, 2018).

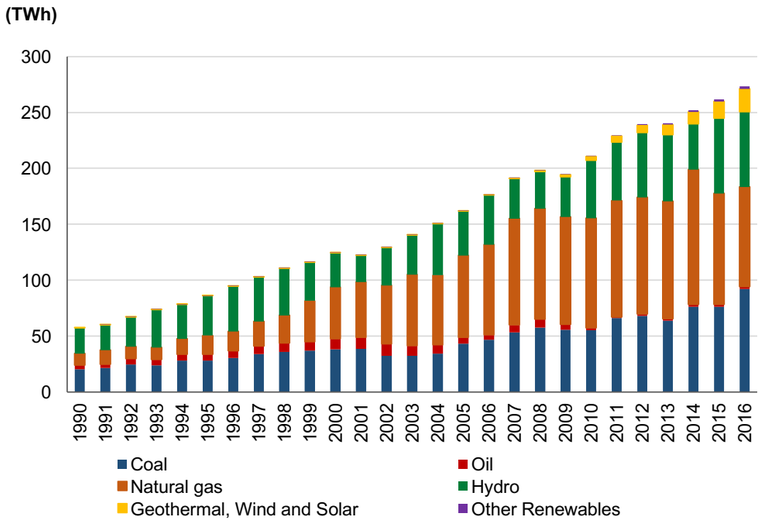

Figure 2. 15 Electricity generation by primary energy resources, 1990-2016. Data source: TEİAŞ_b, 2018

2.6.3 Energy Efficiency

Energy efficiency is a crucially important component of the National Energy and Mining Policy in terms of security of supply. An overall target to reduce the energy intensity by 20% until 2023 compared to the 2008 levels is formulated. Accordingly, in the National Energy Efficiency Action Plan (2017-2023) the importance of sustainable development along with competitive and green growth has been a topic of intrest. Thereby, Turkish primary energy consumption will be reduced by 14% (23.9 MToe) and a cumulative saving of 66.6 million tons CO2 emission is expected by 2023 through an investment of 10.9 billion USD.

As a result of energy efficiency activities conducted in 2000-2016 periods, cumulative energy savings, in manufacturing industry is estimated to be 9.8 million Toe, in residential sector is estimated to be 7.7 million Toe and in transport sector is to be 24.9 million Toe. Thus, 42.5 million Toe energy savings has been achieved in final energy consumption during 2000-2016 periods and resulted in corresponding emission reduction as compared to non-energy saving situations

2.7 BUILDING STOCKS AND URBANISATION

Turkey has a high rate of urbanization with an annual urban population increase of around 2%. Urban population increased from 29 million to 70.2 million during 1990-2016 periods. High rate of urbanization leads to a fast-growing building stock and intensive need of transportation in cities. The construction sector is one of the most important drivers of the Turkish economy, contributing 8.6% of gross domestic product (GDP) growth. The construction sector in Turkey that includes residential, commercial and public buildings which is responsible for 32% (33.3 million Toe) of the country's total energy consumption in 2016.

According to the building census results (TurkStat_e, 2018), the number of buildings in Turkey grew from 4.3 million in 1984 to 7.8 million in 2000, and the number of dwelling units in the same period reached 16.2 million reflecting an increase of 129%. Construction sector has been growing rapidly. According to structure permits statistics, the majority of new buildings are constructed after 2002. 47 thousand new building with a total floor area of 31.7 million m2 was constructed in 2002. In 2016, 118.8 thousand new building with the floor area of 151.2 million m2 were constructed (Figure 2.16), (TurkStat_e, 2018).

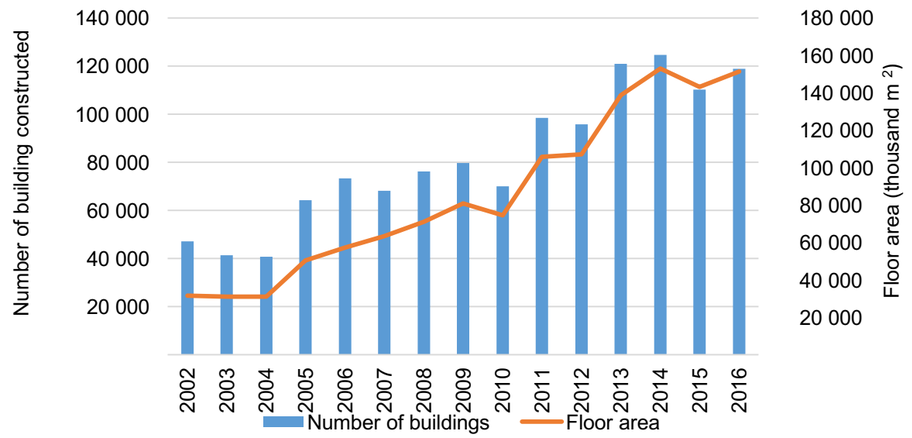

Figure 2. 16 Number of buildings constructed by year. Data source: TurkStat_e, 2018

The share of residential buildings is 86% of the total building stock, it is followed by commercial buildings. Public buildings are the smallest category of the stock (Figure 2.17), (TurkStat_f, 2018).

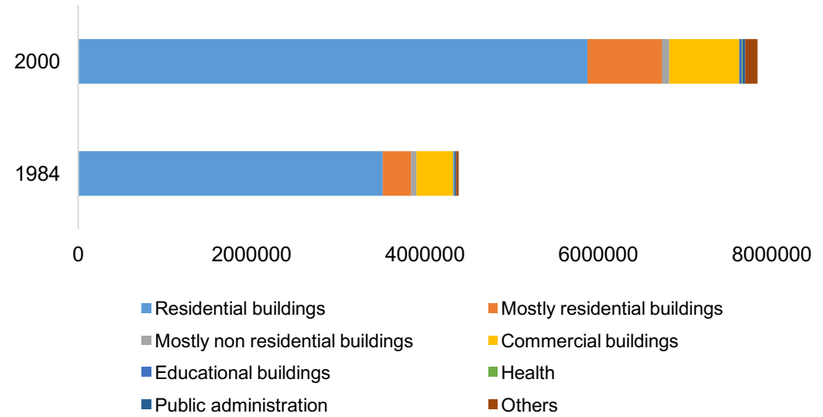

Figure 2. 17 Number of buildings by building type in 1984 and 2000. Data source: TurkStat_f, 2018

In 2016, energy consumption in buildings is met by natural gas (36%), electricity (30%), coal (18%), renewable energy sources (13%) including solar, geothermal, wood and plant/animal residues, and liquid fuels (3%) (Figure 2.18), (MENR 2017).

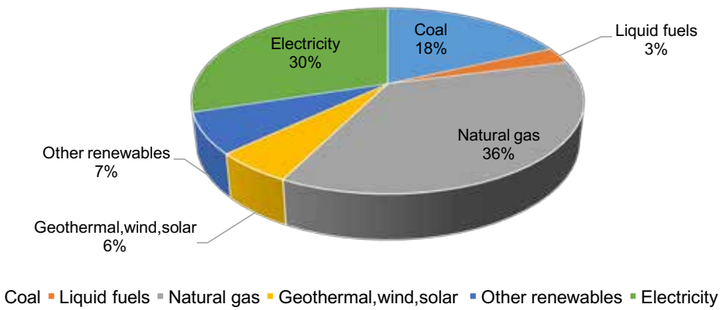

Figure 2. 18 Energy Consumption in buildings by energy resource. Data source: MENR, 2017

Building sector is responsible for 16% of total GHG emissions in 2016. Energy consumption of buildings has been increasing by 4% per year since 1990. Although energy efficiency activities lower the rate of increase in energy consumption of buildings, growing building stocks is expected, with a continues increase in GHG emissions in Turkey.

2.8 INDUSTRY

Turkish industry is composed of many different sub-sectors with different characteristics that represent 20-25% in GDP. Industry greatly affects national economic growth. In the industry sector by Statistical Classification of Economic Activities in the European Community (NACE) Rev. 2, manufacturing industry had 83.8% share of turnover. 12.4% of turnover was in electricity, gas, steam and air conditioning supply, 2% was in mining and quarrying, 1.8% was in water supply, sewerage, waste management and remediation activities in 2016. Manufacturing industry also had the biggest share in the number of employees with 97%. The food, basic metal, manufacture of motor vehicles, trailers and semi-trailers, and textile industry represent the largest contributors to manufacturing industry turnover with an 15.6%,9.7%, 8.7% 8.4% share respectively. Those sectors are followed by fabricated metal productsexcept machinery and equipment, wearing apparel,manufacture of the Non-metallic mineral products, rubber and plastic products, and electrical equipment (TurkStat_g, 2018).

Table 2. 2 Main indicators of industry sector, 2016

	Number of enterprises	Number of persons employed	Turnover (TRY)
Mining and quarrying	4 793	125 879	31 163 777 308
Manufacturing industry	379 894	3 922 221	1 314 067 168 530
Electricity, gas, steam and air conditioning supply	3 193	101 256	194 733 932 790
Water supply; sewerage, waste management and remediation	3 825	102 941	27 827 462 540

Source: TurkStat_g, 2018

The automotive industry has the highest share of Turkish exports, representing 14.8% of exports. Other export industries include the basic metal industry (with 12.5% of the exports) and textiles (with 9.5% of exports) in 2016 (TurkStat_h, 2018). Small and medium-sized enterprises (SMEs) constitute 99% of the total number of industrial businesses, constituting 46% of the total employment and generating 35% of the added-value (TurkStat_g, 2018).

Primary energy consumption of industry in 2016 was 33.3 million Toe, responsible for 32% of the total energy consumption. The largest two single industries, in terms of primary energy consumption have been Non-metallic mineral industry with 30 % (10.1 million Toe) and the iron and steel industry with 26% (8.7 million Toe) (MENR,2018).

Although energy consumption of industrial sector increased from 13.6 Mtoe to 33.3 Mtoe during 1990-2016 periods, emission intensity of the sector decreased considerably from 2.4-ton CO_2-eq/Toe to 1.8-ton CO_2-eq/Toe in the same periods. Energy efficiency activities, increasing share of renewables and use waste as an alternative fuel is expected to lead to lower the rate of increase in GHG emissions from industrial sector.

2.9 TRANSPORTATION

The transport sector was responsible for 25.6% (26.8 million Toe) of Turkey's final energy consumption in 2016. Road transport was responsible for 92.9% of energy consumption in transportation sector and air transport was responsible for 5.3%. The largest portion of transportation sector GHG emissions was from road transport and domestic aviation with 92.4% and 5.2% respectively in 2016. The number of road motor vehicles have been increasing since 1990. While there were 3.8 million road motor vehicles in 1990, this number reached approximately to 21.1 million in 2016 (Figure 2.19). This is reflected in the rise of road motor vehicles per 1000 people from 66 in 1990 to 264 in 2016 (TurkStat_i, 2018)

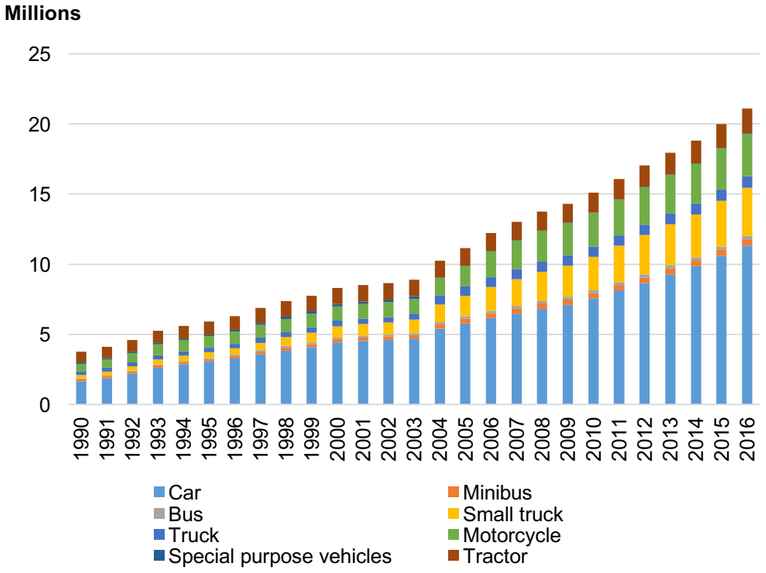

Figure 2. 19 Road motor vehicles, 1990-2016. Data source: TurkStat_i, 2018

As a result of recent motored vehicle technology and an increase in alternative fuel use after 2003, the transport efficiency has increased. LPG was introduced in road transportation after 1997 and fuel used shifted from gasoline and diesel to diesel and LPG in road transportation. The share of LPG in total energy consumption of road transport reached

to 15% in 2016. Since the Carbon intensity of LPG is the lowest among other liquid fuels, a decrease in GHG emissions from road transportation was seen.

As a result of tax incentive policy; to remove the vehicles over 20 years old from the market caused the removal of approximately 400,000 vehicles in 2013 and 2014 (TurkStat_i, 2018), resulting in CO_2 emission reduction. Also, the Ministry of Treasury and Finance launched a regulation in February 2011 to encourage the use of electric-motor based vehicles. This decision caused a reduction of tax in electric-motor based vehicles.

As a result of a new transport policy of (MoTI) domestic aviation was improved after the year 2003, to reach around 5% of the sectors total fuel consumption, with another 5% in Corresponding emissions. The GHG emissions from motor-ways is expected to increase over the years.

2.10 WASTE

The sector's most important greenhouse gases are methane (CH_4) and nitrous oxide (N_2O) and the waste sector alone is responsible for 25.8% of total CH_4 emissions and 6.5% of total N_2O emissions in the year 2016. Greenhouse gas emissions originating from the waste sector in Turkey are mainly related to solid waste disposal and wastewater treatment. Waste generation has been increasing continuously in Turkey. Significant improvement was achieved in waste management In 1994, by far the main disposal method for municipal waste was the open dumping of waste, nearly without the existence of any composting of waste or other biological waste recovery methods and only 2 sanitary landfills were available, 88 sanitary landfills were in operation by 2016 receiving 61.2% of the total municipal waste collected. Landfill gas collection and electricity generation facilities have become popular particularly in the last 5 years. The biogas production (collected gas) on landfills and wastewater treatment has reached to a capacity of more than 200 MWe. Biological treatment of waste is also on a verge of development. There are 13 biological waste recovery facilities and 1 co-incineration plant available in Turkey. 140.5 thousand tons of waste was treated in composting plants and 19.7 thousand tons of compost waste has been produced (TurkStat_j, 2018, MoEU_b, 2018).

Recovery of Methane from waste disposal sites and wastewater treatment plantsincreased significantly from the year 2002 onwards resulting in reduction of GHG emissions from waste sector. GHG emissions from waste disposal sites increased by 73.6% during 1990-2016 periods (from 6.7 Mt to 11.7 Mt), while waste disposal was increased by 83% in the same period. Wastewater discharge increased by 200% while GHG emissions from the same sector was increased by 6%. Methane recovery slows down the increase rate of GHG emissions. Based on Methane recovery, GHG emissions are expected to increase in a slower rate.

2.11 AGRICULTURE

Turkey's agricultural sector is accounted for 6.2%of the country's GDP in the year 2016. The main sources of agriculture sector GHG emissions are enteric fermentations, agricultural soils and manure management. Agricultural activities are the primary contributors of CH_4 and N_2O, 55.5% of CH_4 emissions and 77.6% of N_2O emissions originat from agricultural activities.

There were 30 agriculture basins defined by climate, soil characteristics, topography, and land class criteria in 2009. Basin-based agricultural support policy was implemented for 17 products. In order for more rational planning, district level agricultural basins were then defined in 2016 and the number of agricultural basins reached to 941 basins. 21 products have been under the scope of basin-based supporting system. By adding newly established ristricts, the number of basins are at 944 from 2018.

Value Added

The share of agriculture sector in GDP in 1960 was 54% in Turkey and Turkey was considered to be an agricultural country in those years. However, contribution of the agricultural sector to the economy gradually decreased and the share in GDP fell below 30% by the end of 1970, below 20% in the mid-1980s and below 10% by 2000s (World bank, 2018). By the year 2016 the share of agriculture in GDP was dropped to 6.2% Figure 2.20), (TurkStat_c, 2018), and the course of the ratio is expected to continue declining in the coming years.

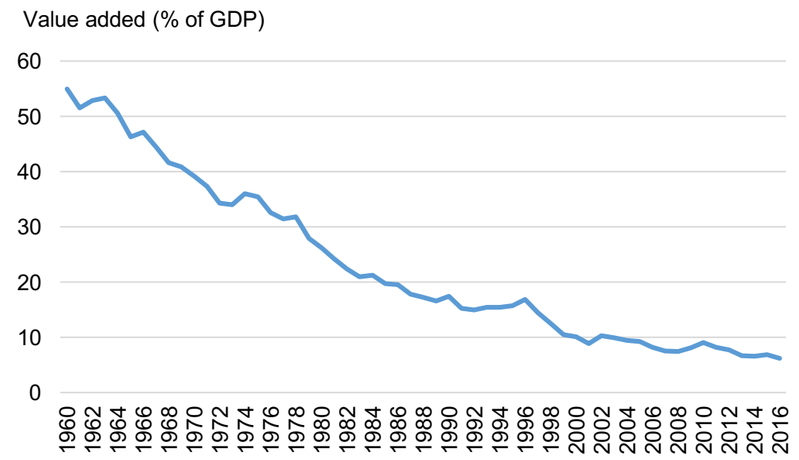

Figure 2. 20 Value added of Agriculture sector as % of GDP, 1960-2016. Data source: World bank, 2018

Agricultural Lands

There has been a significant decline of agricultural lands in Turkey since 1990. Turkey had 23.7 million hectares arable land in 2016 while it was 27.9 million hectares in 1990 (Figure 2.21). There are 921 different agricultural basins based on rainfall, temperature and topographical properties. In those agricultural basins above 250 agricultural products are produced and sold. Of the total arable land, 67% is cropland, 17% is fallow land and the rest of them are cultivated as horticulture, vegetable, vineyards and olive gardens (TurkStat_l 2018).

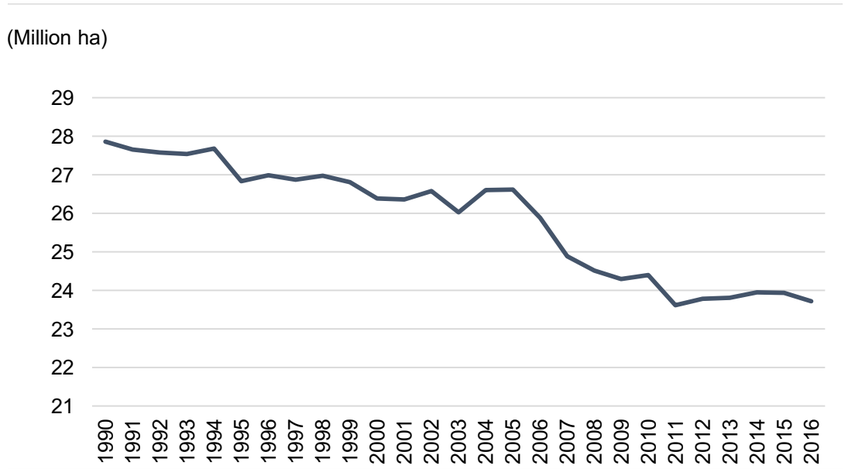

Figure 2. 21 Total arable land and land under permanent crops. Data source: TurkStat_l, 2018

Livestock

Livestock has the biggest share of the agricultural GHG emissions and is an important part of Turkey's agricultural sector. In 2016 the total number of cattle is approximately 14 million, and for sheep and goats, it is around 31.5 and 10.4 million, respectively while those numbers were 11.4 million, 40.6 million and 10.9 million respectively in 1990 (TurkStat, 2017, 2). Turkey has experienced a decline in the number of sheep and goats since 1990 (UNFCCC, 2018). Based on recent agricultural policy to increase livestock for sustainable food supply from domestic sources, GHG emissions is expected to increase from enteric fermentation and manure management

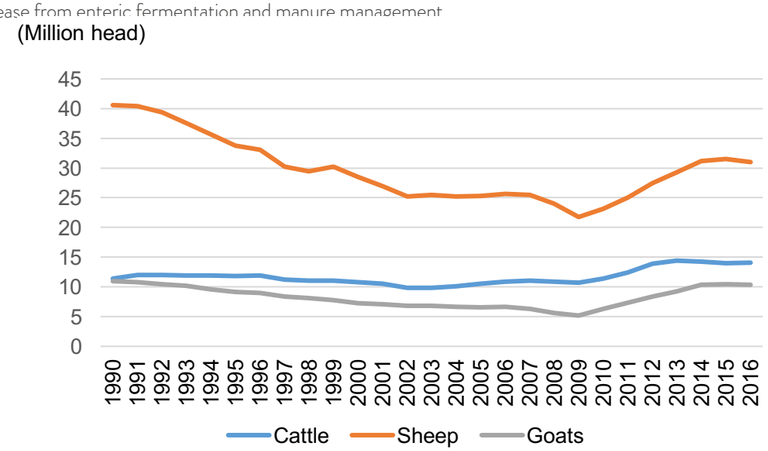

Figure 2. 22 Livestock population, 1990-2016. Data source: UNFCCC, 2018

Organic Farming Practices;

Organic farming in Turkey began practice in the mid-1980s. In order to create an improvment in legal framework for organic farming, the By-Law on Production of Plant and Animal Products through Ecological Methods entered into force by 1994. The Organic Farming Act No. 5252 was prepared within the framework of the EU laws and was enacted in 2004. On the basis of this law, the By-Law on the Principles and Implementation of Organic Farming was passed in 2005 and underwent comprehensive changes in 2008. by2002, 310 125 tonnes of organic products were produced on an agricultural area of 89 827 ha, those figures were 543 033 ha agricultural land under organic farming with a crop production of 2.4 million tonnes in 2017 (MoAF, 2018).

Agricultural soils are one of the main drivers of agricultural sector's GHG emissions. In Turkey around 19.6 million hectares agricultural land is fertilized annually, 113 kg fertilizers per hectare is used on the average. Total N-fertilizer consumption increased from 1.2 Mton to 1.9 Mton during 1990-2016 (MoAF, 2018). The Increase in fertilizer consumption has foreseen a continuous increase in N_2O emissions from agricultural soils.

2.12 FORESTRY

Turkey is broadly located in the Mediterranean climate zone. Turkey is considered as one of the richest countries in terms of biodiversity which is the result of different topography and different climate zones. A great part of this biodiversity is located in the forest lands. In North Anatolia and parts of the Marmara region, forest ecosystems are composed of pure and mixed forests, which include coniferous tree species such as black pine, Scots pine, fir, spruce and juniper, as well as broad-leaved tree species such as beech, oak, hornbeam, alder, chestnut, ash, elm, poplar, maple, hazelnut and rhododendron. In the South, West and large parts of Marmara, the forests are pure and mixed Mediterranean forest ecosystems composed of coniferous tree species, such as red pine, black pine, Taurus fir, Taurus cedar, juniper, stone pine,

Aleppo pine, maritime pine and cypress, as well as broad-leaved tree species such as sweet gum, oak, eucalyptus along with maqui's elements such as sandal and laurel. Along with the steppes, Turkey has arid and semi-arid forest ecosystems consisting of especially pine, Scots pine, cedar, juniper and oak species. Turkey also has forest ecosystems that are within transition zone between coastal and inland regions in Central, Eastern and South-eastern Anatolia regions.

A large portion of Turkey's forests are natural forests with high biodiversity values. Many of the plant species have additional values in raw material production, including wood, and the use of roots, bark and resin for medicinal and aromatic purposes. Many of the harvested fauna species are used for the production of herbal products of animal origin.

According to forest inventory results, forest area was 20.2 Mha in 1973 and increased to 22.57 Mha in 2016. Forest lands increased nearly 2,3 M hectares in the last 42 years. According to 2016 forest inventory results, approximately 9.4 M hectares of this forest estate can be classified as degraded forests. The inventory estimates that growing stocks increased from 1.1 billion m^3 to 1.6 billion m^3 during 1973-2016 periods. The annual increment of the forests in Turkey changed to 28.1 million m^3 which is 1.4 m^3 in 1 ha in 1973 to 46.97 million m^3 in 2.1 m^3 in 1 ha in 2016. The main reason of this increment is the increase of growing stock due to the maintenance activities species (UNFCCC, 2018).

Pinus brutia, Pinus nigra and, Pinus sylvestris are the dominant coniferous species among the other coniferous such as four kinds of Abies spp., Picea orientalis, Cedrus libani etc. In portion these three-pine species is more than 52 % as in totalvolume of growing stock. Fagus orientalis and 22 Quercus spp. have 68% ratio in total volume of the deciduous trees such as Tilia, Ulmus, Alnus, Castanea species (UNFCCC, 2018).

99% of the forests in Turkey belong to the state. 4.1 million hectares of the total forest area (19%) are found in protected areas and the rest of the 17.3 million hectares of forest area are in managed forests

Table 2. 3 Forest inventory results of Turkey, 2016. Source: GDF, 2018

Area					
	High forests (ha)		**Total high forests (ha)**	**Coppices (ha)**	**Total forest area (ha)**
	Coniferous	**Deciduous**			
Productive1	6 340 328	6 102 780	12 443 108	633 111	13 076 219
Degraded2	3 565 661	4 331 552	7 897 213	1 596 736	9 493 949
Total	9 905 989	10 434 332	20 340 321	2 229 847	22 570 168
Growing stock					
	High forests (m^3)		**Total high forests (m^3)**	**Coppices[1] (m^3)**	**Total forest growing stock (m^3)**
	Coniferous	**Deciduous**			
Productive1	849 918 006	690 805 569	1 540 723 575	29 215 427	1 569 939 002
Degraded2	30 056 551	30 838 234	60 894 785	10 376 601	71 271 386
Total	879 974 557	721 643 803	1 601 618 360	39 592 028	1 641 210 388
Annual volume increment					
	High forests (m^3)		**Total high forests (m^3)**	**Coppices[1] (m^3)**	**Total forest annual increment (m^3)**
	Coniferous	**Deciduous**			
Productive1	23 885 600	19 783 910	43 669 510	1 277 030	44 946 540
Degraded2	746 726	792 962	1 539 688	487 331	2 027 019
Total	24 632 326	20 576 872	44 946 540	1 764 361	46 973 559

Forest Restoration

Almost half of Turkey's forests are considered to be degraded, with less than 10% caNopy cover (Table 2.3). In addition, 2.3 million hectares of forest has a caNopy cover between 11% and 40%. The ability of forests to regenerate declines based on human-induced pressures, including industrialization and urbanization. However, in areas where threats have been reduced, forests have regenerated. The General Directorate of Forestry has been conducting activities on

the restoration of damaged forests and reforestation since 1995. The main goal of these efforts is to develop forest structure thorough the sink capacity and increase the yield ratio of forests. This process also covers the maintenance of naturally regenerating forests species. Reforestation and rehabilitation have been carried out in Turkey. In 2016 48230 ha was reforested and 106267 ha was rehabilitated (GDF, 2018).

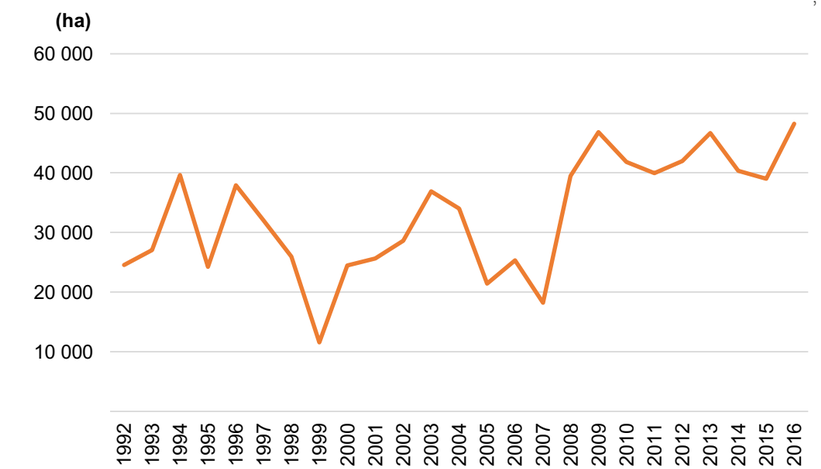

Figure 2. 23 Reforestation Activities, 1992-2016. Data source: GDF, 2018

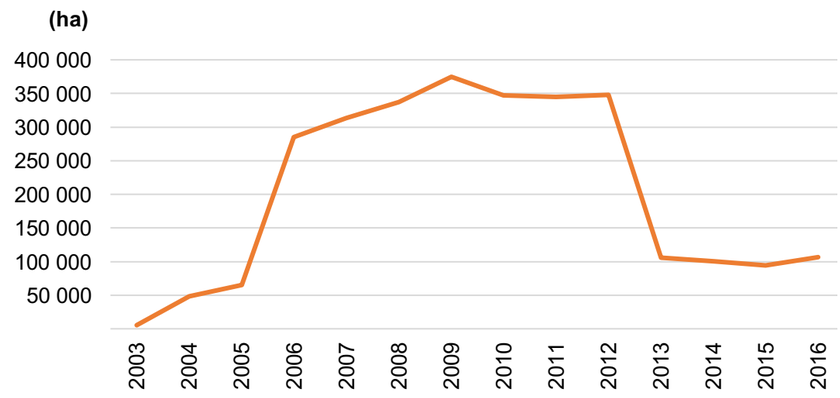

Figure 2.24 Forest Rehabilitation Activities, 2003-2016. Data source: GDF, 2018

Sustainable forest management activities aim to increase forest area and growing stocks in Turkey through reforestation, rehabilitation and Carbon removal rate is expected to increase in the next decade. GDF has a target for increase the growing stocks per hectare and forest area in the Strategic Plan of GDF (2017-2021)

2.13 TOURISM

Surrounded by seas on three sides, acting as a natural bridge between Asia and Europe, and with unique geopolitical importance, Turkey has been a cradle of great civilizations throughout history. There are nine World Heritage Sites in Turkey and an additional 18 temporarily listed values on the World Heritage List. With its 8,333 km long European coastline Turkey's is a major tourist attraction. Tourism is also the country's main source of foreign exchange.

Turkey is the 6th most popular tourist destination in the world, attracting more than 30 million tourists annually and continuing to show positive growth year-on-year. Turkey has 444 blue-flag beaches in 2016. There are also 22 blue-flag marinas in Turkey. Bed capacity documented by the Ministry of Culture and Tourism was 568,960 in 2000 and reached 1.2 million in 2016. Bed capacity documented by the municipalities grew from 350,000 in 2000 to approximately 496 538 in 2016. The majority of tourism businesses are represented by hotels and hostels. Hotels and hostels make up over 80% of the bed capacity (MoCT, 2018).

According to the Ministry of Culture and Tourism, there has been a rapid increase in the number of tourists coming to Turkey (Figure 2.24). The annual number of tourists has grown from approximately 5.4 million in 1990 to 31.4 million in 2016. It was 41.6 million in 2015. Tourism revenue worth of 22.1 billion USD was generated in 2016 (TurkStat_m, 2018).

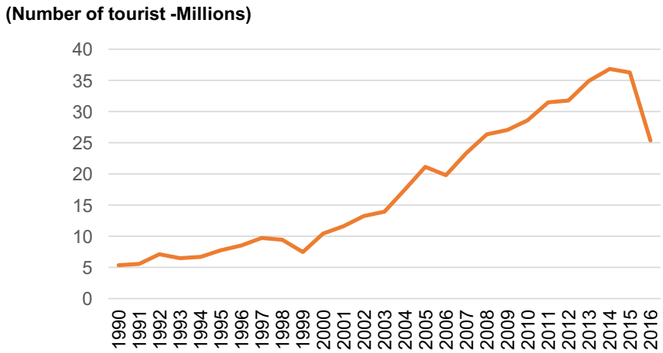

Figure 2. 25 Number of tourists, 1990-2016. Data source: TurkStat_m, 2018

Turkish tourism sector is targeting to be among the top 5 countries in the world in terms of attracting the highest number of tourists and receiving the highest amount of tourism revenue by 2023. The tourism sector has set a target of 50 million tourist arrivals and 50 billion USD tourism revenue by 2023.

2.14 WATER RESOURCES

Rainfall and River Basins

Turkey has a large variety of spatial and temporal precipitation patterns. There is strong seasonality in precipitation. Approximately 40% of the total annual rainfall occurs in winter, 27% in spring, 10% in summer and 24% in autumn. The amount and type of precipitation in the winter and spring seasons are important for replenishing underground and surface water resources. The Black Sea and Mediterranean coastal areas and high mountain areas are the places in Turkey with highest precipitation. The amount of average annual rainfall is highest in the Rize region with rainfall of about 2,300 mm. In contrast, the Central and Eastern Anatolia regions, especially in the lower plains and deep valleys and depressions of tectonic origin, have low precipitation values with the average annual amount of precipitation falling below 350-400 mm.

River hydrological regulations in Turkey depend heavily on the variability of precipitation and these rivers regulations are thus quite irregular. According to General Directorate of State Hydraulic Works (DSİ), Turkey has 25 hydrological basins. Turkey has a hydro-meteorological observation network of 2045 observation stations, of which are261 snow monitoring stations and 120 lake observation stations, all of which are operated by the DSİ.

Water Potential and Budget

Turkey's consumable surface and ground water potential is 112 billion m^3 per year. Based on the projects developed by the public institutions responsible from soil and water resources in Turkey annual water consumption for various purposes reached to 54.0 billion m^3 as of the end of 2016.

Utilization rate of the current 112 billion m^3 of available water resources is still around 48,2%. 40 billion m^3 of the available water is used for irrigation (74%), 7 billion m^3 is used for drinking water (13%), and 7 billion m^3 is used in the industry (13%). 39.0 billion m^3 (72.2%) of the consumed water is supplied from surface waters and 15.0 billion m^3 (27.8%) from groundwater.

Water consumption in Turkey is increasing due to population growth and industrialization. However, Turkey is a country that is not rich in freshwater resources. According to the annual per capita water consumption figures, Turkey is a country that experiences water stress. The amount of annual water available per capita is calculated as 1403 m^3.

Turkey's Hydroelectric Potential

Turkey's gross theoretical hydropower potential is 433 billion kWh. However, as it is not possible to use the whole potential with existing technologies, technically feasible potential is about half of this total (at 216 billion kWh). Further limiting potential is the fact that each facility that can technically be constructed may not be economical. Therefore, technical and economic potential is closer to 180 billion kWh/year. Turkey has about 2.3% of the world's economically viable hydropower potential and about 17% of Europe's total potential.

As of the end of 2016, there were 594 hydropower plants, with a total capacity of 26678 MW. This is the equivalent of 34% of the total capacity. In 2016, hydroelectricity production has realized 67.2 billion kWh and 24.5% of our electricity production was obtained from hydropower. Additional hydropower plants are currently under construction, further helping Turkey meet the potential for enhanced hydropower development.

2.15 TURKEY'S SPECIAL CIRCUMSTANCES

The 1992 United Nations Framework Convention (UNFCCC) established a system of annexes that divided countries into Annex I and II countries and Non-Annex countries. The Annex I countries included the industrialized countries that were members of the OECD and the former countries of the USSR as "Economies in Transition" [EIT]. Annex II included the developed and industrialized countries. Turkey, a developing country, because of its membership with the OECD was included in both Annexes I and II. The Non-Annex countries were considered as developing countries. However, the UNFCCC does not provide a definition of "developed" or "developing" countries. Turkey did not sign the UNFCCC when adopted in 1992 and in 1997 initiated the process to be deleted from Annexes I and II.

In 2001, at the Seventh Conference of the Parties held in Marrakesh, Decision 26/CP.7 was adopted and Turkey was removed from the list in Annex II. Parties were also invited to recognize the "special circumstances of Turkey, which placed Turkey after becoming a Party, in a situation different from that of other Parties included in Annex I to the Convention." The decision took note of FCCC/CP/1997/MISC.3, submitted by Turkey outlining its socio-economic status as a developing country. It was explained that GNP of Turkey was $2,700 and human-induced carbon dioxide emission was 2.3 tons per capita in 1993 and total of 153 million tons was 1/10 of the Annex II countries in the submitted document. The decision further underlined the need for all Parties to protect the climate system for present and future generations, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities. Turkey's position regarding its "special circumstances" is based on the principles of equity, common but differentiated responsibilities and respective capabilities, and the right to promote sustainable development in accordance with article 3 of the Convention. Further, difference from other Parties included in Annex I, Turkey does not bear historical responsibility for climate change.

Turkey subsequently became a Party to the UNFCCC in 2004 and submitted its First National Communication as an Annex I Party. In accordance with the Report (FCCC/IDR.1/ TUR, 3 December 2009) of the in-depth review of the first national communication of Turkey noted that Turkey had the lowest per capita primary energy consumption and the lowest per capita GHG emissions, among Annex I Parties. In spite of Turkey's national circumstances which follow the typical patterns of developing countries (e.g. relatively low per capita energy use and GHG emissions, high growth

rates in population and GDP, when compared with other Annex I Parties), considerable efforts have been undertaken in selected areas to contribute to GHG mitigation."

The World Bank lists Turkey as an upper middle-income developing country. According to World Bank's data in 2016, Turkey's gross national income was $ 10,950 per capita and carbon emission was 4.2 tons per capita. Because of this condition, Turkey is also eligible for official development aid under the OECD Development Assistance Committee list. (FCCC/TP/2013/3). Moreover, according to World Bank data, Turkey's per capita and total carbon emissions are lower than many developing countries that are outside Annex I Parties.

The Conference of the Parties has taken other decisions concerning Turkey in the coming years. 16. The decision 1/CP.16 adopted by the Conference of the Parties has officially recognized that Turkey's national circumstances are different from Annex-I countries and has clearly approved that Turkey is in a different position from the developed countries and countries in transition to a market economy. This decision also requested from the Long-Term Cooperative Action Ad Hoc Working Group (AWG-LCA) established under the Convention to dwell upon f Turkey to have better access to the financing, technology and capacity-building opportunities to develop its ability to apply the provisions of the Convention more effectively.

In Durban, decision No. 2/CP.17 was taken to continue to further develop the Cancun the decisions on Turkey

Decision No. 2/CP.17:

"Have agreed to continue the discussion on the procedures for providing support in mitigation, adaptation, technology development and transfer, capacity building and financing issues to assist in the implementation of the Convention..."

Decision No. 1/CP.18 accepted in Doha reaffirmed the importance of the financial, techNological and capacity-building supports to Turkey as an Annex I Party special circumstances of which is recognized by the Conference of the Parties so that it becomes able to implement the Convention more efficiently and encouraged the Annex II countries with appropriate conditions to provide financial, technological, technical and capacity-building supports to the Annex I countries with special position through multilateral agencies. The purpose of these supports is that these countries implement the climate change strategies and action plans in accordance with the decision No. 1/CP.16 and develop low-emission development plans. The aforementioned multilateral agencies term contains the concerned international organizations, international financial organizations, other collaborations, bilateral agreements, private sector and all types of institutional arrangements that may be deemed appropriate.

Decision No. 1/CP.18:

Parties included in Annex I to the Convention whose special circumstances are recognized by the Conference of theParties,

Reaffirming decisions 26/CP.7, 1/CP.16 and 2/CP.17, which recognizedthatTurkeyisinasituationdifferentfromthatof other Parties included in Annex I to theConvention; Recalling that deep cuts in global greenhouse gas emissions are required and that closing the ambition gap is a matter of urgency; Recognizing that various actions to address climate change can be justified economically in their own right and can also help in solving other environmental problems in accordance with the objectives of sustainable development;

Reaffirming the importance of financial, techNological and capacity-building support to Parties included in Annex I to the Convention whose special circumstances are recognized by the Conference of the Parties in order to assist these Parties in implementing the Convention,

1. Urges Parties included in Annex II to the Convention which are in a position to do so, through multilateral agencies,includingtheGlobalEnvironmentFacilitywith- in its mandate, relevant intergovernmentalorganizations, international financial institutions, other partnerships and initiatives, bilateral agencies and the private sector, or through any further arrangements, as appropriate, to provide financial, techNological, technical and capacity-building support to Parties included in Annex I to the Convention (Annex I Parties) whose specialcircumstances are recognized by the Conference of the Parties in or- der to assist them in implementing their national climate change strategies and action plans and developing their low-emission development strategies or plans in accordance with decision 1/CP.16;
2. R2. Requests the secretariat to prepare, for consideration by the Subsidiary Body for Implementation at its thirty-eighth session, a technical paper identifying opportunities for Annex I Parties whose special circumstances arerecognizedbytheConferenceofthePartiestobenefit, at least until 2020, from support from relevant bodies

established under the Convention and other relevantbodies and institutions to enhance mitigation, adaptation, technology, capacity-building and access tofinance;

3. Also requests the Subsidiary Body for Implementation, on the basis of the technical paper referred to in paragraph 95 above, to develop recommendations on this matter at its thirty-ninth session for consideration by the Conference of the Parties at its nineteenth session. "

In the decision of the Conference of the Parties, UNFCCC is requested to prepare a technical report identifying the opportunities that Turkey (Annex I Parties whose special circumstances are recognized by the Conference of the Parties) can benefit, at least until 2020, from support from relevant bodies established under the Convention and other relevant bodies and institutions to enhance mitigation, adaptation, technology, capacity-building and access to finance, to be evaluated by the Subsidiary Body for Implementation (SBI) at the next conference. The technical report with No. FCCC/ TP/2013/3 prepared by the secretariat states clearly that Turkey is an upper middle class rapidly growing country and that is appropriate for the official development assistance under the OECD Development Assistance Committee. According to the technical report prepared by the Secretariat, 20th Lima Conference of the Parties adopted the decisions similar to the decisions adopted in Doha at the 20th Conference of the Parties on the basis of the recommendations offered by the Subsidiary Body for Implementation (FCCC/TP/2013/3) (21/CP.20). According to this decision, the supports that can be received by Turkey at least until 2020 from the bodies established under the Convention, other relevant bodies and institutions in order to ensure progress in areas such as mitigation, adaptation, technology, capacity building and finance. The Annex-II countries have been invited to help Turkey with the implementation of national climate change strategies and actions plans and development of low-emission development plans and strategies in line with the decision No. 1/CP.16 by providing financial, techNological, technical and capacity-building support thorough multinational agencies including the GEF, relevant intergovernmental organizations, international financial institutions, other partnerships and initiatives, bilateral agencies and the private sector, or through any further arrangements, as appropriate.

Decision No. 21/CP.20:

Reaffirming decisions 26/CP.7, 1/CP.16, 2/CP.17 and 1/ CP.18, which recognized that Turkey is in a situation different from that of other Parties included in Annex I to the Convention,

Also reaffirming the importance of financial, techNological and capacity-building support to Parties included in Annex I to the Convention whose special circumstances are recognized by the Conference of the Parties in order to assist these Parties in implementing the Convention,

1. Recognizes the opportunities for Parties included in Annex I to the Convention whose special circumstances are recognized by the Conference of the Parties to benefit, at leastuntil2020,fromsupportfromrelevantbodiesestablished under the Convention and other relevant bodies and institutions to enhance mitigation, adaptation, technology, capacity-building and access to finance; Encourages Parties included in Annex I to theConvention whose special circumstances are recognized by the Conference of the Parties to fully utilize those opportunities; Urges Parties included in Annex II to the Convention which are in a position to do so, through multilateral agencies,including the Global Environment Facility within its mandate, relevant intergovernmental organizations, international financial institutions, other partnerships and initiatives, bilateral agencies and the private sector, or through any further arrangements, as appropriate, to provide financial, technological, technical and capacity-building support to Parties included in Annex I to the Convention whose special circumstances are recognized by the Conference of the Parties in order to assist them in implementing their national strategies, actions and plans on climate change mitigation and adaptation, and in developing their low-emission development strategies or plans in accordance with decision1/CP.16.

The Conference of the Parties having recognized Turkey's special circumstances ackNowledge that Turkey is an upper middle-income developing country still undergoing rapid development in need of financial support to enable it to shift to a low emission and climate-resilient development pathways paradigm. Turkey's access to financial support available to other upper middle-income developing Parties to the Convention fulfills the principles of equity, common but differentiated responsibilities, and the right and duty to promote sustainable development as stipulated by the decision 26/CP.7 dated 2001.

The Government of Turkey signed the Paris Climate Agreement on 22 April 2016 during the signatory ceremony held in New York. However, the obligations of the Paris agreement will only be binding for Turkey once the Turkish Parliament ratifies the new climate agreement.

3

INVENTORY OF GREENHOUSE GAS EMISSIONS

3.1 GREENHOUSE GAS EMISSION TRENDS

Turkey, as an Annex I party to the United Nations Framework Convention on Climate Change (UNFCCC), reports annually on greenhouse gas (GHG) inventories. The latest GHG inventory submission contains national GHG emission/removal estimates for the period of 1990-2016. The emissions presented in this document are those communicated in the 2018 submission to the UNFCCC Secretariat. A complete description of the factors underlying the Turkish emission trends, the rationale for the choice of methodologies, the emission factors and parameters used to estimate emissions for the relevant sectors is provided in the National Inventory Report, and CRF tables. NIR and CRF tables can be found at the following address; https://unfccc.int/process/transparency-and-reporting/reporting-and-review-under-the-convention/greenhouse-gas-inventories-annex-i-parties/national-inventory-submissions-2018.

According to the latest GHG inventory of Turkey, total GHG emissions were 496.1 Mt of CO_2 equivalents (CO_2 eq.) excluding the LULUCF sector and 428.0 Mt CO_2 eq. including the LULUCF sector in 2016. This represents 135.4 increase as compared to 1990 level (Table 3.1) (UNFCCC,2018).

Table 3. 1 Greenhouse gas emissions/removals, 1990-2016

	Energy	IPPU	Agriculture	LULUCF	Waste	Total CO_2 equivalent emissions without LULUCF	Total CO_2 equivalent emissions with LULUCF
1990	134.33	22.89	42.40	-28.92	11.09	210.71	181.79
1995	162.70	26.13	40.99	-28.91	12.38	242.19	213.29
2000	212.33	26.64	40.03	-34.74	14.49	293.49	258.75
2005	240.33	34.63	40.77	-42.65	16.92	332.65	290.00
2010	292.32	49.22	42.83	-45.96	18.20	402.56	356.61
2011	313.38	54.41	45.13	-48.09	18.49	431.41	383.31
2012	320.11	56.78	50.61	-49.30	18.13	445.63	396.33
2013	308.77	59.81	53.63	-57.16	16.77	438.98	381.82
2014	321.26	60.20	53.74	-58.15	16.61	451.81	393.66
2015	339.72	59.57	53.65	-63.67	16.98	469.93	406.26
2016	360.98	62.42	56.49	-68.08	16.18	496.07	427.99
Change from base to latest reported year	168.73	172.66	33.21	135.38	45.90	135.42	135.43

Source: (TurkStat, NIR 2018)

In overall 2016 GHG emissions without LULUCF, the energy sector had the largest portion with 72.8%. The energy sector was followed by the industrial processes and other product use (IPPU) sector with 12.6%, the agriculture with 11.4% and the waste with 3.3%.

There is an increasing trend in emissions from 1990 to 2016 in all sectors. Emissions from energy sector increased by 168.7% as compared to 1990. The increase in emissions from IPPU sector was 172.7%, and there were 33.2% and 45.9% increase in agriculture and waste sectors emissions respectively. Change in LULUCF sector was 135.4% in the same period (table 3.1), (GDF,2018).

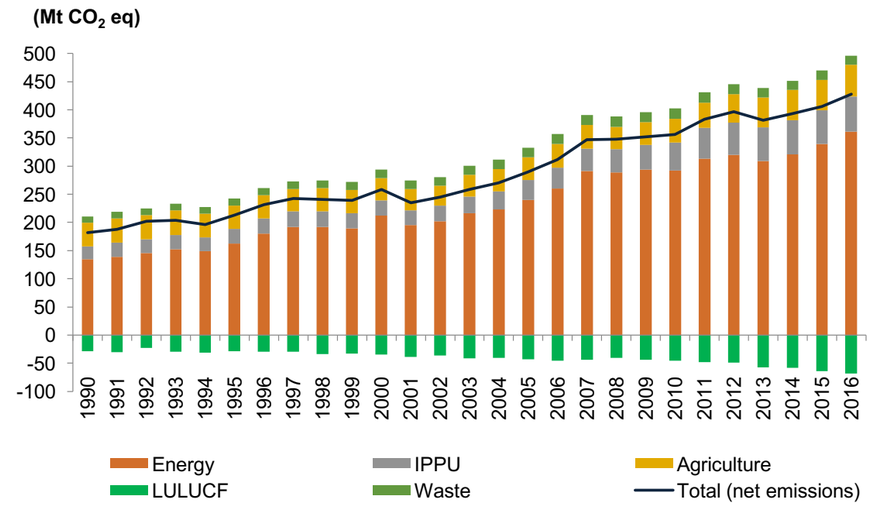

Figure 3. 1 GHG emissions by sector, 1990-2016

Fuel combustion emissions are the major source of Turkish anthropogenic GHG emissions. Total emissions from the energy sector for 2016 were 361 Mt CO_2 eq. and 97.7% of that amount is related to fuel combustion. Energy industries were the main contributor of energy sector GHG emissions with 41%. This is followed by transport sector with 23%, manufacturing industries with 17%, residential and commercial/institutional sector with 16% and agriculture, forestry, fishing sector with 3%.

3.1.1 General Factors Underlying Emission Trends

Turkey's population was 56.47 million in 1990 and it reached to 79.81 million by 2016 (41.3% increase). Urban population increased while the rural population declined between 1990-2016 periods. Proportion of urban population (population of the localities which has population of 20.001 and more) was 51.3% in 1990 while it was 87.9% in 2016 (TurkStat_a,2018). There is 142.1% increase in urban population as compared to 1990's population. In fact; real increase in the urban population is not so high. Legislative changes in administrative division of localitiese specially in the border of metropolitan municipalities has affected the urban and rural population significantly. As a matter of fact; the proportion of "urban population" which was 72.3% in 2012 and increased to 86.7% in 2013 mainly due to the changes in administrative borders. Although legislative changes has affected the urban/rural population distribution, there is still a real increase in urban population. Urban population growth and urbanization have a significant effect on the increased demand for housing, energy, transportation and etc... and this result in an increase in GHG emissions (Table 3.2).

During 1990-2016 periods, GDP has increased by 208%, and the electricity consumption per capita has increased by 249% (Table 3.2). Growing economy, population growth and rapid urbanization are the main drivers of GHG emission in Turkey.

As shown in figure 3.2, the total and net GHG emissions trends are similar to the trend in GDP for 1990-2016 periods. There is an increasing trend in the total emissions over the period of 1990-2016. However, for year 1994, 1999, 2001 and 2008 the GHG emissions decreased due to economic crisis in those years. The GHG emissions decreased by 2.7%, 0.4%, 6.3% and 0.8% respectively as compared to the previous years.

Table 3. 2 Selected indicators of Turkey, 1990-2016

Indicators	1990	2000	2010	2015	2016	Change as compared to 1990 (%)
GDP (constant PPPs, Billion US$)	595	851	1262	1778	1835	208.4
Population (million people)	56.47	67.80	73.72	78.74	79.81	41.3
Urban Population (million people)1	28.98	40.17	52.34	69.00	70.17	142.1
Rural Population (million people)2	27.49	27.63	21.38	9.74	9.65	-64.9
GDP per capita (constant 2010 US$)	6468	7205	10470	13815	14063	117.4
Total Primary Energy Supply (Mtoe)	52.5	79.4	105.9	129.1	136.2	159.7
Primary Energy Supply Per Capita (Toe/person)	0.93	1.17	1.44	1.64	1.71	83.7
Energy Intensity of the Economy (Toe/1000 US$)	0.088	0.093	0.084	0.073	0.074	-15.8
Electricity consumption per capita (kWh/capita)	829	1450	2334	2760	2897	249.4
	210.7	293.5	402.6	469.9	496.1	135.4
Total GHG emissions (Excluding LU- LUCF) (Mton CO_2-eq.)	130.0	206.4	284.2	334.5	352.7	171.2
GHG emissions from fuel combustion (Mton CO_2-eq.)	28.92	34.74	45.96	63.67	68.08	135.4
Total CO_2 removal by sinks (Mton)	3.8	4.6	5.5	6.0	6.3	63.7
Greenhouse Emissions Per Capita (ton CO_2-eq. per capita)	2.36	3.21	3.89	4.28	4.45	88.6
GHG Emissions from fuel Combustion Per Capita (ton CO_2-eq. per capita)	0.35	0.34	0.32	0.26	0.27	-23.7
Carbon Intensity of the Economy (ton CO_2-eq./1000 US$)	4.02	3.70	3.80	3.64	3.64	-9.3

Source: OECD, 2018 for GDP, TurkStat_a, 2018 for population, MENR, 2018 for energy, UNFCCC, 2018 for GHG emissions/removals data.

1 "Urban population" is defined as population of the localities which has population 20.001 and over
2 "Rural population " is defined as population of the localities which has population 20.000 and below.

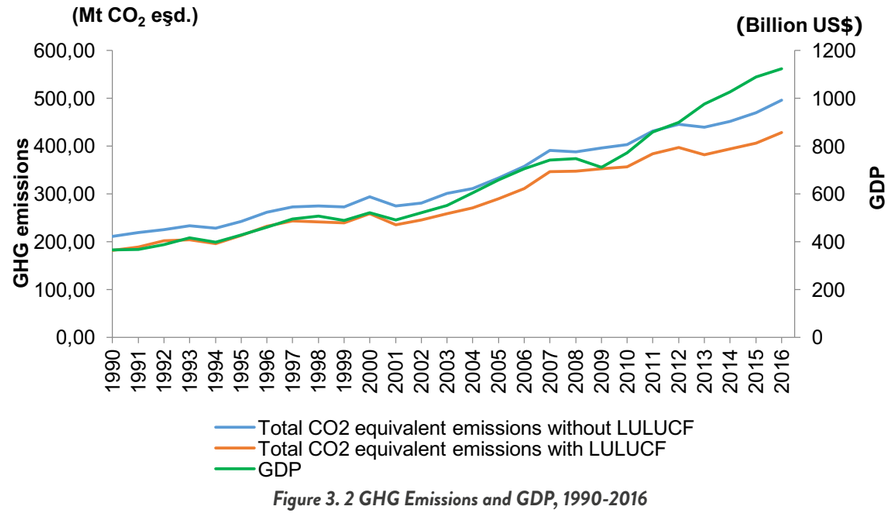

Figure 3. 2 GHG Emissions and GDP, 1990-2016

GHG emissions per capita shows similar increasing trend as total GHG emissions (figure 3.3). CO_2 equivalent emissions per capita increased from 3.8 tons in 1990 to 6.3 tons in 2016.

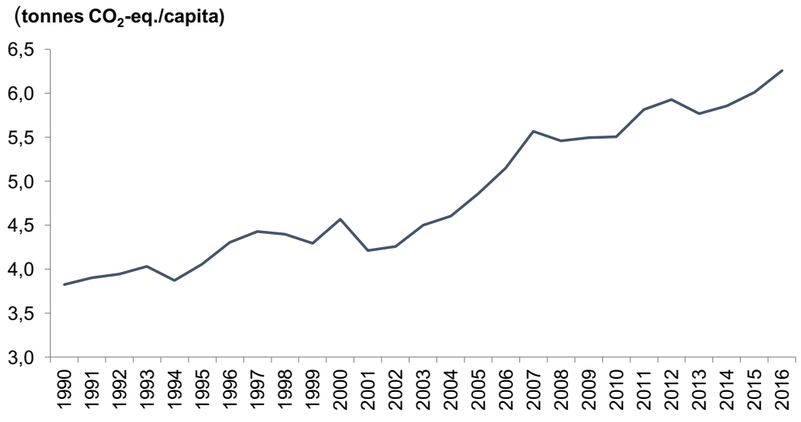

Figure 3. 3 GHG Emissions per capita, 1990-2016. Data source: NIR, 2018

While GDP increased by 208.4% between 1990 and 2016, the total greenhouse gas emissions increased by 135.4%. Energy intensity and Carbon intensity of the economy decreased in the same period (15.8% and 24% respectively). Also, total CO_2 removal by sinks were increased by 135.4%, Those figures indicate that Turkey has made progress to lower its carbon emissions while achieving its economical growth. But there are still actions that can be taken to reduce greenhouse gas emissions.

3.1.2 GHG Emission Trends by Gas

Contribution of-gases to the total CO_2 equivalent emissions without LULUCF are given in Figure 3.4. There are increasing trends in CO_2 equivalent emissions of each gas. CO_2 emissions were increased by 175% as compared to 1990. CH_4, N_2O and F-gases emissions were increased by 29.7%, 49.4 % and 950.4% respectively (table 3.3).

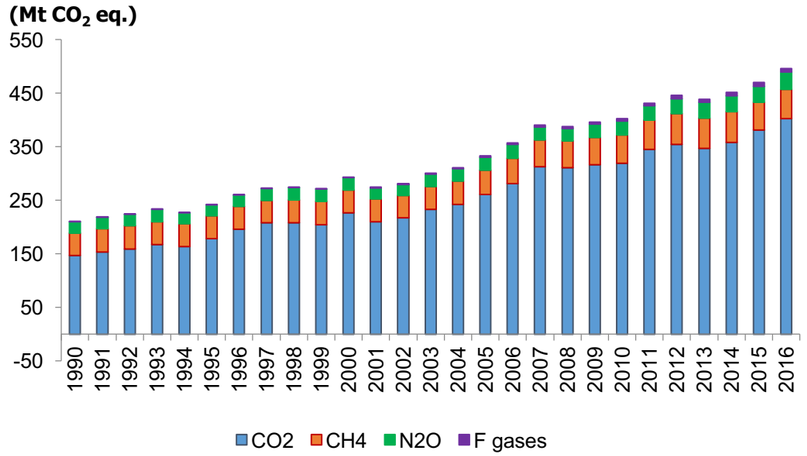

Figure 3. 4 GHG Emissions by gas, 1990-2016

The highest portion of the total GHG emissions without LULUCF is CO_2 emissions. The share of CO_2 emissions in total CO_2-eq. emissions risen from 69.5% in 1990 to 81.2% in 2016. The share of CH_4 emissions fell from 20% to 11% and share of N_2O emissions fell from 10.2% to 6.4% in the same period. The share of F-gases emissions on the other hand increased from 0.3% to 1.3% (Figure 3.5).

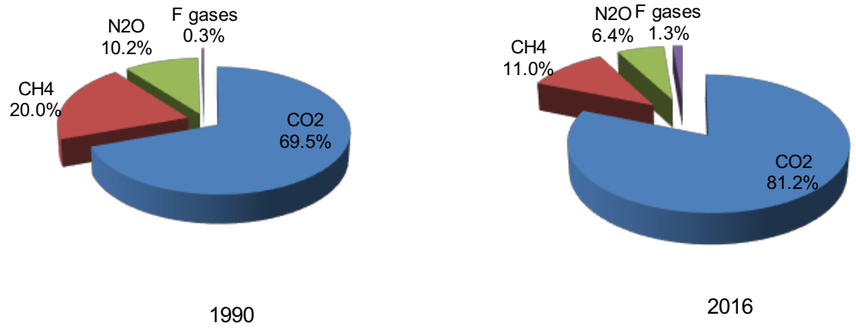

Figure 3. 5 Contribution of-gases in total GHG emissions, 1990, 2016

CO_2 emissions mainly originated from energy and IPPU sectors. In 2016, the highest portion of total CO_2 emissions was from energy sector with 86.1%. The remaining 13.6% originated from IPPU and 0.3% from agriculture. CO_2 emissions from energy increased from 125 Mt to 347 Mt between 1990-2016 (178% increase). CO_2 emissions from industrial processes were increased by 158% as compared to 1990 and reached to 54.6 Mt in 2016. (Table 3.3)

Table 3. 3 GHG emissions by gas, 1990-2016

		Energy	Industrial processes and product use	Agriculture	Waste	Total
CO_2 (kt)	1990	124 823	21 197	459.9	27.4	146 507
	(kt)	200 986	24 404	617.5	22.9	226 030
	2010	276 010	42 868	645.0	6.0	319 528
	2015	328 848	51 199	810.6	0.8	380 858
	2016	346 907	54 617	1295.3	1.1	402 821
Change from 1990 (%)		**177.9**	**157.7**	**181.6**	**-95.9**	**175.0**
CH_4 (kt)	1990	302.4	0.3	1000.8	383.9	1687.3
	2000	352.9	0.35	873.35	512.74	1739.4
	2010	493.9	0.4	949.7	654.4	2098.5
	2015	286.1	0.6	1211.3	597.8	2095.7
	2016	407.7	0.7	1215.8	564.5	2188.7
Change from 1990 (%)		**34.8**	**116.9**	**21.5**	**47.1**	**29.7**
N_2O (kt)	1990	6.5	3.6	56.8	4.9	71.8
	2000	8.5	2.8	59.0	5.5	75.8
	2010	13.3	5.5	61.9	6.2	86.9
	2015	12.5	4.9	75.7	6.8	99.9
	2016	13.0	4.1	83.2	6.9	107.3
Change from 1990 (%)		**99.3**	**14.6**	**46.5**	**41.0**	**49.4**
F-gases (kt CO_2-eq.)	1990	-	625	-	-	625
	2000	-	1 384	-	-	1 384
	2010	-	4 684	-	-	4 684
	2015	-	6 910	-	-	6 910
	2016	-	6 568	--	-	6 568
Change from 1990 (%)		**-**	**950.4**	**-**	**-**	**950.4**

Methane emissions are mainly originated from agricultural activities and waste sector. In 2016, Methane emissions were 2.19 Mt. 55.5% of total CH_4 emissions were from agriculture, 25.8% from waste, and 18.6% from energy and 0.03% from IPPU sectors. For 1990-2016 periods CH_4 emissions increased in all sectors. The increase in CH_4 emissions as compared to 1990 was at 21.5.0% increase in agriculture sector, 34.8% in energy sector, 47.1% in waste sector, and 116.9% in IPPU sector. Increase in emissions from agriculture was mainly related to enteric fermentation and manure management. Waste sector methane emissions increased in parallel to the increase in amount of managed waste. The CH_4 emissions from energy sector are mainly related to fugitive emissions from fuels.

The main source of N_2O emission is the agriculture sector. In 2016, N_2O emissions were 0.11 Mt. 77.6% of N_2O emission was from agricultural activities, 12.1% from energy, 6.5% from waste and 3.8% from IPPU sectors. The increase in N_2O emissions as compared to 1990 was 46.5% in agriculture sector, 41% in waste sector, and 99.3% in energy sector. N_2O emissions were mainly related to the use of fertilizers in agricultural soils, fuel combustion and wastewater treatment and discharge.

The only source of F-gases is IPPU sector. The emissions of F-gases had increased by 950.4% during 1990-2016 and reached to 6.6 Mt CO_2-eq. The main contributor of total F-gas emissions is the substitution of ozone depleting substances (ODS) by HFCs gases and SF6 emissions from electrical equipment

3.1.3 Indirect GHG Emissions

Emissions of CO, NOx, NMVOC and SO_2, which are mentioned under the IPCC Guidelines as a seperate topic of "indirect GHGs", also has an influence on climate change. Table 3.4 shows the indirect GHG emissions which are reported under the requirements of the UN ECE Convention on Long Range Transboundary Air Pollution by the Ministry of Environment and Urbanization since 2012 in accordance with EMEP/EEA Guidebook referred by the IPCC Guidelines. CO emissions were 2 Mt, NOx emissions were 0.70 Mt, NMVOC emissions were 1.07 Mt and SO_2 emissions were 2.2 Mt in 2016. Energy sector was the main source of CO, NOx, and SO_2 emissions and responsible for 99% of the emissions. NMVOC emissions are mainly from agriculture and energy sector. The largest portion of NMVOC emissions is from agriculture with 39% and from energy with 24%.

Table 3. 4 Indirect greenhouse gas emissions, 1990-2016

(kt)

Gas	1990	1995	2000	2005	2010	2015	2016
NOX	257	427	591	667	696	687	699
CO	2 026	2 403	2 609	2 323	2 899	2 181	2 000
NMVOC	890	1 006	1 071	1 012	1 058	1 084	1 068
SO2	1 688	1 807	2 238	2 002	2 555	1 944	2 247

3.2 GREENHOUSE GAS EMISSIONS BY SECTOR

3.2.1 Energy

Energy sector is the major source of Turkish anthropogenic GHG emissions. In 2016 the energy sector had the largest portion of GHG emissions with 72.8% (excluding LULUCF). Total emissions from the energy sector for 2016 were estimated to be 361 Mt CO_2 eq. of which 352.7 Mt CO_2 eq. comesfrom fuel combustion and 8.3 Mt CO_2 eq. is related to fugitive emissions from fuels.

Fuel combustion emissions are the major source of Turkish anthropogenic GHG emissions. Energy sector's industries were the main contributor of energy sector GHG emissions with 41% and it is followed by transport sector with 23%, manufacturing industries with 17%, residential, commercial and institutional sectors with 16% and, agriculture, forestry and fishing sectors with 3%.

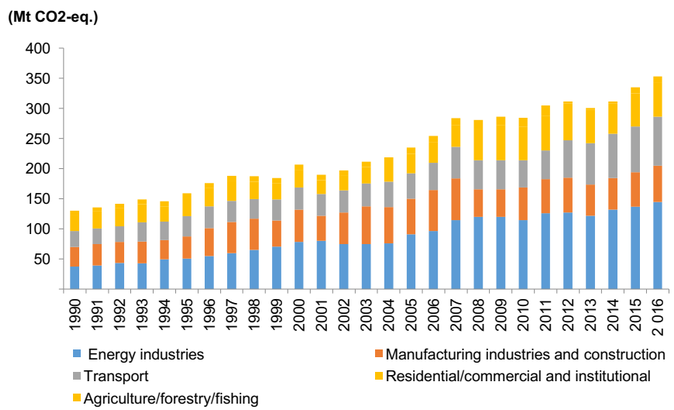

Figure 3. 6 GHG emissions from fuel combustion, 1990-2016. Data source: NIR, 2018

Total primary energy consumption was 50 MToe in 1990 and increased to 129 MToe in 2016 (with 159% increase). The share of fossil fuels in total energy consumption was 81% in 1990, and 87% in 2016. The share of renewables was 19% and 13% respectively. During 1990-2016 periods, the share of natural gas in total energy consumption increased considerably from 6% to 29%, while the share of liquid fuels decreased from 43% to 28%. The share of coal decreased from 32% to 30% (Figure 3.7).

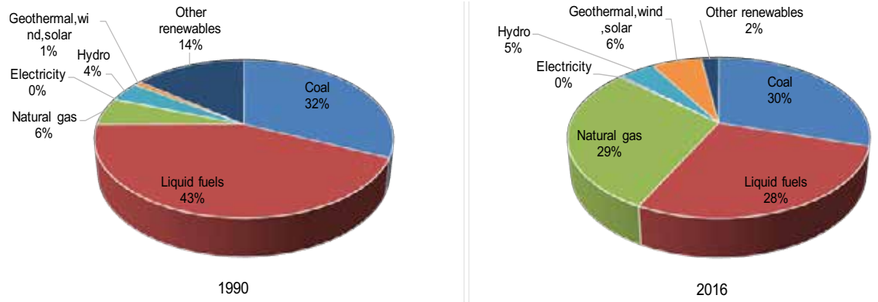

Figure 3. 7 Total fuel consumption by energy resources, 1990-2016

The largest portion of the total energy consumed by residential/commercial/institutional (buildings) was 31% and industrial sector with 27% in 1990. The share of energy industry was 21% and that of transport sector was 17%. The share of energy consumption of buildings and industrial sector decreased in 2016, however, the share of energy industry and transport increased in 2016 (increased to 21% and 24% respectively)

There are fuel shifts in sectoral energy consumption from liquid fuels to natural gas. In industrial sector 77.3% of energy consumption was coal and liquid fuels and 18% was electricity in 1990, the share of coal and liquid fuels decreased to 42.6%, share of natural gas increased to 26%, and electricity increased to 27% in 2016. In buildings, 41% of energy consumption was fossil fuels mainly coal and liquid fuels, 50% was renewables and 9% was electricity in 1990. The shares changed as 57.5% fossil fuels (36.5% natural gas), 13% renewables, 29.5% electricity in 2016. Substitution of coal and liquid fuels with natural gas resulted in lowering the increase rate of GHG emissions especially in industry and building sectors.

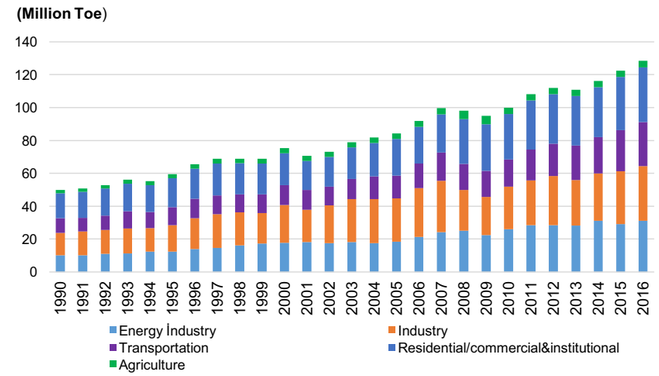

Figure 3. 8 Total fuel consumption by sectors, 1990-2016

The GHG emissions from energy industry was 37 Mt CO_2 eq. in 1990 and increased to 144.6 Mt CO_2 eq. in 2016. Public electricity and heat production have the highest portion with 94%, and it is followed by petroleum refining with 4% and manufacturing of solid fuels with 1%. Annual electricity production grew from 57.5 TWh to 274.4 TWh during 1990-2016. Coal and natural gas had the highest share in total electricity generation in 2016 with 33.7% and 32.5% respectively. Share of hydro power was 24.5%, other renewables were 8.6% and liquid fuels were 0.7%. Turkey has high energy dependency with more than 70% and need to use its domestic coal especially in electricity production. Depending on share of coal in energy mix, GHG emissions increases.

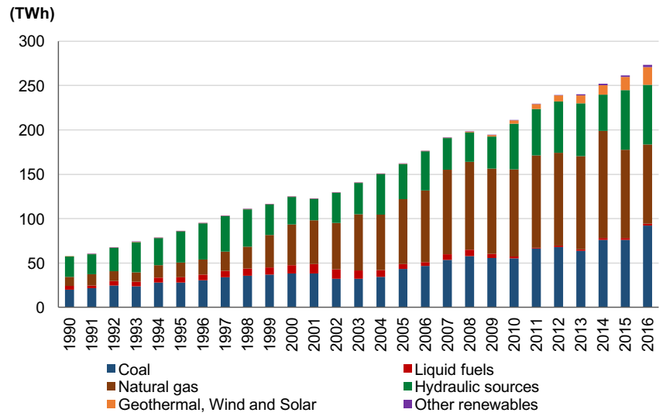

Figure 3. 9 Electricity generation by primary energy resources, 1990-2016

In 2016, transport sector contributed 81.8 Mt CO_2 eq., which is 16.5% of total GHG emissions (excluding LULUCF). The major source of transport emissions in Turkey is motor-way transportation Which is accountable for 92.4% of transport emissions. It is followed by domestic aviation with 5.2% and domestic navigation with 1.2%. Pipeline transport contribution was 0.8% and railway contribution was 0.5%..

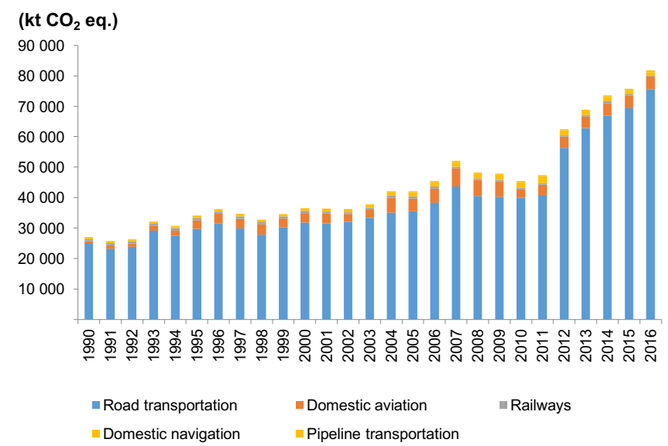

Figure 3. 10 GHG emissions from Transport sector, 1990-2016

Emissions from transport sector increased to 203% (54.9 Mt CO_2 eq.) in 2016 compared to 1990. In the same period increase in road transportation emissions was 205%, in domestic aviation it was 364% and in domestic navigation it was 91%. Emissions from railway transport decreased by 48% between 1990 and 2016.

GHG emissions from motor-way transportation was 75.6 Mt CO_2 eq. in 2016 while it was 24.8 Mt CO_2 eq. in 1990. Figure 3.8 shows GHG emission trend for motor-way transportation, and figure 3 shows the distribution of vehicle fleet by fuel type. In 2016, highest portion of emissions is from diesel oil with 77.4%, it is followed by LPG with 13.1% and gasoline with 9.2%, while 49% of motor vehicle fleet is diesel, 21.5% is LPG and 29.1% is gasoline fueled vehicles in the same year.

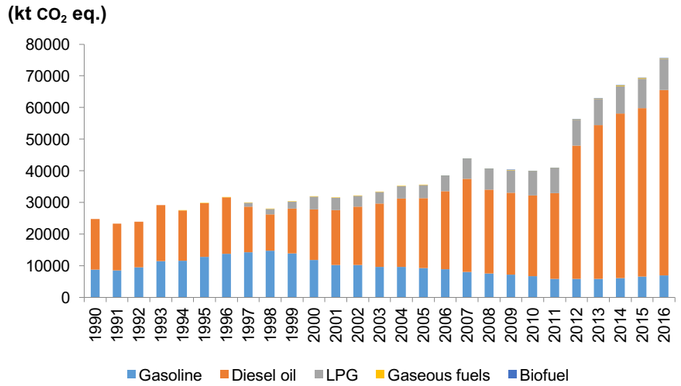

Figure 3. 11 GHG emissions from road motor vehicles by fuel type, 1990-2016

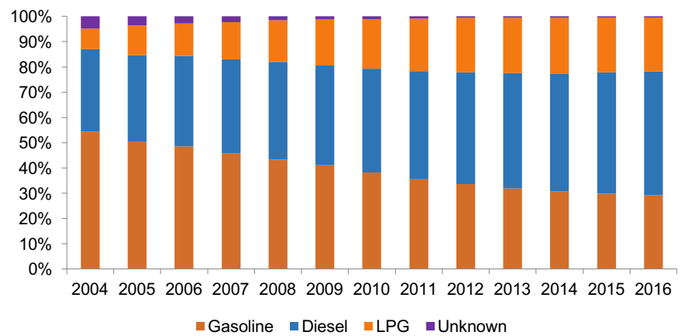

Figure 3. 12 Road motor vehicles by fuel type, 2004-2016

The second biggest contributor of GHG emissions from transport is domestic aviation. GHG emissions from domestic aviation was 4.3 Mt CO_2 eq. in 2016, it was 0.9 Mt CO_2 eq. in 1990. The fuel type used in domestic aviation was jet kerosene. The trend of the emissions is similar to the trend of fuel consumption in the sector.

Contributions of railway and domestic navigation to the total transport sector emissions are too small. GHG emission from domestic navigation was 0.5 Mt CO_2 eq in 1990 and increased to 0.97 Mt CO_2 eq in 2016. Based on the increasing electricity consumption in railways, GHG emissions decreased from 0.7 Mt CO_2 eq in 1990 to 0.4 Mt CO_2 eq in 2016.

Fuel used in international aviation and marine bunkers is not included in the total national emissions but reported separately. In 2016, international bunker GHG emissions were 13.76 Mt CO_2 eq. 10.72 Mt is from international aviation and 3.04 Mt is from international navigation.

Total fugitive emissions for 2016 were 8.3 Mt CO_2 eq., representing 1.67% of total GHG emissions (excluding LULUCF). Oil and natural gas systems contributed 32.5% solid fuels are accountable for the remaining 67.5% of fugitive emissions. Overall fugitive emissions increased by 93% between 1990 and 2016. In 2014 a serious mining accident happened, and many underground mines were closed in the following year as a precaution, therefore in 2015 fugitive emissions were decreased remarkably. In overall, from 1990 to 2016, fugitive emissions from oil and natural gas systems increased by 196%. Emissions from solid fuels were increased by 65% in the same period.

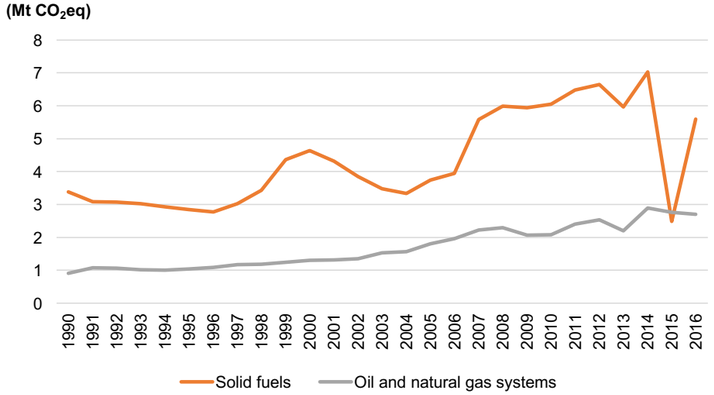

Figure 3. 13 Fugitive emissions from fuels,1990-2016

3.2.2 Industrial Processes and Product use

GHG emissions from industrial processes and product use was 22.94 Mt CO_2 eq. in 1990 and increased to 62.4 Mt CO_2 eq. in 2016 and It has contributed 12.6% to the total anthropogenic of GHG emissions in Turkey.

Mineral industry and metal industry sectors have the biggest share in total IPPU sector emissions in 2016 with 67.2% and 18.3% respectively. IPPU sector is responsible for 13.6% of total CO_2 emissions and the only source of F-gas emissions. 87.5 % of total IPPU sector GHG emissions are CO_2 emissions. Main sources of CO_2 emissions are from mineral production with 76.8% (cement production is 65.4%) and metal production with 20.9% (iron and steel production were 20.4%) in 2016. Cement production, iron and steel production has 7.2% and 2.3% shares in the total national GHG emissions, respectively.

The mineral industry contributed 67.2% of the sector's emissions, the metal industry contributed 18.3%, and product uses as ODS substitutes contributed 7.6%, while the chemical industry contributed 3.8%. The main gas emitted by the IPPU sector in 2016 was CO_2, contributing 87.5% (54 617 kt) of the sector's emissions in 2016. HFCs, PFCs and SF6 contributed 10.5% (6 568 kt CO_2 eq.) while the share of N_2O emissions was 2% (1 219 kt CO_2 eq.) and CH_4 emissions were 0.03% (17 kt CO_2 eq.).

The total emissions from industrial process and product use increased by 172.7% between 1990 and 2016 (from 22.9 Mt CO_2 eq. to 62.4 Mt CO_2 eq.) and increased 4.8% between 2015 and 2016. The increases in sectoral emissions observed over the longer term are principally due to growth in emissions associated with the mineral industry, predominantly cement production, and metal industry, primarily iron and steel production. The increases in emissions in these sectors are because of the industrial growth and the increased demand for construction materials. The share of construction sector in GDP increased from 6.1% in 1998 to 8.6% in 2016. Construction sector grew considerably especially between the periods of 2011 and 2016. GHG emissions from IPPU sub sectors are given in Figure 3.14.

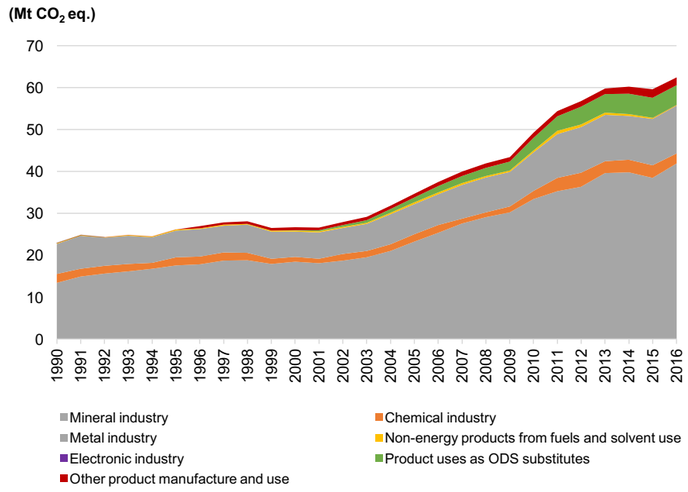

Figure 3. 14 GHG emissions from IPPU sub sectors, 1990-2016

GHG emissions from mineral industry were 41.9 Mt CO_2 eq. and contributed to 67.2% of total IPPU sector emissions in 2016. 85.2% of which is related to cement production, 6.3 % is from ceramics production, and 6.4% is from lime production.

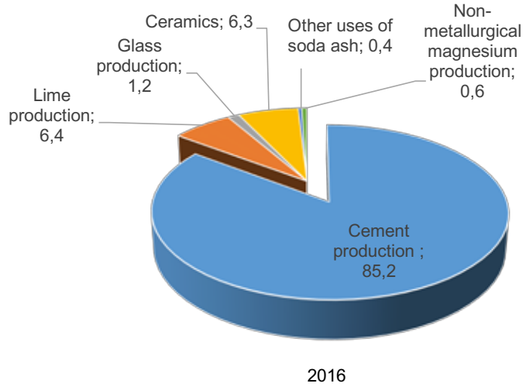

Figure 3. 15 GHG emissions from mineral industry, 2016

GHG emissions from chemical industry were 2.4 Mt CO_2 eq. and contributed to 3.8% of total IPPU sector's emissions in 2016. 86.5% of which is related to ammonia production and 12.7% is from soda ash production.

Metal industry is the second big contributor of IPPU with 11.5 Mt CO_2 eq. emissions in 2016. 97.7 % of metal sector's GHG emissions are released from iron and steel industry. There are 3 integrated iron and steel production facilities contributing 68% of total emissions from iron and steel production and around 30 electric arc furnaces releasing 14% of emissions in this sector by 2016.

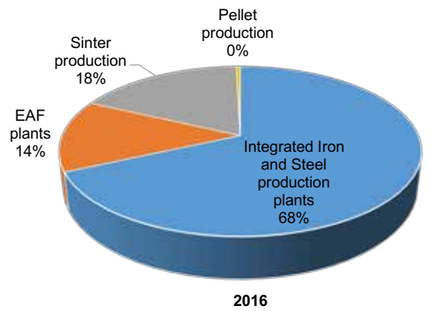

Figure 3. 16 GHG emissions from iron and steel industry, 2016

Non-energy products from fuels have a minor contribution and GHG emissions from this sub sector was 146.2 kt CO_2 eq.in 2016. 92.3% of this amount is related to lubricant use and 7.7% is related to paraffin wax use.

F-gases emissions are related to aluminum production. PFCs (CF4 and C2F6) emissions are in accordance to primary aluminum production. Primary, minor usage of F-gases for research and development studies in electronic industry, HFCs emissions for fire protection and other applications and SF6 emissions from manufacture and usage of electrical equipment constitutes 6.57 Mt CO_2 eq. (10.5% contribution to total IPPU sector emissions) in 2016.

3.2.3 Agriculture

According to the latest GHG inventory of Turkey, the total GHG emissions from agriculture sector were 56.5 Mt CO_2 eq. in 2016 which is 11.4% of total GHG emissions (excluding LULUCF). There is 33.2% increase in agriculture sector's GHG emissions as compared to 1990's level.

Main source of agriculture sector GHG emissions are from enteric fermentation, agricultural soils and manure management. Figure 3.17 shows GHG emissions from agriculture sector. In 2016, 47.7% of the agriculture sector GHG emissions were from enteric fermentation, 38.2% was from agricultural soils, 11.2% from manure management, 2.3% was from urea application and 0.7% was from rice cultivation and combustion of agricultural residues in the fields.

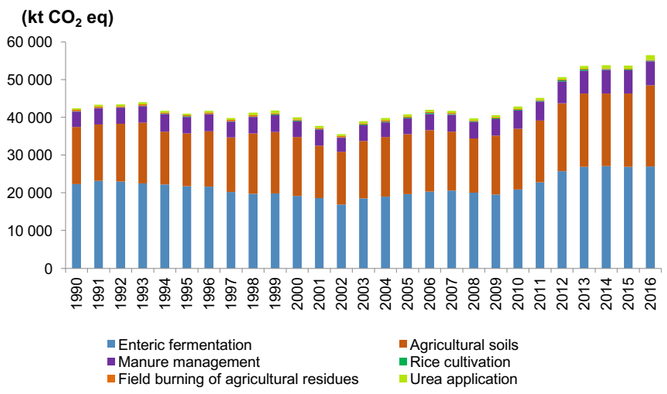

Figure 3. 17 GHG emissions from agriculture sector, 1990-2016

Agriculture sector is responsible for 55.5% of total CH_4 emissions, and 77.6% of total N_2O emissions in 2016. Methane emissions mainly originating from enteric fermentation while N_2O emissions were released from the agricultural soils.

Figure 3.18 and 3.19 shows methane emissions from enteric fermentation and livestock population respectively. Methane emissions from enteric fermentation increased from 22.3 Mt CO_2-eq in 1990 to 26.9 Mt CO_2-eq n 2016. Fluctuating trends are observed in livestock population. It decreased until 2003; there were small changes between 2003 and 2010. Based on the agricultural support policy, livestock population has been increasing since 2011. CH_4 emissions from enteric fermentation shows similar trend as livestock population.

The highest portion of CH_4 emissions from enteric fermentation was from cattle. In 2016, contribution of cattle was 79.4% and it was followed by sheep with 14.7% and goats with 4.8% and other livestock with 1.1%.

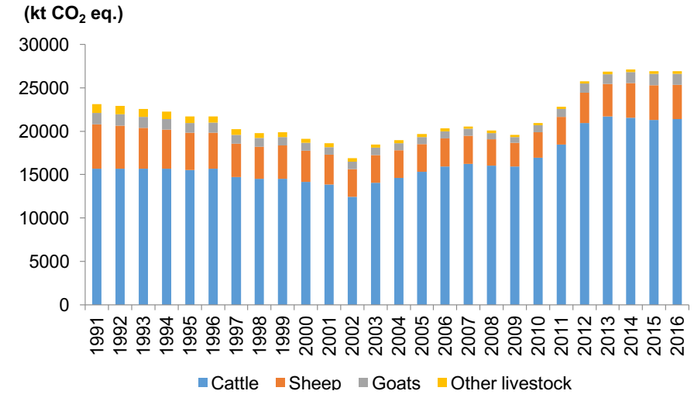

Figure 3. 18 CH_4 emissions from enteric fermentation, 1990-2016

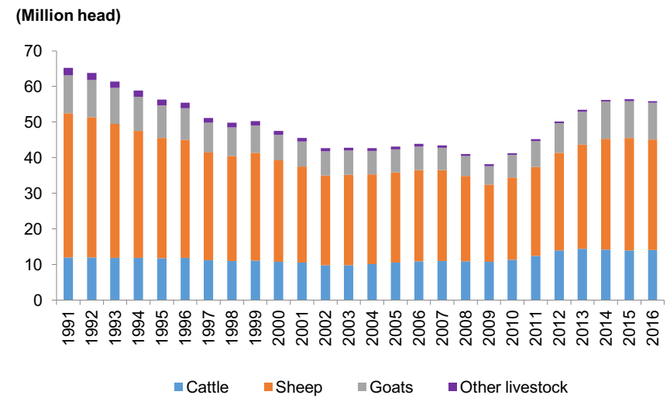

Figure 3. 19 Livestock population, 1990-2016

Figure 3.20 shows GHG emissions from manure management. Total emissions from this sub sector were 4.1 Mt CO_2 eq. in 1990 and increased to 6.3 Mt CO_2 eq. In 2016 (53.5% increase). Manure management is responsible for 10.2% of CH_4 and 12.9% of N_2O emissions within agriculture sector in 2016. As in the case of enteric fermentation, highest portion of both CH_4 and N_2O emissions within manure management was from cattle.

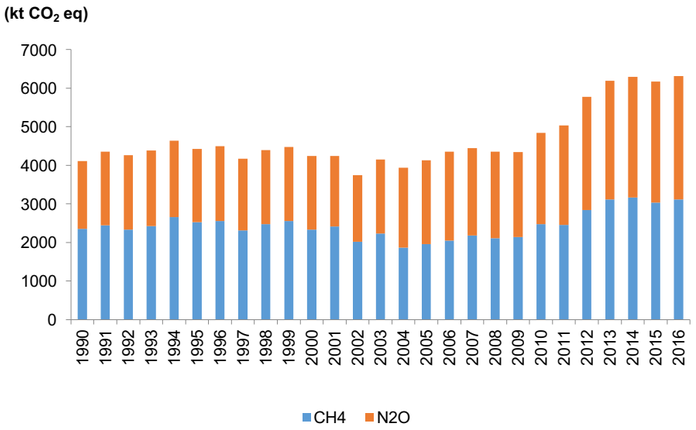

Figure 3. 20 GHG emissions from manure management, 1990-2016

Agricultural soils as a source of direct and indirect N_2O emissions are the biggest contributor to total N_2O emissions. Direct N_2O emissions include organic and inorganic fertilizer application to the soil, nitrogen input from above-ground and below-ground crop residues, urine and dung deposited by grazing animals. Indirect N_2O emissions include atmospheric deposition and nitrogen leaching and run-off.

N_2O emissions from agriculture soils were 21.6 Mt CO_2 eq. in 2016 while it was 15.1 Mt CO_2 eq. in 1990 (42.9% increase). This represents 87% of N_2O emissions in the agriculture sector, 67.5% of total N_2O emissions. Direct N_2O emissions were 19.3 Mt CO_2 eq., indirect N_2O emissions were 2.2 Mt CO_2 eq. in 2016. The major contribution to direct N_2O emissions was the use of synthetic fertilizer (Figure 3.21).

The other sub categories; rice cultivation, combustion of agricultural residues and urea application have minor contribution to agriculture sector's GHG emissions.

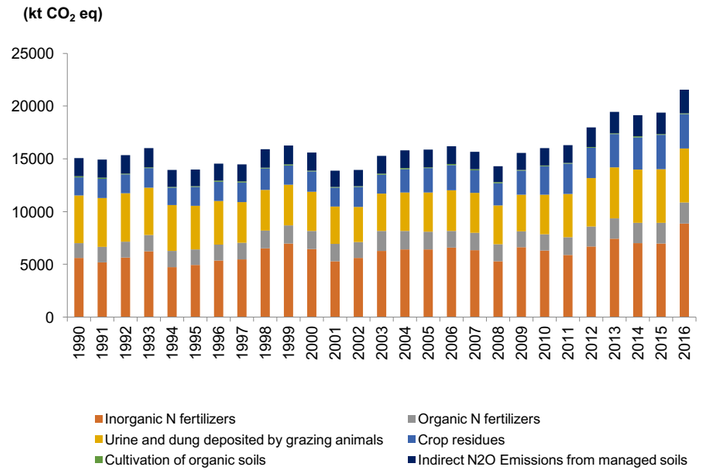

Figure 3. 21 N_2O emissions from agricultural soils, 1990-2016

3.2.4 Land Use Land Use Change and Forestry

Turkey reports both greenhouse gas emissions and removals in the LULUCF sector in accordance with the IPCC guidelines, the changes in different carbon pools which include above and below-ground biomass, dead wood, litter and soil, are reported for each category. In addition, carbon stock changes of harvested wood products and emissions originating from other sources are reported in this sector. Subcategories reported as sinks are forest land remaining forest land; land converted to forestland, cropland remaining cropland and harvested wood products. Subcategories reported as emission source are land converted to cropland, grassland remaining grassland, land converted to grassland and land converted to settlements.

In 2016, the LULUCF sector acted as a CO_2 sink for –68.1 Mt CO_2 eq. It was 28.9 Mt CO_2 eq. in 1990 (135.4% increase). Although removals from LULUCF sector constituted 13.7% of total GHG emissions of Turkey (excluding the LULUCF) both in 1990 and 2016, its share was in the range of 10.2-14.2%.

Table 3. 5 Total emissions and removals from the LULUCF sector

					(kt CO_2 eq.)
	1990	**2000**	**2010**	**2015**	**2016**
Forest land	-27 041	-34 649	-43 946	-56 489	-60 370
Cropland	-37	-502	194	213	-44
Grassland	99	-248	2275	2789	2913
Wetlands	1 742	1 233	61	NO, NE	NO, NE
Settlements	683	683	45	45	45
Harvested wood products	-4 368	-1 257	-4 585	-10 227	-10 622
Other	NE	NE	NE	NE	NE
Other land	NO, NE	NO, NE	NO, NE	NO, NE	NO, NE
Land use, land-use change and forestry	-28 923	-34 740	-45 957	-63 669	-68 078

The largest sink was forest land with 60.4 Mt CO_2 eq in 2016 and removals were 12.2% of total GHG emissions (without LULUCF). It is followed by harvested wood products with 10.6 Mt CO_2 eq. (2.1% of total GHG emissions).

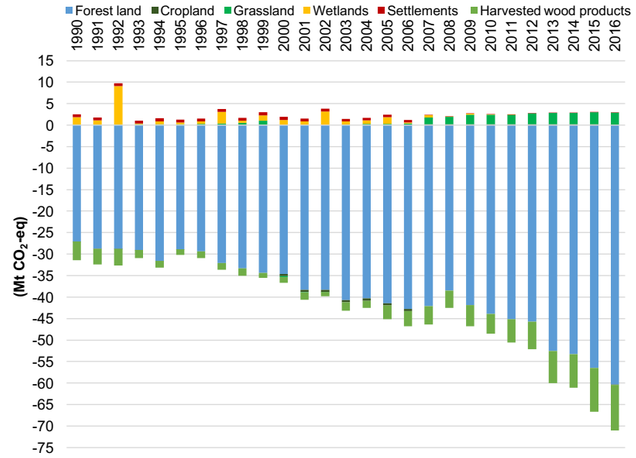

Figure 3. 22 Emissions and removals from the LULUCF sector, 1990-2016

The figure 3.22 shows that LULUCF sector has been a net sink in Turkey for the reporting period and the removals increased in time. The key drivers for the rise in removals are improvements in sustainable forest management, afforestation, rehabilitation of degraded forests, reforestation on forest land and conversion of coppices to productive forests in forest land remaining forest land, efficient forest fire management and protection activities, conversions to perennial croplands from annual croplands and grasslands, and conversions to grasslands from annual croplands. The key drivers for the variations in removals are related to drought and biomass burning as wildfire (e.g., year the 2008; 29,749 ha forest area burned,), deforestation, conversions to wetlands (flooded land, dams) and settlements.

Turkey has 22.57 Mha forest areas by 2016; it was 20.57 Mha in 1990. This indicates that 2 Mha areas have been converted to forest land between 1990 and 2016. The key driver for the rise in forest land is mainly afforestation activities. Especially, in 2008, National Afforestation and Erosion Control Action Plan have been initiated to increase forest areas of Turkey. Various forestry activities (afforestation, reforestation, rehabilitation, erosion control, etc.) have been carried out between 2008 and 2012.

Forest fires (wildfires) and construction of dams is the main reasons of emissions from LULUCF sectors. For example, in 2008 29.749 ha forest area burned; in 1992 the greatest dam of Turkey (Atatürk Dam), in 1997 Dicle Dam and in 2002 Ermenek Dam were constructed.

3.2.5 Waste

Total GHG emissions from waste sector was 16.2 Mt CO_2 eq. in 2016 which constituted 3.3% of total GHG emissions (excluding LULUCF). There is 45.9% increase in waste sector GHG emissions as compared to 1990 level.

Main source of waste sector GHG emissions are solid waste disposal and wastewater discharge and treatment. In 2016, 72.2% of the waste sector GHG emissions was from solid waste disposal and is 27.7% was from wastewater discharge and treatment.

Waste sector is responsible for 25.8% of total CH_4 emissions, and 6.5% of total N_2O emissions in 2016. Methane emissions mainly originating from solid waste disposal site while N_2O emissions released from wastewater discharge and treatment

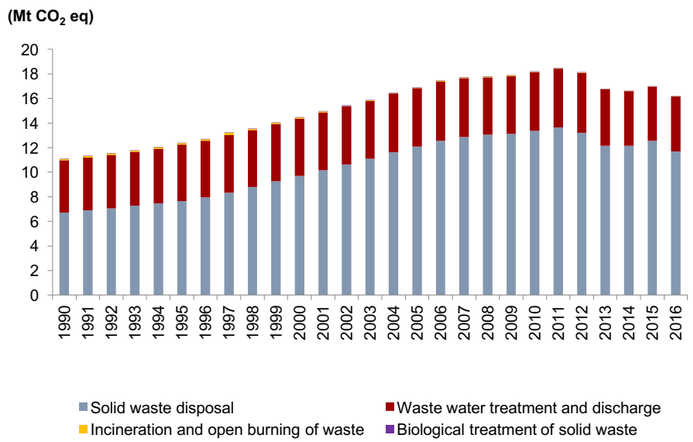

Figure 3. 23 GHG emissions from waste sector, 1990-2016

Depending on the population growth, waste disposals are also increasing in the waste disposal sites. Around 28.5-million-ton waste was disposed to landfills in 2016 and 68% of that amount was disposed on the managed landfill sites (Figure 3.24). CH_4 emissions from landfill sites were 6.7 Mt in 1990 and increased to 11.7 Mt in 2016.

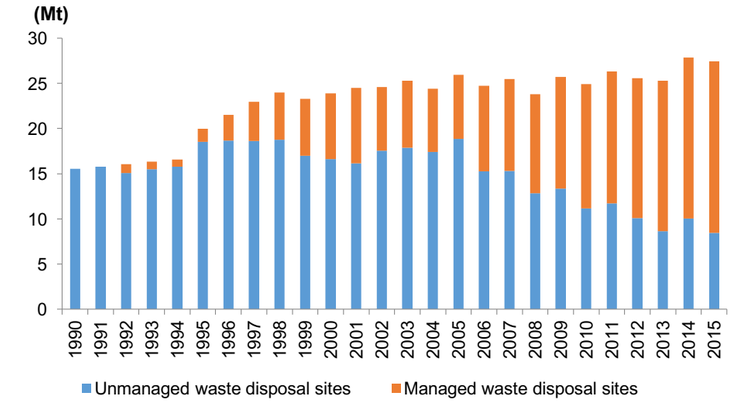

Figure 3. 24 Annual waste disposals at solid waste disposal sites, 1990-2016

As the amount of waste disposed of managed landfill sites are increasing theunmanaged waste amount is decreasing, rate of methane emission from landfill sites is also decreasing. The main reason is that CH_4 emissions from managed waste disposal sites are lower than that of unmanaged landfill sites. Also, methane is recovered and used for energy production since 2002 so provides methane emissions reduction at waste disposal sites.

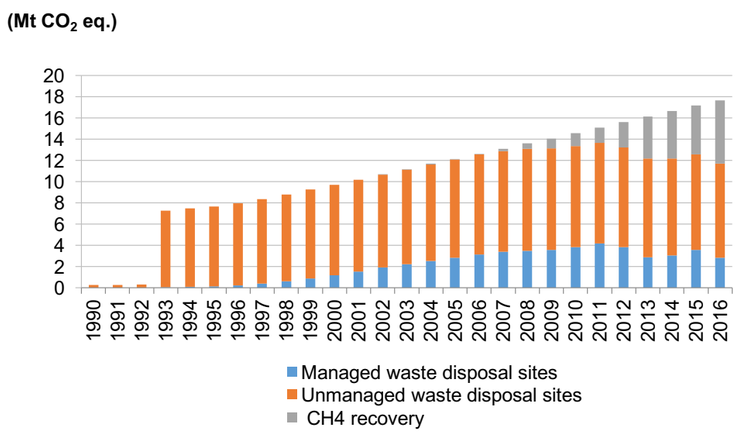

Figure 3. 25 CH_4 emissions from waste disposal sites, 1990-2016

Wastewater treatment and discharge is another GHG emission source category for mainly N_2O and CH_4 emissions. GHG emissions from wastewater discharge and treatement was 4.2 Mt CO_2 eq.in 1990 and increased to 4.5 Mt CO_2 eq. in 2016.

In 2016, 84.2% of the total population (67.2 million) had access to municipal wastewater collection network and 70.2% of population (56 million) were served by wastewater treatment. Rate of wastewater treatment was quite low until 2000; only 10% of wastewater collected by municipal sewerage systems was treated in 1994. However, as a result of effective wastewater treatment policy an implementation was improved and out of 4.5 billion m^3 of collected wastewater, 85.7% (3.8 billion m^3) was treated in 2016. 76.1% of collected wastewater was treated in biological and advanced treatment plants, and 23.9% was treated in physical and natural treatment systems (Table 3.6).

Table 3. 6 Municipal wastewater collection and treatment, 1994-2016

	1994	1998	2002	2006	2010	2012	2014	2016
Municipal population served by sewerage system	32 696 622	37 189 736	44 342 222	50 856 943	54 017 052	58 754 795	65 071 589	67 227 191
Wastewater discharged from municipal sewerage to receiving bodies (thousand m^3/year)	1 509 651	2 096 714	2 497 657	3 366 894	3 582 131	4 072 563	4 296 851	4 484 075
Amount of wastewater treated by wastewater treatment plants (thousand m^3/year)	150 061	589 515	1 312 379	2 140 494	2 719 151	3 256 980	3 483 787	3 842 350
Physical	77 725	281 374	344 509	714 404	751 101	929 334	869 248	906 221
Biological	72 335	308 142	745 852	926 581	931 356	1 072 873	1 155 353	1 214 977
Advanced	-	-	222 018	499 509	1 031 616	1 245 977	1 450 494	1 708 361
Natural	...	...	...	...	5 079	8 795	8 692	12 791
Municipal population served by wastewater treatment plants	6 044 364	10 449 370	18 955 305	29 643 258	38 050 717	43 543 737	49 358 266	56 016 738
Amount of wastewater discharged per capita in municipalities (liters/capita-day)	126	154	154	181	182	190	181	183

Source TurkStat_b 2018

N_2O emissions shows increasing trend during 1990-2016. However, there is a decreasing trend in methane emission after 1998. The main reason for that trend in CH_4 emissions is the increasing amount of methane recovery for energy purposes. Methane recovery is about 1Mt CO_2 eq.in 2016 (Figure 3.26).

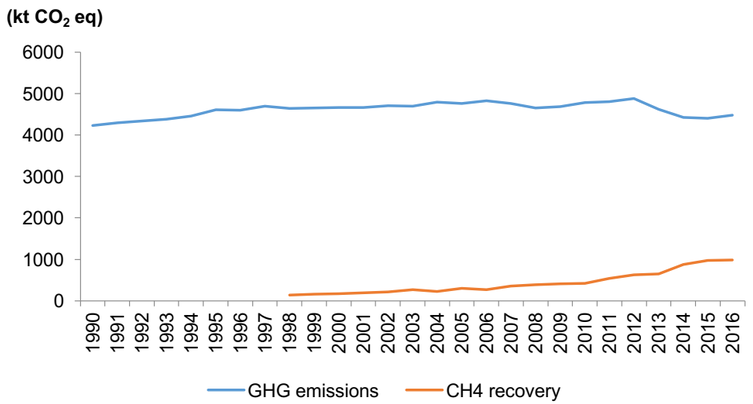

Figure 3. 26 GHG emissions from wastewater treatment and discharge, 1990-2016

3.3 NATIONAL INVENTORY SYSTEM

3.3.1 Institutional, Legal and Procedural Arrangements

The Turkish national inventory system is featured by centralized governance. Ministry of Environment and Urbanization (MoEU) is the National Focal Point of the UNFCCC together with the UNECE and CLRTAP are responsible for climate change and air pollution policies and measures. Turkey established the Coordination Board on Climate Change (CBCC) in 2001 with the Prime Ministerial Circular No.2001/2 in order to determine the policies, measures and activities to be pursued by Turkey on climate change. Under the chairmanship of Minister of Environment and Urbanization, this board is composed of high-level representatives (Undersecretary and President) from Ministries related to foreign relations, finance, energy, transport, industry, agriculture, forestry, health, education, TurkStat, and NGOs from business sector. The CBCC was restructured in 2013 and renamed as Climate Change and Air Management Coordination Board (CCAMCB). The CCAMCB, a public body created by Prime Minister Circular 2013/11, is competent for taking decisions and measures related to climate change and air management.

Climate Change and Air Management Coordination Board Decisions is the first legal means for national inventory system.

Under the Coordination Board currently there are seven working groups (WGs):

- GHG Mitigation WG
- Climate Change Adverse Effects and Adaptation WG
- GHG Emission Inventory WG
- Finance WG
- Technology Development and Transfer WG
- Education, Capacity Building WG
- Air Management WG

The national GHG inventory is prepared under the auspices of the "GHG Emissions Inventory Working Group" which was established in 2001 by the former CBCC. TurkStat was formally appointed as single national responsible authority to coordinate and implement national inventory activities from planning to management by Decision 2009/1 of the CBCC in 2009. TurkStat is also in charge of annual inventory submission to the UNFCCC Secretariat and of responding to the ERT recommendations.

Also, the legal basis of the national inventory system is currently provided by the Statistics Law of Turkey through the Official Statistics Programme (OSP). The OSP is based on the Statistics Law of Turkey No. 5429 and was first prepared in 2007 for a 5-year-period and updated every 5 years. OSP identifies the basic principles and standards dealing with the production and dissemination of official statistics and produce reliable, timely, transparent and impartial data required at national and international level. For all kind of official statistics, the responsible and related institutions are defined; data compilation methodology and the publication periodicity/schedule of official statistics are specified. TurkStat is the responsible institution for the compilation of the national GHG inventory through the OSP and coordinates the activities of the GHG emission inventory working group established in the scope of OSP with the same composition as WG 3. The GHG emission inventory groups under CCAMCB.

The GHG national inventory is compiled by GHG Emission Inventory groups under the coordination of TurkStat.

The institutions included in the working group are:

- Turkish Statistical Institute (TurkStat),
- Ministry of Energy and Natural Resources (MENR),
- Ministry of Transport and Infrastructure (MoTI),
- Ministry of Environment and Urbanization (MoEU),
- Ministry of Agriculture and Forestry (MoAF)

The national inventory arrangements are designed and operated to ensure the TACCC quality objectives and timeliness of the national GHG inventories. The quality requirements are fulfilled by implementing consistently inventory quality management procedures.

Responsibilities of the institutions involved in the national GHG inventory are shown in Table 3.7.

Table 3. 7 Institutions by Responsibilities for National GHG Inventory

Sector	CRF Category	Collection of Activity Data	Selection of Methodology and Emission Factors	GHG Emission Calculation	Filling in CRF tables and preparing NIR	Quality control
Energy	1-Energy (Excluding 1.A.1.a-public electricity and heat production and 1.A.3-Transport)	MENR TurkStat	TurkStat	TurkStat	TurkStat	TurkStat
	Public electricity and heat production - 1.A.1.a	MENR	MENR	MENR	MENR	MENR
	Transport	MoTI TurKStat	MoTI	MoTI	MoTI	MoTI
Industrial Processes and Other Product Uses	2- IPPU (except F-gases)	TurkStat	TurkStat	TurkStat	TurkStat	TurkStat
	F-Gases	MoEU	MoEU	MoEU	MoEU	MoEU
Agriculture	3-Agriculture	TurkStat	TurkStat	TurkStat	TurkStat	TurkStat
Land Use, Land Use Change and Forestry		MoAF	MoAF	MoAF	MoAF	MoAF
Waste	Waste - 5	TurkStat	TurkStat	TurkStat	TurkStat	TurkStat
Cross cutting issues						
Key Source Analysis	TurkStat					
Uncertainty analysis	TurkStat					

The national GHG inventory is subjected to an official consideration and approval procedure before its submission to the UNFCCC. The national inventory is subjected to a two-step official consideration and approval process. The final version of the NIR and CRF tables are first approved by the TurkStat Presidency and published in the official TurkStat press release. Subsequently, The MoEU as National Focal Point to the UNFCCC provides final checks and approval of the CRF tables via CRF web application tool as a final step prior to its submission to the UNFCCC.

TurkStat, as the Single National Entity responsibilities go from official inventory submission to UNFCCC, and also responsible for responding to the UNFCCC expert review team (ERT) recommendations on national inventory improvement and ensuring they are incorporated in the current and following NIR(s) in the broader context of its continuous improvement.

The inventory planning system of Turkey is conducted in line with QA/QC (Quality assurance and quality control) plan. Planning stage is under the responsibility of GHG Inventory WG. Planning activities include data collection and processing, selection of EF estimation methodology, compilation of CRF and NIR, UNFCCC expert review team (ERT) recommendations, documentation and archiving, verification through time series consistency and cross checks, reporting and publication process.

Information required for the inventory is mostly covered by OSP. Distribution of work for data gathering, processing and estimation of emissions are shown in Table 3.6. Fuel combustion emissions other than electricity generation and transport are calculated by TurkStat via using the energy balance sheets of the Ministry of Energy and Natural Resources. Emissions from industrial process (excluding F-gases), agricultural activities, waste and fugitive emissions from coal mining, oil and gas systems are also calculated by TurkStat. The emissions originating from public electricity and heat production are calculated on the basis plant level data by the Ministry of Energy and Natural Resources; the emissions originating from transportation are calculated by The Ministry of Transport and Infrastructure. The fluorinated gases are calculated by the Ministry of Environment and Urbanization. Emissions and removals from land use, land-use change, and forestry are estimated by The Ministry of Agriculture and Forestry (former Ministry of Food, Agriculture and Livestock and Ministry of Forestry and Water Affairs).

Also, country specific (CS) CO_2 EFs of natural gas, Turkey lignite, hard coal, fuel oil and diesel oil are calculated by using fuel, slag and ash analyses and gas chromatography results, by the MENR.

Every sector expert that performs the emission estimation has the responsibility to prepare the data entry to CRF reporter and other related sections or sub-sections of NIR. TurkStat compiles and makes the key source and does the uncertainty analysis, final quality checks and submits the national GHG inventory to the UNFCCC's secretariat.

TurkStat is also responsible for archiving the GHG inventory. EFs, AD, calculation sheets, CRF and NIR outputs and the emission inventory are all archived on TurkStat's main server. All inventory related documents are also archived by the line Ministries for the CRF categories under their responsibilities.

3.3.2 Quality Assurance and Quality Control (QA/QC) and Verification

QA/QC and verification procedures are an integral and indispensable parts of the national GHG inventory of Turkey. The quality of the national inventory system is ensured by the QA/QC system, through the QA/QC plan adopted by the CCAMCB decision in 2014. The QA/QC plan introduces the structure and purpose of the QA/QC system, endorse the quality objectives. The main objective of the QA/QC plan is to ensure that the national GHG inventory is prepared in accordance with the quality objectives: transparency, accuracy, comparability, consistency, completeness (TACCC) as defined in UNFCCC reporting guideline (24/CP.19). Turkey also considers three additional quality objectives as improvement, sustainability and timeliness.

Together with verification, the implementation of QA/QC procedures are considered integral parts of national inventory preparation and play a pivotal role not only to achieve the quality objectives but also for continuous reassessing and improving the national inventory where needed.

TurkStat is the designated body for overall implementation of the QA/QC system and its main purpose is to ensure the coordination of the QA/QC activities.

Quality Control (QC) is a system of routine technical activities to assess and maintain the quality of the inventory as it is being compiled. QC activities include general QC procedures and category specific QC procedures.

General QC procedures include generic quality checks related to the calculations; data processing, completeness and documentations that are applicable to all inventory sources and sink categories. General QC procedures are applied routinely to all categories by sector experts using the check lists attached in Annex II of the QA/QC Plan during the acquisition of data and the emissions calculation procedures and during the compilation of NIR and the CRF tables.

Category-specific QC procedures complement general inventory QC procedures and are directed at specific types of data used in calculating GHG emissions for individual source or sink categories. These procedures require knowledge of the specific category; the types of data available and the parameters associated with emissions or removals and are performed in addition to the general QC check lists. Category specific QC procedures are also applied by sector experts using the check lists attached in Annex III of the QA/QC Plan.

QC activities are performed by sector experts compiling the GHG inventory. Each sector expert should fill and sign the check list, that the necessary QC checks were undertaken. Each sector expert should carry out immediate corrections of the input data/emissions calculations where errors are found. If an issue cannot be resolved, such issues may then be incorporated into the inventory improvement plan. A copy of the completed checklist is sent to TurkStat and is archived in TurkStat main server. TurkStat undertakes further quality checks on compiled CRF and NIR.

In Turkey, annual review of GHG inventory submission is considered as an QA activity. Turkey's GHG inventory submission is subject to be reviewed by an international team of experts on an annual basis in accordance with decision 13/CP.20. The ERT develops an annual review report based on the findings of the review. These annual review reports are considered as supplementary to the QA procedures undertaken by experts in Turkey. Findings in the annual review reports are considered feedback for improvement of the GHG inventory, and as such are included in Turkey's inventory improvement plan.

Also, Turkish GHG inventory is reviewed two times by experts from European Union (EU) in the scope of EU funded Projects in 2014 and during 2016-2017 periods.

In addition, for the period 2017-2019, TurkStat is responsible for implementing an investment project with the objective of improving the GHG Inventory. Under this project, a QA work was conducted for the agriculture sector in December 2017. Undertaking QA works related to the remaining sectors of the GHG Inventory are under consideration until the end of 2019 within the scope of this investment project.

Regarding verification, each Institution involved in national inventory development is responsible for its own verification activities. Sectorial experts within the Institution carry out the activities. In Turkey, some level of verification happens on an annual basis, as Turkey estimates and reports CO_2 emissions from fossil fuel combustion based on both the reference approach and the sectoral approach. Differences in the emissions estimated using these two approaches are described in the NIR.

Also, lower tier IPCC methods applied for comparison in especially energy sector. Emissions calculated and reported on the basis of higher tiers (Tier 2 or Tier 3) are compared with emissions calculated by Tier1 method.

Considering the current situation in Turkey, there is no other emission calculation to compare to the whole inventory or sub-sectors. However, By-Law on the Monitoring of Greenhouse Gases has come into force in 2012. In the scope of that By-Law, companies will report their verified GHG emissions to the MoEU from 2017 onwards. GHG emissions from most of the IPCC categories could be compared with those emissions reported under the MRV By-Law for next submissions.

Detailed information about national inventory system is available in latest National Inventory Report of Turkey which was submitted to UNFCCC in 2018.

3.3.3 Reporting under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

Turkey, as a Party included in Annex I with No commitments inscribed in Annex B to the Kyoto Protocol, has No obligation to report on the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol

3.3.4 National Registry

Turkey, as a Party included in Annex I with No commitments inscribed in Annex B to the Kyoto Protocol, has No obligation to report on the National Registry.

4

POLICIES AND MEASURES

Turkey became a party to UNFCCC on 24th of May, 2004 and ratified the Kyoto Protocol on 26 August 2009. Being a candidate country to the European Union, Turkey aims to sustain the full harmonization to EU Climate Aquis. Within this framework, reflections in the institutional, legal and policy frameworks have accelerated in several ways over the recent years. The following sessions describe the evolution of legal, institutional and policy frameworks of Turkey and their impacts in order to contribute to the global efforts to fight against climate change.

Protection of environment was first recognized as a priority issue for the Government of Turkey with its **3rd Five-Year Development Plan** in 1973, which recognized the preceding need for protecting the environment while ensuring the adequate supply of water to households, agricultural users and industry. Starting from the **6th Development Plan (adopted in 1989)**, which included direct targets to fight against environmental pollution based on "sustainable development principle", the concept of sustainable development has taken its place in several legislative and policy frameworks.

Turkey adopted its first **National Environmental Action Plan** in 1998, introducing the measures to address environmental degradation. Turkey has also benefited from some positive structural changes (change in energy mix, privatization of State-owned enterprises and industrial restructuring). "National Sustainable Development Report" prepared by the former Ministry of Environment and Forestry in 2002 has established the objectives, principles and policies of the sustainable development concept. In 2004, "National Sustainable Development Commission" was established in order to monitor application and dissemination of the sustainable development concept.

The issue of climate change was clearly stated for the first time in **8th Five-Year Development Plan (2000-2006). This Plan** states that regulations will be carried out for increasing energy efficiency in order to mitigate greenhouse gas emissions within the framework of UNFCCC commitments. The 9th Development Plan (2007 -2013) has been adopted with the vision of completing the approximation process for full membership to European Union, which also required full alignment with European Environmental Aquis. In 2012, Turkey's national sustainable development report namely "Claiming the Future" revealing country's vision for the sustainable development and green growth and showing country's best practices was prepared under coordination of former Ministry of Development. The green growth vision and targets are then reflected in the 10th Development Plan (2014-2018). In 10th Development Plan, "Green Growth" concept is involved among the policies to be implemented in major sectors such as energy, industry, agriculture, transport, spatial development and planning. The 11th Development Plan (2019-2023) is under preparation.

Turkey's main Climate Change Policy has been framed in two policy documents: **Climate Change Strategy (2010-2023) and National Climate Change Action Plan (2011-2023).** The both policy documents have been explained in detail in the "Policies and Measures and Their Effects" section below.

4.1 INSTITUTIONAL FRAMEWORK AND POLICY-MAKING PROCESSES

4.1.1 STATE ACTORS

Establishment of an institutional framework for Turkey to take its part in international efforts to combat climate change started in 2001 with the establishment of Coordination Board on Climate Change (CBCC) with the responsibility to coordinate Turkey's efforts on climate change. In parallel, the Coordination Council on Air Emissions[4] (CCAE) was established in 2012. Given their close relation and similar sector of competences, the two were finally merged into the CCAMCB[5] in 2013. The Board became responsible from coordination of activities under the agreements of UNECE Convention on Long-range Transboundary Air Pollution and with UNFCCC, together with the protocols subject to these conventions and relevant national policies and legislation. Therefore, the roles of the Board are:

- taking decisions and measures to fight against climate change and preventing air pollution
- coordinating activities of setting up internal and external policies dealing with UNFCCC and UN-ECE CLRTP.

4) Circular of the of the Prime Minister No.2012/22
5) Circular of the Prime Minister No.2013/11.

The CCAMCB represents a crucial entity given its great potentials in terms of enhancing and streamlining Turkish GHG monitoring and reporting performances. Therefore, CCAMCB is structured in order to ensure a high degree of technical and political expertise in different sectors, as well as the widest possible representation of relevant institutions and stakeholders. Therefore, besides the relevant ministries, CCAMCB includes representatives from public institutions, private sector and Non-governmental organizations such as Turkish Industry and Business Association, Turkish Statistical Institute, Turkish Union of Chambers and Commodity Exchange.

The coordination board has several Working Groups (WG) which meet at least twice a year, provide technical support to the Board, carry out the activities envisaged in Board Decisions and operate according to their working programmes. Institutions and Organizations in the working groups are represented by two persons one of which shall be at least at the position of Head of Department. For each WG a Coordinator Agency is appointed and MoEU is the permanent member of each WG. WGs can receive scientific and technical support from Advisors coming from academia, civil society and private sector, provided their qualified expertise in climate change/air pollution fields. Also, each member of the CCAMCB have specialized units on climate change. Also, all institutions that take place in the CCAMCB have their own units which particularly coordinate the Ministries' activities on climate change.

The Ministry for Environment and Urbanization (MoEU) is the National Focal Point for the UNFCCC, Kyoto Protocol, Vienna Convention and Montreal Protocol. The Ministry bears the responsibility for coordinating the preparatory work for the climate negotiations. Preparatory work for the climate negotiations is carried out in a number of ministries.

Each relevant Ministry develops initiatives and implements activities that supports the fight against climate change. Policies and measures that aim to reduce GHG emissions and increase resilience against climate change are developed within the framework of the decisions taken at the CCAMCB.

The Ministry of Environment and Urbanization coordinates the activities to developTurkey's policy in the field of climate change and protection of ozone layer, and coordinates the CCAMCB. The Ministry also coordinates preparation of national policy documents such as National Climate Change Action Plan (NCCAP) and National Climate Change Strategy (NCCS). The Department of Climate Change coordinates the activities of the MoEU within the framework of Turkey's obligations under international commitments, such as preparation of National Communications and Biennial Reports. The head of Department of Climate Change has the responsibility as the Focal Point of Turkey to UNFCCC.

Turkish Statistical Institute (TurkStat) is the main responsible authority to coordinate and implement national GHG inventory activities, being also the National Focal Point for national inventory in charge to submit the final yearly document to the UNFCCC Secretariat. Relevant Ministries such as Ministry of Energy and Natural Resources, Ministry of Transport and Infrastructure (formerly Ministry of Transport, Maritime Affairs and Communication), Ministry of Agriculture and Forestry (formerly two separate entities as Ministry of Food, Agriculture and Livestock and Ministry of Forestry and Water Affairs provide data to TurkStat in order to prepare national GHG emission inventories.

4.1.2 SUB-STATE ACTORS

Cities, states and regions are playing a key role in the fight against climate change, since they are responsible for taking a wide range of decisions that can make or break the success of any international strategy. Local authorities are ultimately responsible for making policy a reality. They can the fight against climate change, taking decisive action on transport emissions, urban biodiversity, urban regeneration and waste management. The importance of involvement of local authorities to the international efforts to fight against climate change is acknowledged widely among the international climate change community, which also had reflections in the COP decisions over the last decade especially in Paris in 2015.

The level of awareness regarding the role of local authorities in the fight against climate change has been increasing in Turkey over the last decade, including both mitigation and adaptation actions. Currently, there are 16 Municipalities (3 of which is Metropolitan Municipalities) that are signatory to the EU Covenant of Mayors for Climate and Energy Initiative, and 7 Municipalities (one of which is Metropolitan Municipality) that are members of ICLEI.

Several local authorities in Turkey are conducting several projects in order to reduce the GHG emissions and increase resilience against the impacts of climate change. Several local authorities have developed their climate change action plans, and many of them have started their implementation through funding from local, national or international resources. List of selected projects that are implemented by local authorities that support GHG emission reduction and climate resilience efforts are given in detail in Chapter 9.

4.1.3 SYSTEM FOR MONITORING AND EVALUATION OF POLICIES AND MEASURES

Turkish Statistical Institute ensures the collection of GHG emission data as the UNFCCC Focal Point for National GHG Inventories. Each Ministry that oversees respective policies and measures are responsible from monitoring and evaluation of the implementation status and GHG emission reduction impacts of those policies. However, as the National Focal Point for the UNFCCC, Ministry of Environment and Urbanization gathers the information and coordinates the reporting of the progress through National Communications and Biennial Reports.

4.2 LEGISLATIVE FRAMEWORK

Turkey's legislative framework which edges its policies and measures to fight against climate change is mainly lead by international concerns regarding climate change especially the UNFCCC process and Turkey's accession process to the EU. In order to make progresses in its path to join the EU, Turkey is called to, inter alia, align its national legislation, administrative and institutional set up with the whole current EU Acquis distributed into 35 Chapters. Among these, Chapter 27 covers Environment and Climate Change.

Within the scope of this chapter, a general overview on Turkey's current status of legislative framework relevant to climate change have been provided. Detailed policies that are based on the legislative framework will be provided in Section 4.4. As an accession country, Turkey's legislative framework will be provided together with its linkages with EU Environmental Legislation.

The **Environment Law** of 1982, which was amended in 2006, considers the environment as a whole. This Law outlines Turkey's environmental policy in general terms and it embraces the "polluter pays" principle. Turkey aims to align its national legislations with the EU acquis and improve enforcement. Secondary legislations have been adopted on air quality protection, air pollution control, landfill, integrated waste management, waste water, chemicals, noise management, environmental impact assessment (EIA), strategic environmental assessment (SEA), ozone depleting substances and Monitoring of GHG emissions to further boost the Law's implementation.

As a part of the efforts to approximate to EU Environmental Acquis, the following cross-cutting legislation have adopted. Sectoral legislative framework is provided in section 4.2.1.

By-Law on Monitoring of Greenhouse Gas Emissions has been promulgated on Official Gazette No. 29003 on May 17, 2014 and came into force in order regulate the principles and procedures for monitoring, verifying and reporting of greenhouse gas emissions arising out of the activities listed in Annex-1 of the legal document. According to the By-Law, manufacturing sector representatives of energy intensive sectors such as electricity and steam production, petrol refineries, petrochemistry, cement, iron-steel, aluminum, brick, ceramic, lime, paper and glass production regularly reporting and verify their annual GHG emissions.

The By-Law and the two Communiques under the framework of the By-Law have been developed as a part of efforts to align with the Decision No 280/2004/EC of the European Parliament and of the Council of 11 February 2004 concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol

Communique on Monitoring and Reporting Greenhouse Gases has been published on Official Gazette No 29068 on July 22, 2014. The legal document aimed at providing the principles and procedures for monitoring and reporting the greenhouse gas emissions originating from the activities listed in Annex 1 of the By-Law on Monitoring Greenhouse Gas Emissions.

Communique on Verification of Greenhouse Gas Emission Reports and Authorization of Verification Institutions has been published on Official Gazette No 29314 on April 2, 2015. The legislation came into force in order to determine the principles and procedures regarding the features of verification institutions that will carry out this verification processes. The verification system established within the scope of the By-Law will provide for verification control of emission reports prepared in facility basis by on-site inspection of independent institutions before submitting to the Ministry. Production of transparent, accurate, comparable, complete and consistent data and information regarding greenhouse gas emissions in facility basis will be provided through implementation of these regulations and communiques.

4.2.1 SECTORAL LEGISLATION

4.2.1.1 ENERGY

Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy (No 5346) has entered into force in 2005 in order to progress on extending the use of renewable energy resources for power generation, increasing resource diversity, reduction of waste, protection of the environment, and development of renewable technology manufacturing industry. The Law defines the renewable energy resources, determines the price of electricity to be generated from these resources as between 5-5.5 Euro cents and encourages electricity production from renewable energy by small subsidies. The Law No:5346 has been amended with the Law No:6094 that entered into force on January 8, 2011, where the subsidy rates were increased. The Law No:6094 increased the renewable power generation subsidies for hydroelectric power plants and wind power plants to 7.3 USD cents/kWh, for geothermal power plants to 10.5 USD cents/kWh and for biomass power plants (including landfill gas) and solar power plants to 13.3 USD cents/kWh.

By-Law on Documentation and Support of Electricity Manufacturing from Renewable Energy Resources (YEKDEM) has come into force in 2013 (revised in 2016, 2017 and 2018), within the scope the **Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy No. 5346 and By-Law on Documentation and Support of Electricity Manufacturing from Renewable Energy Resources.** YEKDEM is a support mechanism for electricity manufacturers from renewable energy resources. Pursuant to the article (4) of the By-Law, the support mechanism consists of feed-in tariffs (valid until 2020) for electricity manufacturing license holders and unlicensed electricity manufacturers producing electricity from renewables and other opportunities for renewable energy. The By-Law sets the rules for 10 years of power purchase guarantee for a set of renewable power plants, that have been registered to the system between years 2010 and 2020, including wind, solar, geothermal, biomass and small hydropower.

By-Law on Renewable Energy Resource Zones, which has come into force on October 9, 2016, introduced a new investment model to support renewable energy investments and incentivize local manufacturing of renewable generation assets. The main purposes of the By-Law are to use renewable energy resources much more efficiently and effectively by identifying renewable energy zones on the public, treasury, or private-owned territories; to realize the renewable energy investments much more rapidly; to manufacture renewable energy equipment in Turkey; to use locally-manufactured equipment/components; and to contribute to research and development activities through technology transfer

Energy Efficiency Law, No:5627 that entered into force in 2007. The law provides a legal framework for policies, strategies and activities regarding effective use of energy, prevention of loss, relieving the burden of energy cost on the economy and protecting the environment.

Law on Establishment and Operation of Nuclear Power Plants and Energy Sales, No:5710 was published in Official Gazette No 26707 on December 21, 2007. In years that followed 2007, preparations for legal infrastructure were carried out with the regulations published and a contract was signed with Russian Federation and Japan separately for construction of the Nuclear Power Plants in Akkuyu and SiNop.

By-Law on Unlicensed Electricity Production in Electricity Market published in 2013 (repealing the By-Law on Unlicensed Electricity Production in Electricity Market from year 2011) . As per the By-Law, real or legal persons who establish a production plant and/or micro cogeneration plant based on renewable energy resources with installed power capacity of maximum 1 MW are exempted from the licensing and company establishment liabilities.

By-Law Amending the By-Law on Domestic Manufacturing of the Parts Used in Facilities that Produce Electricity Energy from Renewable Energy Resources entered into force after promulgated on Official Gazette No 28755 on June 24, 20163. This By-Law regulated the principles and procedures regarding determination of additional price, documentation and inspection of parts and components to be manufactured in Turkey which have been determined in Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy No 5346. According to the By-Law, additional price subsidy of 0.4 and 3.5 USD cents has been provided for renewable power plants where domestically manufactured equipment have been used.

By-Law Amending the Electricity Market Network By-Law has been published on Official Gazette No 28517 on 03/01/2013. The By-Law aims to connect all engaged wind power plants to a centralized system.

Law on Geothermal Resources and Mineral Waters No 5686 has come into force on 03.06.2007. The Law shapes

heat and hot spring applications with geothermal resources, while electricity production from geothermal resources is regulated through Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy No 5346. The Law No 5686 (together with the secondary legislation) defines and frames the principles and procedures regarding effective exploration, research, development, production, protection of geothermal resources and natural mineral water resources, obtaining rights on these resources and transfer of rights, their economic utilization in harmony with the environment and abandonment.

4.2.1.2 BUILDINGS

By-Law on Principles and Procedures for Documentation of Sustainable Green Buildings and Sustainable Settlements entered into force and published in the Official Gazette on December 8, 2014.

By-Law on Energy Performance in Buildings[6] , which came into force in 2008 and revised substantially in 2010 and 2011, has been an important step to create more efficient building stocks in the country. The By-Law frames issues on standards and methodologies for preparation of buildings' "energy identity documents"; authorization for monitoring the building energy performances; provision of energy supply from renewable resources, preparation and update of national building inventory; increasing awareness for energy efficiency in buildings among the public. The By-Law is based on Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings.

Green Certificates By-Law for Buildings and Settlements, the By-Law has been adopted in December 2017 and replaced the By-Law on Principles and Procedures for Documentation of Sustainable Green Buildings and Sustainable Settlements which came into force in 2014.

4.2.1.3 INDUSTRY

By-Law on Ecodesignof Energy-Related Products, has come to force in 2010, in line with Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 on establishing a framework for the setting of Ecodesign requirements for energy-related products. The By-Law aims to contribute to provision of energy supply security and energy efficiency through defining the set of standards for energy utilizing products' design. The product groups that are subject to the By-Law are power utilizing products such as boilers, computers, TVs, white goods and light bulbs; and products that indirectly have impacts on energy utilization such as windows, isolation materials, bathroom equipment etc. Within the framework of the By-Law, the following Communiqués have come into force:

- **Communiqué Regarding EcodesignRequirements for Standby and Off Mode Electric Power Consumption of Electrical and Electronic Household and Office Equipment,** which came into force in 2011 (revised in 2015) (in line with Commission Regulation (EC) No 1275/2008)
- **Communiqué Regarding EcodesignRequirements for Simple Set-Top Boxes**, which came into force in 2011 (in line with Commission Regulation (EC) No 107/2009)
- **Communiqué Regarding Ecodesign Requirements for Non-Directional Household Lamps,** which came into force in 2011 (revised in 2017) (in line with Commission Regulation (EC) No 244/2009)
- **Communiqué Regarding Ecodesign Requirements for Fluorescent Lamps Without Integrated Ballast, For High Intensity Discharge Lamps, And for Ballasts and Luminaires Able to Operate Such Lamps,** which came into force in 2011 (revised in 2017) (in line with Commission Regulation (EC) No 245/2009)
- **Communiqué Regarding Ecodesign Requirements for No-Load Condition Electric Power Consumption and Average Active Efficiency of External Power Supplies,** which came into force in 2011 (in line with Commission Regulation (EC) No 278/2009)
- **Communiqué Regarding Ecodesign Requirements for Glandless Standalone Circulators and Glandless Circulators Integrated in Products,** which came into force in 2011 (revised in 2014 and 2015) (in line with Commission Regulation (EC) No 641/2009)

6) http://www.bep.gov.tr/BEPTRWEB/Default.aspx#.W2XHDygzbIV

- **Communiqué Regarding Ecodesign Requirements for Televisions,** which came into force in 2011 (revised in 2015) (in line with Commission Regulation (EC) No 642/2009)
- **Communiqué Regarding Ecodesign Requirements for Household Refrigerating Appliances,** which came into force in 2011 (in line with Commission Regulation (EC) No 643/2009)
- **Communiqué Regarding Ecodesign Requirements for Household Washing Machines**, which came into force in 2011 (in line with Commission Regulation (EU) No 1015/2010)
- **Communiqué Regarding Ecodesign Requirements for Household Dishwashers**, which came into force in 2011 (in line with Commission Regulation (EU) No 1016/2010)
- **Communiqué Regarding Ecodesign Requirements for Electric Motors,** which came into force in 2012 (revised in 2015) (in line with Commission Regulation (EC) No 640/2009)
- **Communiqué Regarding Ecodesign Requirements for Household Tumble Driers,** which came into force in 2013 (in line with Commission Regulation (EC) No 932/2012)
- **Communiqué Regarding Ecodesign Requirements for Air Conditioners and Comfort Fans,** which came into force in 2012 (in line with Commission Regulation (EC) No 206/2012)
- **Communiqué Regarding Ecodesign Requirements for Vacuum Cleaners,** which came into force in 2015 (in line with Commission Regulation (EC) No 666/2013)
- **Communiqué Regarding Ecodesign Requirements for domestic ovens,** hobs and range hoods, which came into force in 2015 (in line with Commission Regulation (EC) No 666/2013)
- **Communiqué Regarding Ecodesign Requirements for Vacuum Cleaners,** which came into force in 2015 (in line with Commission Regulation (EU) No 66/2014)
- **Communiqué Regarding Ecodesign Requirements for computers and computer servers,** which came into force in 2015 (in line with Commission Regulation (EU) No 617/2013)
- **Communiqué Regarding Ecodesign Requirements For directional lamps, light emitting diode lamps and related equipment,** which came into force in 2015 (revised in 2017) (in line with Commission Regulation EU No 1194/2012)

By-Law on the Indication by Labelling and Standard Product Information of The Consumption of Energy and Other Resources by Energy-Related Products, No:2011/2257 in line with Directive 2010/30/EU of the European Parliament and of the Council of 19 May 2010, has come into force in 2011. The By-Law established a framework for the harmonization of national measures on end-user information by means of labelling and standard product information, on the consumption of energy and where relevant of other essential resources during use, and supplementary information concerning energy-related products, thereby allowing end-users to choose more efficient products. Within the framework of the By-Law, the following Communiqués have come into force:

- **Communiqué Regarding Energy Labelling of Household Dishwashers, No:2012/5,** which came into force in 2012 (revised in 2015) (in line with Commission Regulation EU No 1059/2010)
- **Communiqué Regarding Energy Labelling of Household Refrigerating Appliances, No:2012/4,** which came into force in 2012 (revised in 2015) (in line with Commission Regulation EU No 1060/2010
- **Communiqué Regarding Energy Labelling of Household Washing Machines, No:2012/6,** which came into force in 2012 (revised in 2015) (in line with Commission Regulation EU No 1061/2010)
- **Communiqué Regarding Energy Labelling of Televisions, No:2012/7**, which came into force in 2012 (revised in 2015) (in line with Commission Regulation EU No 1062/2010)
- **Communiqué Regarding Energy Labelling of Household Tumble Driers, No:2013/6,** which came into force in 2013 (revised in 2015) (in line with Commission Regulation EC No 392/2012)
- **Communiqué Regarding Energy Labelling of Air Conditioners, No:2013/11,** which came into force in 2013 (revised in 2015) (in line with Commission Regulation EU No 626/2011)

- **Communiqué Regarding Energy Labelling of Vacuum Cleaners, No:2015/5,** which came into force in 2015 (revised in 2015) (in line with Commission Regulation EU No 665/2013)
- **Communiqué Regarding Energy Labelling of Domestic Ovens and Range Hoods, No:2015/8,** which came into force in 2015 (in line with Commission Regulation EU No 65/2014)
- **Communiqué Regarding Energy Labelling of Electrical Lamps and Luminaires, No:2015/9,** which came into force in 2015 (revised in 2015) (in line with Commission Regulation EU No 874/2012)

In the Automotive Sector, legislative framework has been developed in line with the following EU legislation as a part of the approximation process:

- Regulation (EC) No 715/2007 of the European Parliament and of the Council of 20 June 2007 on type approval of motor vehicles with respect to emissions from light passenger and commercial vehicles (Euro 5 and Euro 6) and on access to vehicle repair and maintenance information
- Regulation (EC) No 595/2009 of the European Parliament and of the Council of 18 June 2009 on type-approval of motor vehicles and engines with respect to emissions from heavy duty vehicles (Euro VI) and on access to vehicle repair and maintenance information and amending Regulation (EC) No 715/2007 and Directive 2007/46/EC and repealing Directives 80/1269/EEC, 2005/55/EC and 2005/78/EC
- Directive 2000/25/EC of the European Parliament and of the Council of 22 May 2000 on action to be taken against the emission of gaseous and particulate pollutants by engines intended to power agricultural or forestry tractors and amending Council Directive 74/150/EEC
- Commission Delegated Regulation (EU) 2015/96 of 1 October 2014 supplementing Regulation (EU) No 167/2013 of the European Parliament and of the Council as regards environmental and propulsion unit performance requirements of agricultural and forestry vehicles
- Directive 2006/40/EC of the European Parliament and of the Council of 17 May 2006 relating to emissions from air conditioning systems in motor vehicles and amending Council Directive 70/156/EEC

Other legislation that has come into force in various sectors are as follows:

- **Communiqué Regarding Ecodesign requirements for water pumps,** in line with Commission Regulation (EU) No 547/2012
- **Communiqué Regarding Efficiency Requirements for New Hot-Water Boilers Fired with Liquid or Gaseous Fuels** in line with Council Directive 92/42/EEC
- **Communiqué Regarding the Energy Labelling of Space Heaters, Combination Heaters, Packages of Space Heater, Temperature Control and Solar Device and Packages Of Combination Heater, Temperature Control And Solar Device,** in line with Commission Delegated Regulation (EU) No 811/2013
- **Communiqué Regarding the Energy Labelling of Water Heaters, Hot Water Storage Tanks and Packages of Water Heater and Solar Device,** in line with Commission Delegated Regulation (EU) No 812/2013
- **Communiqué Regarding Ecodesign Requirements for Space Heaters and Combination Heaters,** No 2018/3 in line with Commission Regulation (EU)
- **Communiqué Regarding Ecodesign Requirements for Water Heaters and Hot Water Storage Tanks,** in line with Commission Regulation (EU) No 814/2013

4.2.1.4 TRANSPORT

By-Law on Procedures and Principles Regarding the Improvement of Energy Efficiency in Transportation entered into force in 2008. By-Law sets rules and procedures regarding the establishment of systems for reducing fuel consumption of motor vehicles per unit, raising efficiency standards in vehicles, dissemination of public transportation and increasing traffic flow in order to increase energy efficiency the transportation. By-Law is implementing by Ministry of Transport, and Infrastructure.

By-Law on the Disclosure of Consumers About Fuel Economy of New Passenger Car and CO_2 Emissions aims to provide enlightenment of consumers about CO_2 emission and fuel economy of new passenger cars offered for sale or rent in the market in order to make consumers informed choices. Therefore, Directorate General for Industry collects and publishes fuel consumptions and emissions of new passenger cars. Within the scope of the By-Law, the market supervision of the cars is done by Directorate General for Safety and Supervision of Industrial Products.

By-Law on Recreational Craft and Personal Watercraft entered into force in May 2017, in accordance with the EU Directive 2013/53/EU on Recreational Craft and Personal Watercraft. The By-Law aims to limit carbon, nitrogen oxides and hydrocarbons ratios in the exhaust emissions of the personal watercraft engines.

4.2.1.5 AGRICULTURE

Agricultural Law, No.5648 has come into force in 2007, and it includes determining policies necessary for developing and supporting agricultural sector and rural area, making the arrangements, specifying scope and subjects, forming and conducting programs, finance and administrative structuring, application principles and procedures related to primary research and development programs. The Law also defines supports to be given for agriculture insurance payments, rural development and environment, and agricultural land protection program.

Law on Soil Conservation and Land Use, No.5403 has come into force in 2005 and it aims to provide protection and development of soil by preventing soil loss and quality loss. It also aims to provide planned land use in compliance with environmentally sustainability development principles. Law on Amending the Law on Soil Conservation and Land Use (came into force in 2014[7]) defines the smallest agricultural parcel size according to provinces and counties for determining minimum agricultural land.

Pasture Law, No:4342 which came into force in 1998 determines the responsibilities of state institutions in arrangements in determining research, planning, breeding projects, grazing periods, usage system, protection and control measures to provide maintenance, breeding, protection, control and proper use of pastures, summer pastures and winter quarters. Methane gas emission in stock farming is directly related to feeding. In development of pastures, determination and using plant types which may reduce methane emission arising as a result of enteric fermentation is a kind of opportunity for greenhouse gas emission arising from stock farming. As it has granted this authority, Pasture Law has an important function in controlling Greenhouse Gases.

Law on Veterinarian Services, Crop Health, Food and Feed No 5996 has come into force in 2010. The Law applies to all stages of production, processing and distribution of food, materials and articles intended to come into contact with foodstuffs and feed, controls of residues of plant protection products and veterinary medicinal products and other residues and contaminants, control of epidemic or contagious animal diseases and harmful organisms in plants and plant products, welfare of farm and experimental animals and pet animals, zootechnics, veterinary health and plant protection products, veterinary and plant health services, entry and exit procedures of live animals and products to country as well as related official controls and sanctions

Organic Agriculture Law No 5262 came into force in 2004, repealing the Law on Production of Agricultural and Livestock Production Using Ecological Methodologies (1994), and it determines principles and procedures on taking necessary precautions to provide development of organic product and inputs production for offering the consumers reliable, high quality products. The Law assuring control and control of certification process, and this process is one of the strongest tools in controlling fertilizer use in agricultural production. In this context, it provides significant contribution in decreasing N_2O emission.

By-Law on Organic Agriculture, which came into force in 2010 (amended in 2012 and 2013), is in line with Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and Commission Regulation (EC) No 889/2008 of 5 September 2008 laying down detailed rules for the implementation of Council Regulation (EC) No 834/2007.

Chemical Fertilizer Control By-Law No 2015/42, which came into force in 2015, includes technical arrangements in production, import and consumption of chemical fertilizer and are prepared for providing market control in specific standards, in compliance with rules and taking under record. By-Laws enable preventive control of exceeding specific amounts of Greenhouse Gases to be released in case chemical fertilizers are applied by analysis.

7 http://www.resmigazete.gov.tr/eskiler/2014/05/20140515-1.htm

By-Law on Good Agricultural Practices, No 27778, which has come into force in 2010 and it includes provision agricultural practices which do not give any harm to environment, human and animal health, protecting natural resources, and arranging principles and procedures of good agricultural practices to provide traceability and sustainability in agriculture and for submitting reliable products. Effective practices are performed in terms of food security and proper-sufficient fertilizer use. **Farmer Registry System By-Law**[8] has come to force in 2014, in order to create database of farmers and their food production and livestock activities, which enables to create a platform for monitor and update annual production. The legislation does not directly have influence on mitigating GHG emissions, however it facilitates a monitoring mechanism for implementation of measures in the agriculture sector.

4.2.1.6 FORESTRY

Forest Law, No:3116 came into force in 1937, the first modern forest law that builds the basics of scientific forestry applications, was put in force, with this law, the principles of State Property, management by the state and sustainability were introduced.[9]

Forest Law, No 6831, which came into force in 1956, determines the definition of forests, the areas excluded from the boundaries of forests, classification of forests from the different points, state forests and forest cadaster, economic development and transfer of forest villagers, preservation of forests, grazing land and pasture affairs, protected forests, national parks, production and sale places, forestation and building affairs, extinguishing forest fines, the power of forest officials regarding carrying.

4.2.1.7 WASTE

By-law on Packaging Waste Control was published in the Official Gazette No. 28035 of 24 August 2011, in order to align with the Directive 94/62/EC on packaging and packaging waste. In compliance with the Directive 94/62/EC, the By-law sets annual recovery targets for materials: glass, plastic, metal, paper/cardboard and wood. Recovery targets are detailed in the By-law beginning from 2005 to the end of 2020. This By-Law was revised and published in the Official Gazette No. 30283 of 27 December 2017, to meet the requirements set by Directive 2015/720 amending Directive 94/62/EC as regards reducing the consumption of lightweight plastic carrier bags. With this by-law, national recycling and recovery targets are put into effect. Moreover, certain quotas concerning recycled material to be used as input during production process of the packages are set as to support recycling as well as a means of circular economy approach. Municipalities are the main responsible institutions for separate collection of the packaging waste at source. To this end, they have to prepare and submit a packaging waste management plan to the MoEU. In addition, to assess the problematic issues as well as the progress achieved in the field of the packaging waste management, committee meetings are arranged by the MoEU including all stakeholders.

By-law on Waste Management was published in the Official Gazette No. 29314 of 2 April 2015 in parallel with the Waste Framework Directive. With this By-law, by-product definition, determination of competent authorities and licensing and recording authorities, preserving the records of all waste types and transportation of wastes are introduced to waste management legislation.

By-law on the Use of Domestic and Municipal Sewage Sludge on Soil was published in the Official Gazette No. 27661 of 3 August 2010 in conformity with the Directive 86/278/EEC on sewage sludge to a large extent. In order to improve implementation on management of sewage sludge, Project on Preparation of Management Plan of Sludge Treatment of Ergene Basin has been implemented in 2015 from national budget. Furthermore, Project on Preparation of Management Plan of Sludge Treatment of Gediz Basin has been launched in 2016. Other projects financed through national budget are, Project on Domestic and Urban Treatment Sludge Management which was completed in 2013 and Project on Sewage Sludge Management and Action Plan in Turkey which was launched in July 2016 and is planned to be completed in 2018.

The Directive 91/157/EEC on batteries and accumulators containing certain dangerous substances was transposed into the By-law on Control of the Waste Batteries and Accumulators which was published in the Official Gazette No. 25569 of 31 August 2004.

8 http://www.resmigazete.gov.tr/eskiler/2014/05/20140527-5.htm
9 http://www.fao.org/docrep/ARTICLE/WFC/XII/0072-C1.HTM

By-law on Control of End-of-Life Vehicles was published in the Official Gazette No. 27448 of 30 December 2009 in parallel with the Directive 2000/53/EC on the End-of-Life Vehicles.

By-law on Control of Waste Electrical and Electronic Equipment was published in the Official Gazette No. 28300 of 22 May 2012 in parallel with the Directive 2002/95/EC of the European Parliament and of the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment and Directive 2002/96/EC of the European Parliament and of the Council on waste electrical and electronic equipment (WEEE). The percentage of the collection and the amount of recycling are increasing with years and the EU targets will be achieved at the date of accession.

By-law on Landfill was published in the Official Gazette No. 27533 of 26 March 2010 aligned with the Directive 1999/31/EC on landfill of waste. In accordance the By-law, by 2018 the amount of the biodegradable waste to be stored in landfill shall be reduced to 50% by the weight of the total amount of the biodegradable waste produced in 2005. This ratio is set as 35% by 2025. The MoEU shall draw up a national strategy on the reduction of the biodegradable waste to be disposed of in landfill facilities.

The MoEU published the **National Waste Management and Action Plan (2016-2023)** in December 2017 in 2018, in order to set goals for local authorities in all 81 provinces towards an integrated waste management system, which will require more recovering, recycling and energy production from waste and accordingly limit the number of sanitary landfills needed as it is aimed at in circular economies. National Waste Management and Action Plan presents general plans in the waste management sector for municipal waste as well as packaging waste, medical waste and hazardous waste. This plan, which will function as a roadmap for investments, also includes information regarding the place, timeframe and the required capacity for plants to be built, and afterwards a national strategy will be developed on the reduction of the biodegradable waste to be disposed of in landfills. Regional Waste Management Plans will also be prepared taking into account waste management system at national level. Preparation of hazardous waste management plans was completed in 2008, and these plans are being revised within the framework of the studies on the waste management plan. The waste management plans (National Waste Management and Action Plan and Solid Waste Master Plan and Local Waste Management Plans) will be prepared by the projects funded by national budget, which were launched in 2016.

As the main principle, reduction of waste at the source is the priority and recovering waste, where source reduction is not possible, is preferred in preparing legislation in order to overcome the problems. Waste, which could not be recovered, should be disposed as the last option in accordance with the technique that will not damage the environment and human health. To achieve this goal; the framework of **National Recycling Strategy and Action Plan** is being prepared to apply national legislation and within the scope of harmonization process with EU Environment Acquis in waste management. The plan covers whole Turkey and the time horizon is set as 2016-2023.

4.3 POLICIES AND MEASURES AND THEIR EFFECTS

Turkey's overall Climate Change Policy is framed with several cross-cutting and sectoral policies, strategies and action plans that are based on the National legislation in relevant sectors. The main policy documents that are dedicated only to Turkey's Climate Change policies are National Climate Change Strategy (NCCS), and National Climate Change Action Plan that is based on NCCS. Below both cross-cutting and sectoral policies are given in details.

4.3.1 CROSS-CUTTING POLICIES AND MEASURES

The **10th Development Plan,** covering the 2014-2018 period, is a significant document, since the term "Green Growth" was first introduced to the Government Policies. 10th Development Plan of Turkey (2014-2018) refers to the global importance of "green growth" concept and introduces the concept in areas like energy, industry, agriculture, transport, construction, services and Urbanization under climate change policies.

According to the Plan, adapting and combating climate change will be maintained in line with the principles of "common but differentiated responsibilities" and "respective capabilities", while considering national circumstances. Moreover, in this Plan, pollution prevention efforts, protection and sustainable usage of natural resources, and biodiversity conservation are considered as priorities. Climate change and its impacts over different sectors of economy are also recognized. The

following points take place in the 10th Development Plan:

- The Plan mentions the importance of local energy resources and underlines the importance of increasing the use of lignite, nuclear power and renewable energy sources as well as energy efficiency measures.
- The Plan envisages to explore Green growth opportunities in areas such as energy, industry, agriculture, transportation, construction, services and Urbanization to be evaluated, and new business areas, R&D and innovation that provide environmentally sensitive economic growth to be supported.

11th Development Plan is under preparation.

National Climate Change Strategy (2010-2020) (NCCS), covering the 2010-2020 period, has been prepared with contribution from a variety of stakeholder groups including CCAMCB members, public and private sector representatives, universities and NGOs, and approved by Higher Planning Council on May 3, 2010. It is one of the key policy documents which frames Turkey's contribution to global efforts to fight against climate change.

The NCCS describes Turkey's vision as "becoming a country fully integrating climate change-related objectives into its development policies, disseminating energy efficiency, increasing the use of clean and renewable energy resources, actively participating in the efforts for tackling climate change within its "special circumstances", and providing its citizens with a high quality of life and welfare with low-carbon intensity". The NCCS includes a set of objectives to be implemented in the short term (within one year), the mid-term (undertaken or completed within 1 to 3 years), and long term (undertaken over a 10-year period). It also guides the actions (such as energy efficiency measures, usage of renewable sources, transportation type) for GHG emission reduction in the energy, transportation, industry, waste, land use, agriculture and forestry sectors to tackle climate change during the period 2010-2020.

National Climate Change Action Plan (2011-2023) (NCCAP), is the main policy document that identifies sectoral climate actions to fight against climate change and to meet national INDC targets. NCCAP is prepared within the framework of NCCS, 9th Development Plan and other national policies and strategy documents in 2011. NCCAP includes strategic principles and goals on greenhouse gas emissions reductions and adaptation to climate change for the period of 2011-2023. It lays down cross- sectorial mitigation measures from short to long term, including provisions for cross-cutting issues for data collection, reporting, monitoring, and verification. The NCCAP sets clear objectives for both mitigation and adaptation aspects of climate change. It was prepared on the basis of the sectors specified both in Annex-A of the Kyoto Protocol and UNFCCC National Communication and GHG Inventory reporting formats and includes the goals and actions on energy, buildings, transportation, industry, waste, agriculture, land use and forestry, climate change adaptation and cross-cutting issues.

The plan emphasizes "disseminating energy efficiency, increasing the use of clean and renewable energy resources, actively participating in the efforts for tackling climate change within Turkey's special circumstances and providing its citizens with a high quality of life and welfare with low-carbon intensity". NCCAP identifies short, medium and long-term goals under eight topics (energy, industry, forestry, agriculture, buildings, transportation, and waste and climate change adaptation).

Some key elements of the NCCAP are indicated below:

Identifying key sectors for the carbon markets, and identifying the GHG reduction potential in the relevant sectors;

- Making legislative arrangements to enable public institutions regulatory and supervisory role in the emission trading system;
- Developing the existing structure and building new structures to enable carbon assets to be traded with maximum economic value and have their values increased;
- Beginning infrastructure development for establishment of the National Emission Trading System;
- Carrying out activities to increase awareness in carbon markets in Turkey;
- Providing support to stakeholders necessary to identify, develop, market and manage carbon projects.

Strategic Plan of Ministry of Environment and Urbanization (2018-2022) has been developed and adopted in 2018. The strategy integrates environmental sustainability and climate change actions into the Urbanization strategies and policies. The Strategy is composed of I) Environmental Pillar, ii) Urbanization Pillar and iii) Institutional Capacity Pillar.

The following strategic targets are included in the Strategic Plan:

- Taking measures for improving environmental quality, fight against climate change, increase resilience to the impacts of climate change, compliance with international commitments; extending "zero waste" applications in more public institutions.
- Supporting local authorities in providing environmentally sustainable urban areas and livelihoods; promoting and supporting mechanisms to establish smart cities; increasing energy efficiency standards of buildings

Integrated Urban Development Strategy and Action Plan (2010-2023) (KENTGES) was adopted in 2010 for the period of 2010-2023. Plan mentions studies and actions to be performed at central and local levels regarding transport, housing and land supply, disasters, natural and cultural assets, climate change, life quality, social policies and participation. In the Plan, the main principles and values regarding climate change and sustainable development are: (I) Paying attention to ecological balance in natural resource use; (ii) Ensuring healthy, safe, and quality environment, free from natural and technological disasters and risks; (iii) Improving use of a sustainable transportation systems as well as use of renewable energy resources; (iv) Paying attention to environmental, natural and ecological equality; (v) Encouraging methods to decrease impacts of consumption patterns on natural and cultural environment in settlements. KENTGES is a cross cutting strategy document in terms of low carbon and sustainable development.

Implementation of the legislation regarding Monitoring, Reporting and Verification of GHG emissions has accelerated over the recent years. Monitoring plans have been received from the businesses, that are subject to the legislation, have been received. Preparation of monitoring reports and their verification is ongoing. In order to facilitate the implementation of the legislation in an effective way, a web portal has been developed where businesses can prepare their monitoring plans and monitoring reports online. Also, training courses have been organized in order to develop capacities for accredited verifiers and certified verification companies.

4.3.2 VOLUNTARY CARBON MARKETS

Turkey does not benefit from the flexibility mechanisms of the Kyoto Protocol, however there is an increasing interest in Voluntary Carbon Markets in Turkey. Turkey hosts several projects which are eligible for carbon asset development since 2005. Although the Voluntary Carbon Market represents a very small percentage within the World Carbon Market, Turkey's current effective use of this market presents an important opportunity for its future participation in the carbon markets.

In current status, there are 348 projects that have developed carbon assets in the Voluntary Carbon Market. These projects are expected to realize an annual greenhouse gas emissions reduction of over 26 Mtons CO_2-eq. The list of existing projects and their annual carbon seduction potentials as of April 2018 are as follows:

Table 4. 1 Energy Projects in the Voluntary Carbon Market

Project Type	Number of Projects	Annual GHG Emission Reduction Potential (t CO_2-eq)
Hydropower	146	8,543,540
Wind Power	145	11,223,783
Biogas/LFG	34	4,104,066
Geothermal	11	1,868,256
Energy Efficiency	12	268,557
Total	348	26,008,202

On top of the measures indicated above, the following projects are being implemented by relevant Ministries in order to support the policies, measures and strategy documents:

Table 4. 2 Project implemented to Support Cross-cutting Policies and Measures

Project Name	Description	Time Period	Budget & Resource of Financing	Implementing Institutions
Partnership for Market Readiness (PMR)	The aim of the project is to provide capacity development on carbon pricing policies by working in close cooperation with the public and private sectors and to assess the appropriateness of these policies to the country through comprehensive studies.	2014-	3,350,000 USD World Bank and Republic of Turkey	Ministry of Environment and Urbanization
Capacity Development for MRV System for Greenhouse Gas Emissions	The project is part of the International Climate Initiative (IKI) of the German Federal Environment Ministry (BMUB). The Project aims to support the creation of the necessary infrastructure for monitoring, reporting and verification of greenhouse gas (GHG) emissions in Turkish industry.	2013-2018	German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)	- Ministry of Environment and Urbanization -GIZ
Technical Assistance for Support to Mechanism for Monitoring Turkey's GHG Emissions (TASK-GHG)	This EU funded project aims to strengthen existing capacities in Turkey and assist the Country to I) fully implement a monitoring mechanism of Greenhouse Gas (GHG) emissions in Turkey, in line with the EU Monitoring Mechanism Regulation 525/2013 repealing Decision 280/2004/EC, and ii) better fulfill its reporting requirements to the UNFCCC, including national GHG inventories, NCs and BRs.	2014-2017	3.000.000 EUR (EU-IPA) and Republic of Turkey	Ministry of Environment and Urbanization
Enhancing Required Joint Efforts on Climate Action	Within the scope of the project, in order to support MoEU in terms of better response to global climate issues and achieving international reliability, technical assistance is provided on capacity building through an extensive training programme. Effective communication with climate-related stakeholders, and awareness raising activities are conducted and local climate change actions are realized through a grant scheme of 38 projects.	2017-	1.865.000 EUR (EU-IPA) and Republic of Turkey	Ministry of Environment and Urbanization
Technical Assistance for Developed Analytical Basis for Formulating Strategies and Actions towards Low Carbon Development	The purpose of this project is to increase national and local capacity to prepare for medium and long-term climate action towards climate resilient low-carbon development, which will gradually align with the EU climate policy and legislation by providing an analytical basis to support realization of low-carbon in the long-term, specifically focusing on cost effective climate change mitigation actions related to buildings, waste, transportation and agriculture sectors.	May 2017	€ 3,865,010 (EU-IPA) and Republic of Turkey	Ministry of Environment and Urbanization

4.3.3 SECTORAL POLICIES AND MEASURES

In Turkey, climate policy is increasingly being integrated with the decision-making processes in energy production, transport, agriculture, forestry and land-use and other planning. Below sectoral policies, strategies, plans and programmes that have direct or indirect impacts on GHG emission reduction are explained:

4.3.3.1 ENERGY

Turkey's Energy Policy gives top priority to decreasing import dependency by improving security of supply and utilizing renewable energy sources to the maximum extent in an environmentally sound manner. Therefore, the priority of Turkey in the forthcoming period will be reducing dependency on the imports by realizing its domestic and renewable energy potential along with providing the energy supply security. In this context, Turkey's main strategies and policies based on the energy supply security are outlined as:

- Providing resource diversity by prioritizing local resources,
- Increasing the share of renewable energy resources in energy supply,
- Increasing energy efficiency,
- Giving full operability to free market conditions and improving the investment environment,
- Providing resource diversity in petrol and natural gas fields and taking the measures to mitigate the risks arising out of import,
- Becoming and energy corridor and terminal within the context of regional collaboration processes using the geostrategic position effectively,
- Providing for environmentally sensitive execution of activities in energy and natural resources,
- Increasing contribution of natural resources to the country's economy,
- Increasing production of industrial raw materials, metal and Non-metal minerals and providing for their domestic use,
- Making energy accessible for consumers in cost, time and amount aspects.

Turkey's Intended Nationally Determined Contribution (INDC) gives clear policy framework suggests:

- Increasing capacity of production of electricity from solar power to 10 GW until 2030
- Increasing capacity of production of electricity from wind power to 16 GW until 2030
- Tapping the full hydroelectric potential
- Commissioning of a nuclear power plant until 2030
- Reducing electricity transmission and distribution losses to 15 percent at 2030
- Rehabilitation of public electricity generation power plants
- Establishment of micro-generation, co-generation systems and production on site at electricity production

Having witnessed a sharp and continuous increase in almost all forms of energy demand, the economy is in need of vast amounts of investment to meet this growing demand. Over the last ten years, Turkey's economic boom was accompanied by a rise in electricity demand. From 2003 to 2013, electricity demand grew by an average 6% per annum[10]. And according to the Mid-term Plan 2018-2020; GDP growth rate is targeted to be 5.5%. Economic expansion, rising per capita income, positive demographic trends and the rapid pace of Urbanization are the main drivers of the energy demand, estimated to continue increasing trend.

Turkish energy markets have been undergoing tremendous changes over the last two decades. Turkey made a radical decision in 2001 to liberalize its electricity sector, establishing a competitive market under the regulation and monitoring

10) EMRA, (2014a), Capacity of Production Projections (in Turkish), Available at: http://www.epdk.org.tr/ index.php/elektrik-piyasasi/ yayinlar-raporlar

of an independent regulatory agency (EMRA). Over the last two decades, private sector made sizeable investments and played a significant role in the development of energy industry.

The installed power capacity of Turkey increased threefold in the last two decade and reached 86.934 MW as of May 2018[11]. This capacity is expected to reach 120 GWe by 2023. In 2017 alone, 8500 MW additional capacity increase was achieved, and 53% of this increase was obtained from renewable energy resources.

Various policy documents are published in the recent years which directly or indirectly targets GHG emission reduction in the energy sector. The cross-cutting policies that contribute to Turkey's GHG emission reduction in the energy sector are listed below:

10th Development Plan defines Turkey's main Energy objective as "to reach a competitive energy system which makes use of the local and renewable energy resources at the highest level, foresees use of nuclear technology in electricity production, supports decreasing economy's energy-intensiveness, mitigates loss and environmental impact of energy and empowers the country's strategic position in international energy trade." The plan foresights that will affect the greenhouse gas emissions are included in the plan as seen below:

- Construction of Akkuyu NPP's first unit will be completed substantially within the plan period. First construction of a second NPP in Sinop will be initiated. Within the plan period, area determination, preliminary feasibility and investment preparations of a third 5,000 MW NPP will be initiated.
- Energy Efficiency Strategy will be implemented effectively and efficient use of energy in all industries will be provided. Rehabilitations of the thermic and HPPs that are foreseen to remain in government will be completed, their loss-leakage rates will be mitigated to lowest possible level.

As a roadmap for energy policies in Turkey, **Strategic Plan of the Ministry of Energy and Natural Resources (2015-2019)** targets "providing the highest contribution to national welfare by utilizing energy and natural resources in the most efficient and environmentally-conscious manner." Even though targets defined in the plan could not be achieved, they are important due to direct impact of the energy sector emissions on climate change. Some targets in the document are listed as follows:

- to have a strong and reliable energy infrastructure. In order to achieve this target, natural gas storage will be increased.
- to reach an optimum resource diversity by increasing local coal usage, renewable energy shares and decreasing the natural gas usage in electricity production increasing the local crude oil production and exploration of new local coal source mines.
- energy efficiency measures with privatization and modernization of the state-owned power plants, using more efficient street lightings, decreasing loss and illegal consumption and expanding regional heating systems.

National Energy and Mining Policy (2017) was adopted in order to clinch the confidence in the industry and update goals. Ensuring energy supply security and predictable market conditions as well as localization are the three featured axes of National Energy and Mining Policy. The strategies that constitute the Policy are summarized below:

- Increase energy efficiency: An overall target to reduce the energy intensity by 20% until 2023 compared to the 2008 levels is formulated.
- Make progress in renewable energy through local production, R&D and YEKA: One of the identified goals is to increase the share of renewable energy in total energy production by at least 30 percent
- Contribute to the generation of electricity by using nuclear technology: One of the identified goals is to increase the share of NPPs in electricity generation by at least 10 percent according to the forecasts for 2023

Renewable Energy

As the demand for energy grows in Turkey, utilization of renewables for electricity generation appears to be one of the most efficient alternatives in satisfying the growing demand for electricity.

11) General Directorate of Renewable Energy, 2018

The introduction of the **Renewable Energy Sources Support Mechanism (YEKDEM)** has significantly accelerated renewable energy investments especially for wind and solar power. Within the frame of the support mechanism, the retail companies assigned by EMRA are required to purchase the produced electricity from the electricity manufacturers which are subject to this mechanism on the tariffs regulated by the legislation and the electricity manufacturer cannot sell the produced electricity to other companies under the open market conditions. These feed-in tariffs vary on the energy resource, for instance, the tariffs for solar energy and biomass are 13,3 USD Cent/kWh whereas these amount to 7,3 USD Cent/kWh for hydroelectricity and wind.

The **By-Law on Renewable Energy Resource Areas (YEKA)** entered into force in 2016 for ensuring effective and efficient use of Turkey's renewable energy sources by forming large-scale Renewable Energy Resource Areas (YEKAs) on either property belonging to public / treasury or privately-owned property, rapidly completing investment projects by assigning these areas to investors, while ensuring high-tech equipment used in the renewable energy-based generation facilities. Also, the By-Law requires that the equipment which will be used in electricity generation plant to be supplied from a domestic manufacturer and to have a domestic goods certificate. This method will ensure that the local industry receives support in the renewable energy production as well.

Wind Power

YEKDEM accelerated investments for wind power-based electricity generation facilities in Turkey. According to TEIAS (Turkish Electricity Transmission Corporation) data, the wind power plant installed capacity, which used to be 18.9 MW in 2002 reached 6.516,2 MW at the end of 2017 and 6742.4 MW at the end of August 2018 with 235 power plants in total.

EMRA licensed projects with a total capacity of 9.940,25 MW until the end of 2017. As of May 2018, the total of 239 licensed projects correspond to 10.536,41 MW[12].

Following the enforcement of the **By-Law on Renewable Energy Resource Areas (YEKA)**, a capacity allocation tender regarding YEKA practices was organized on 03.08.2017 and the result was a record of 3.84 USD cent/Kwh. Within the scope of the tender, a plant shall be established to manufacture wind turbines with a ratio of at least 65% local production as a total of equipment with a domestic goods certificate and equipment manufactured and/or supplied in line with requested local contribution ratios. The plant will have a production capacity of at least 150 units/year or 400 MW/year wind turbine at a single shift. As the investment partners carried out relevant activities in line with the By-Law and the Specifications, a contract was signed on 26.02.2018 in the General Directorate of Renewable Energy (GDRE) in order to establish a 1.000 MWe Electricity Generation Plant, to maintain R&D activities for the next 10 years and to establish a wind turbine plant. Administrative and technical activities have been initiated for Candidate YEKAs submitted to the GDRE by the Investor as required by the Specifications.

In addition, a tender call for Wind Energy Based Offshore Renewable Energy Resource Areas (YEKA) and Connected Capacity Allocation with a capacity of 1.200 MW installed capacity in total was announced and published in the Official Gazette No. 30455 and dated 21/06/2018. Relevant applications are to be submitted to the GDRE until 23/10/2018.

In order to make maximum use of Turkey's wind power potential, to ensure integration of more wind farms to electricity system and to predict the electricity power to be generated from wind, a By-Law published in 2013 introduced the condition of connecting all wind power plants to Wind Power Monitoring and Forecasting System[13] (RITM). In this framework, 151 wind power plants with a capacity of over 10 MW have been connected to the RITM (99% of the installed power, total installed power 6543 MW). Power generation of operational WPPs can be simultaneously monitored and power generation for 48 hours can be forecasted. Moreover, the activities with the aim of reducing forecast error ratio for the electricity generated from wind are in progress within the scope of the RITM Project.

Solar Power

Due to the financial initiatives that have been implemented over the recent years, the installed power for solar-based electricity generation, which used to be 40.2 MW with 112 solar plants at the end of 2014, increased up to a total of 3420.7 MW with 3616 solar plants at the end of 2017 and reached 4792.9 MW with 5507 solar plants as of the end of May 2018. The installed power accepted, without a license yet, at the end of May 2018 correspond on its own to 4680 MW. Given the licensed projects as well as previously licensed ones becoming operational, this number is expected to rise.

12) http://eskiweb.epdk.org.tr/TR/Dokumanlar/Elektrik/Lisanslar
13) http://www.ritm.gov.tr/root/index_eng.php

Within the framework of YEKA initiative, a tender has been organized for 1000 MW of solar power plant to be implemented in Karapınar RERA SPP-1. The tender has been concluded on 20/03/2017 with a price of 6.99 USD/cent kWh for 15 years. The legal entity that won the tender has an obligation of establishing a photovoltaic (PV) solar module manufacturing plant besides the power plant itself. Once the environment friendly facility is operational, the electricity to be generated will approximately amount to 1.7 billion kWh per year, which in turn will meet electricity requirements of almost 600.000 houses annually. Another obligation of the legal entity, to which the tender was awarded, is to establish an R&D center in the scope of the project and carry out research activities regarding photovoltaic module technologies. In addition to Karapınar REPA SPP-1, the new solar YEKA announced and published in the Official Gazette no. 30550 and dated 29/09/2018.

Biofuels

In order to decrease import dependency, to increase diversity of supply and to progress the approximation process to EU Aquis, the rules and procedures on blending ethanol produced from local agricultural products into gasoline and diesel have been regulated. Therefore, Communique on Blending Ethanol to Gasoline Types and Communique on Blending Biodiesel in Diesel Types came into force in 2012 and 2017 respectively. The legislation introduced the obligation for licensed distributors to blend at least 3% (v/v) of ethanol and 0.5% (v/v) biodiesel respectively from domestic agricultural products/waste, into gasoline and diesel types imported and supplied from refineries.

According to the data of Energy Market Regulatory Authority (EMRA), the installed bioethanol capacity in Turkey is 152.0 million liters and the number of facilities is 3. The total amount of bioethanol production in the year of 2017 was 78.864,39 tons. The installed biodiesel capacity in Turkey is 230 thousand tons and the total amount of biodiesel production in the year of 2017 was 65.603,50 tons according to the data of Energy Market Regulatory Authority.

The Biomass Energy Potential Atlas (BEPA) prepared by the General Directorate of Renewable Energy (GDRE) for the purpose of identifying biomass potential of Turkey includes data regarding crop production, livestock and forestlands, plant, animal and forest waste as well as the amount of urban organic solid waste and the energy to be generated from such wastes at province and district levels. The Atlas was shared with public through the website of the GDRE in February 2014. An updated version of BEPA was published in December 2017 with the data received from public institutions such as the Ministry of Environment and Urbanization, Minsitry of Agriculture and Forestry (former Ministry of Food, Agriculture and Livestock and Ministry of Forestry and Water Affairs) the General Directorate of Forestry and TurkStat. According to the Atlas, the biomass potential is identified, in theory, as 44.1 million TOE.

Energy Efficiency

Energy efficiency has also been an important part of Turkey's energy and climate policy over the last decade. The General Directorate of Energy Affairs under the Ministry of Energy and Natural Resources is responsible for coordination of energy efficiency activities all across the countrySeveral other institutions like Ministry of Environment and Urbanization,Ministry of Industry and Technology (former Ministry of Science, Industry and Technology), Ministry of Transport and Infrastructure (former Ministry of Transport, Maritime Affairs and Communication), Small and Medium Enterprises Development Organization (KOSGEB) also carry out studies and projects for energy efficiency.

Energy Efficiency Strategy Paper (2012-2023) (EESP)[14], which sets a long-term target of 20% reduction in energy intensity by 2023, compared to 2011 figures, was approved by Turkey's High Planning Council on February 27, 2012. The document provides a roadmap of energy-efficiency actions for all sectors of Turkey by defining responsibilities for institutions, by and to increasing collaboration between NGOs and the private sector and identifies measurable, concrete policy activities necessary for reaching the targets. The EESP describes seven strategic purposes and corresponding strategic targets with the focus on the industry, the electricity system, private/public buildings, electrical products, and transport. The following issues were determined as strategic goals and activities were foreseen depending on these goals:

- Decreasing energy intensiveness and energy losses in industry and services sector,
- Decreasing energy demand and carbon emissions of the buildings; promoting sustainable and environmentally friendly buildings that use renewable energy resources,
- Providing exchange of energy-efficient products in market
- Increasing efficiency in electricity production, transfer and distribution; decreasing energy losses and harmful environmental emissions,
- Decreasing unit fossil fuel consumption of motor vehicles; increasing the share of railways and urban mass transportation in load and passenger transportation; preventing unnecessary fuel consumption in urban transportation and decreasing emissions harmful for the environment,
- Efficient and effective use of energy in public establishment,
- Enhancement of corporate structures, capacities and collaborations; increasing use of advanced technology and awareness raising activities; establishing sustainable financing environments

Energy Efficiency Improvement Program has been prepared within the framework of the 10th Development Plan. There are two targets of the Energy Efficiency Improvement Program. The first relates to the reduction of Turkey's primary energy intensity from 0.2646 toe/1000 USD in 2011 to 0.243 toe/1000 USD in 2018. The second relates to decreasing energy consumption of public buildings by 10% in 2018 as compared to 2012.

Component 4 of the plan explicitly requires two actions related to energy performance of public buildings:

- disseminating energy efficiency investments in public buildings by various financing methods including energy performance contract borrowing model that allows debt repayment with savings obtained after project implementation
- converting the external structures surrounding the buildings and the heating systems in old buildings with low and/ or insufficient insulation to thermally insulated ones, which also meet the current standards.

National Energy Efficiency Action Plan[15] **(2017-2023)** has been adopted in January 2018 which emphasizes the importance of sustainable development along with competitive and green growth in Turkey. The plan involved 55 actions defined in buildings and services, energy, transport, industry and technology, agriculture, cross-cutting sectors/ areas. These actions are expected to require an investment of 10.9 billion USD until 2023, and to lead a cumulative energy saving of 23.9 million tons of oil equivalent (MTOE), which corresponds to a 14% reduction in primary energy consumption of Turkey until 2023. In addition, a cumulative saving of 66.6 million tons CO_2 emission is also expected until 2023.

According to the GDRE data, between 2000-2016 there was an annual decrease of 1.4% in both primary energy intensity index and final energy intensity index. In 2016, the primary energy intensity increased 2.6% when compared to the previous year whereas the final energy intensity increased 1.1%. If we are to make a comparison with the data in 2000, the primary energy intensity and the final energy intensity indices improved 19.6% and 20.1% respectively (GDRE, 2018). New Gross Domestic Product series published by TurkStat on 12.12.2016, with 2009 as the base year was utilized for calculating the above-mentioned intensities.

According to the energy efficiency index (ODEX), there has been an improvement of 24.8% in total and 1.8% on annual basis in Turkey during the period of 2000-2016 in terms of energy efficiency.

Nuclear Energy

As indicated in several policy documents such as National Energy and Mining Policy and 10th Development Plan, Nuclear Power will become one of the mechanisms to provide supply security and reduce GHG emissions. Within this framework, in 2010 an agreement on commissioning of a Nuclear Power Plant of 4,800 MW capacity in Akkuyu has been signed between Turkey and Russian Federation. In 2013 an agreement has been signed between Turkey and Japan regarding development of nuclear power generation industry in order to commission another nuclear power plant of 4,560 MW power capacity in Sinop. Akkuyu Nuclear Power Plant is expected to be launched by 2023, while construction of Sinop Nuclear Power Plant is planned to start in 2019. Once the both power plants are active, 10% of Turkey's total power generation is planned to be supplied by nuclear power. A third nuclear power plant is planned to be commissioned.

14) Energy Efficiency Strategy Paper, 2012-2023, Ministry of Energy and Natural Resources, Ankara, 2010

15) http://www.yegm.gov.tr/document/20180102M1_2018_eng.pdf

4.3.3.2 BUILDINGS

Considering the high GHG emission reduction potential in the buildings, Turkey gave special importance to increasing energy efficiency in buildings sector in the INDC. Constructing new residential buildings and service buildings with high energy efficiency performances has been the focus to reach the goals that are identified in the INDC on the buildings sector, which are:

- Constructing new residential buildings and service buildings as energy efficient in accordance with the Energy Performance of Buildings By-Laws
- Creating Energy Performance Certificates for new and existing buildings so as to control energy consumption and greenhouse gas emissions and to reduce energy consumption per square meter
- Reducing the consumption of primary energy sources of new and existing buildings by means of design, technological equipment, building materials, development of channels that promote the use of renewable energy sources (loans, tax reduction, etc.)
- Dissemination of Green Building, passive energy, zero-energy house design in order to minimize the energy demand and to ensure local production of energy

According to the data from Ministry of Energy and Natural Resources, there has been an improvement of 16.8% in total and 1.1% on annual basis during the period of 2000-2016 in terms of energy efficiency. The cumulative savings for the relevant period in residential sector is estimated to be 7.7 million TOE.

Turkey plans to realize measures on reducing energy intensity of buildings through a set of national policies and actions, particularly NEEAP. These are described in several policy documents and legislation such as By-Law on Energy Performance in Buildings (BEP), 10th National Development Plan, National Climate Change Strategy, National Climate Change Action Plan, Energy Efficiency Strategy Paper and Energy Efficiency Improvement Program.

According to the legislative framework and policies that are mentioned above, Turkey has the following objectives of GHG emission reduction in the buildings sector:

- All old and new buildings will have an "Energy Identity Certificate" which indicates the building energy performances of buildings by 2020. By-Law on Energy Performance in Buildings suggests that all buildings must have "Grade C" for their energy performance.
- Solar power collectors for central heating and sanitary hot water will be installed at new hotels, hospitals, dormitories, other Non-residential buildings used for accommodation purposes, as well as sports centers with a usage area of more than 1,000 m^2
- Financing will be provided for increasing of energy efficiency / renewable energy applications in buildings.
- Annual energy consumption in buildings and premises of public institutions will be decreased by 10% until 2015 and by 20% until 2023.
- Energy intensities in each service sub-sector shall be decreased. The rates shall be determined in close collaborations with sector stakeholders, but they shall not be less than a 10% of the intensity for each sub-sector in 2012-2022.
- In 2023, thermal insulation and energy efficient heating systems complying with the current standards shall be installed in all commercial and service buildings having the total usage area of more than 10.000 m2.

Energy efficiency services are being spread throughout the country within the context of the new legislation. One university, one trade association and Energy Efficiency Consultancy companies have been authorized as ESCOs. The preliminary audits in building and industry sectors in the last few years and revealed a substantial amount of energy efficiency potential. Some of these are financed by the banks. In order to support the Energy Identification Certification system, BEP-TR software has been developed in 2011. Within this framework, 654,898 buildings have received Energy Identity Certificate, between 2011-2017. 643,308 of them have Grade C and above.

On top of the measures indicated above, the following projects are being implemented by relevant Ministries in order to support the policies, measures and strategy documents in the Energy Sector:

Table 4. 3 Projects implemented to support Policies and Measures in the Energy Sector

Project Name	Description	Time Period	Budget & Resource of Financing	Implementing Institutions	Estimated GHG Mitigation Impact
Promoting Energy-Efficient Motors in Small and Medium Sized Enterprises (PEEMS)	The project aims at strengthening the legislative and regulatory framework related to both new and existing energy efficient motors in Turkey, developing appropriate governance and information infrastructure, upgrading test laboratories at the Turkish Standards Institution (TSI), launching a sustainable financial support mechanism and developing and implementing a comprehensive public awareness and training program.	2017 -2021	3,750,000 USD	Turkey Ministry Industry and Technology (MoIT) through the Directorate General for Industry and Productivity (DGP)	26,200 tons CO_2eq over the 7-year lifetime of 1000 EE motors expected to be installed during the project
GEO: Turkey Geo-fund	The Project aims to address barriers to geothermal markets in Turkey through technical assistance and Geologic Risk Mitigation. The increase of geothermal energy use by developing and implementing four financially viable projects in Turkey will help to accelerate the use of geothermal energy, build private-sector confidence in investing in this resource and offering geological risk insurance, and demonstrate to the regulatory bodies at national and local government levels approaches to address geothermal resource risks cost effectively.	2010-2016	(GEF-UNDP-MoIT)	Ministry of Environment and Urbanization	Through this project direct GHG emission reductions of 18.4 million tons over a 20-year investment lifetime will be achieved
Sustainable Energy Financing Mechanism for Solar Photovoltaic Systems in Forest Villages in Turkey	The objective of the Project is to support the successful launching of a sustainable energy financing mechanism within the ORKOY credit mechanism to ensure that there is at least 30 MW of installed capacity of grid-connected, residential solar PV in forest villages in Turkey (approximately 2.5% or 175,000 people living in forest villages will have their electricity needs met by solar PV) by the end of the project.		10,000,000 USD (World Bank)	General Directorate of Forestry, Ministry of Agriculture and Forestry	Assuming an expected lifetime of 20 years for the PV systems, the total direct CO_2 Emission reduction is expected to be 574 992 tCO_2
Sustainable Use of Biomass to Assist the Development of Turkey's Economy Towards Green Growth	Trigger sectoral transformation through application of modern bio-energy technologies to improve overall energetic performance, increase competitiveness and reduce greenhouse gas emissions in agro-industry	2016 -	56,280,000 USD	Ministry of Agriculture and Forestry-Ministry of Energy and Natural Resources (MoENR)-UNIDO	

Energy Efficiency in Public Buildings Project	The Project aims to contribute to reducing energy intensity in public buildings and therefore to reduce greenhouse gases in Turkey between 2014 and 2018, consultancy services that will be provided within the context of technical collaboration will provide for improvement of legal framework conditions for increasing demand to products and services to be used to increase energy efficiency especially in public buildings. Project will contribute to reduction of energy intensity in buildings, especially the public buildings in Turkey and therefore to reduction of greenhouse gases. Project includes technical collaboration opportunities thanks to consultancy measures executed by GIZ.		(GEF-UN-DP-MoAF)	The German Climate Technologies Initiative (DKTI)-Ministry of Environment and Urbanization	

The policies and measures and their mitigation effects are summarized below:

Table 4. 4 Policies and Measures according to the Mitigation Scenario in the Energy Sector

Name of policy or measure/ mitigation action	Objective and / or activity affected	GHG(s) affected	Type of instrument	Status and start year of implementation	Implementing entity or entities	Time Period	
						2020	2030
Renewable Energy Sources Support Mechanism (YEKDEM)	Increase in renewable power generation	CO_2, N_2O, CH_4	Economic, regulatory	implemented (since 2011)	Ministry of Energy and Natural Resources		
Renewable Energy Resource Areas (YEKAs)	Increase in renewable power generation	CO_2, N_2O, CH_4	Economic, regulatory	implemented (since 2016)	Ministry of Energy and Natural Resources		
Promotion of power generation from renewable resources	Increase in renewable power generation	CO_2, N_2O, CH_4	Economic, regulatory	implemented (since 2005)	Ministry of Energy and Natural Resources		
Blending Ethanol to Gasoline Types	Decreasing GHG emissions through increase in combustion efficiency in gasoline burning vehicles	CO_2, N_2O, CH_4	Regulatory	implemented (since 2012)	Ministry of Energy and Natural Resources		
Blending Biodiesel in Diesel Types	Increasing share of biofuels use in gasoline vehicles	CO_2, N_2O, CH_4	Regulatory	implemented (since 2017)	Ministry of Energy and Natural Resources		
Energy Efficiency Improvement Program	Increasing energy efficiency in public buildings	CO_2, N_2O, CH_4	Economic, regulatory	implemented (2014-2018)	Ministry of Energy and Natural Resources		
Actions within the framework of National Energy Efficiency Action Plan	Increasing energy efficiency in several sectors such as services, energy, transport, industry and agriculture	CO_2, N_2O, CH_4	Economic, regulatory	implemented (since 2018)	Ministry of Energy and Natural Resources		
Energy Performance in Buildings	Increasing energy efficiency of all buildings including new and existing ones	CO_2, N_2O, CH_4	Economic regulatory	İmplemented (since 2008)	Ministry of Energy and Natural Resources		

4.3.3.3 INDUSTRY

Over the recent years, awareness raising activities about climate change has created an impetus for integrating low carbon development measures in several policy making processes, and manufacturing sector leads this movement with its several sub-sectors.

When general policies in industry are reviewed within the context of the **10th Development Plan** for years between 2014- 2018, main goals are stated as realizing transformation in manufacturing industry and transitioning to high added value structure and increasing share of advanced-technology sectors. To this end, main focuses of transformation in manufacturing industry are innovation and company skills, effective contribution of regions to production, inter-sectoral integration, green technology and production, and diversity of foreign market. It is also aimed to raise the total factor productivity (TFP) in the long term.

Also, **Turkish Industrial Strategy Document[16] (2015-2018)** indicates transformation to a greener and more competitive industry structure as one of the 3 strategic goals within the context of the Strategy.

Over the last decade, within the framework of the new legislation and Strategic Plans, that aim low carbon production and consumption, policies and measures developed for the industry have several aspects that lead the sectors in the direction of increasing energy efficiency, raising awareness on low carbon development, changing consumer behavior and increasing the share of renewable power use. Besides the policies that are implemented for the whole manufacturing sector, there are also specific measures in some specific product groups.

A special importance has always been given to SMEs in order to increase their competitive power and raise their contribution to economic growth, since they constitute the majority of the manufacturing industry. With the support of the new policies and measures, low carbon development measures can be implemented also by SMEs in many sectors.

The policies and measures that are valid for all manufacturing sectors are explained below:

National Eco-Efficiency Programme, which has been initiated within the framework of Turkish Industrial Strategy Document and Action Plan (2015-2018), aims to direct Turkish Industry towards more environmentally friendly practices through several activities such as awareness raising on concepts such as eco-efficiency and cleaner production, increasing cooperation among institutions and businesses, capacity building, providing technical and financial support to businesses.

Financial Support Scheme for Energy Efficiency Projects in Manufacturing Industry (VAP): Within the context of the Energy Efficiency Law implementations, projects that are designed to increase energy efficiency in existing systems and industrial enterprises are eligible for financial support. Enterprises that utilize minimum 1000 TEP of energy per year

16) https://www.sanayi.gov.tr/handlers/DokumanGetHandler.ashx?dokumanId=e9f6e3f2-f8ab-4fd1-9d65-22d553867dc1

are eligible to apply for financial support. Within the context of VAP, the projects with a project cost under 1,000,000 TL are supported for 30% of their cost as grant. Support at an amount up to 200,000 TL is provided to industry organizations within the context of Voluntary Agreements Program.

Promotion of renewable electricity use in industry: Legislative arrangements, which aim to promote renewable power generation and use in manufacturing industry, is planned by the Ministry of Energy and Natural Resources.

Energy Sector Research and Development Projects Support Program (ENAR) was developed in order to support, monitor, complete and evaluate the projects that include technology development and innovation-focused research, development and improvement in order to convert the scientific and technological information to be established in a way that will serve energy policies, supply security, local energy technologies and industry to products and systems. Amendments made in order to make the By-Law published on ENAR on June 8, 2010 operable were published in By-Law Amending ENAR By-Law on February 21, 2013

As a result of several policies implemented regarding promotion of energy efficiency in the industry, there has been an improvement of energy efficiency by 24.7% in total and 1.8% on annual basis during the period of 2000-2016 .

Some sectoral policies and initiatives are explained below:

Taxation based on GHG emissions: Within the framework of Turkish Automotive Sector Strategy Paper and Action Plan (2016-2019), a financial tool which encourages the consumers to choose low emission vehicles has come into force in 2016. The policy tool suggests lower "special consumer tax" for low emission vehicles, compared to high emission ones. Also, the policy suggests hybrid cars to have lower taxes compared to Non-hybrid cars with similar engine properties.

Promotion of environmentally friendly vehicles: Within the framework of Turkish Automotive Sector Strategy Paper and Action Plan (2016-2019) and National Energy Efficiency Action Plan (2017-2023), another policy has been adopted in order to direct consumer behavior towards low carbon vehicles' purchase. Within this framework, a draft legislation has been prepared to promote extension of electric car power stations and CNG providing fuel stations.

Promotion of phasing out of old vehicles: Based on the provisional revisions made in year 2016 in the Law on Special Consumption Tax (SCT), No.4760, tax exemption will be applied at the phase of first acquisition in case of upgrading old commercial vehicles such as taxis, minibuses, service buses, public buses and trucks with newer vehicles which are more energy efficient, until 30.06.2019.

In 2018, provisional regulation has been made by the Law numbered 7103 with which new vehicle purchasers are encouraged by the reductions in the Special Consumption Tax up to 10.000 TRY at the phase of first acquisition following the phasing out of 16 year or older vehicles through scrapping or exporting, until 31.12.2019. The revision in the Law aims renewing vehicle stock, increasing air quality, reducing GHG emissions, increasing safety in urban traffic.

Promotion of electric and hybrid vehicles: The Law on Special Consumption Tax suggests reduction in the SCT for several vehicle types varying from cars to commercial freight vehicles and motorcycles that are electical. Hybrid cars are encouraged by lower tax rates as well. The tax reduction aims at promotion of increasing the percentage of electric vehicles and hybrid vehicles in Turkey in order to reduce GHG emissions from transportation sector.

A new by-law on environmental labelling is under preparation by the Ministry of Environment and Urbanization, which will be in line with Regulation (EC) No 66/2010 of the European Parliament and of the Council on ecolabelling.

On top of the measures indicated above, the following projects are being implemented by relevant Ministries in order to support the policies, measures and strategy documents in the Industry Sector:

Table 4. 5 Projects implemented to support Policies and Measures in Industry Sector

Project Name	Description	Time Period	Budget & Resource of Financing	Implementing Institutions	Estimated GHG Mitigation Impact
Developing a National Green OIZ Framework for Turkey	The objectives of the Project are to identify green competitiveness opportunities in the Organized Industrial Zones (OIZs), to propose a set of recommendations to transform the existing conventional OIZs to Green OIZs as well as to establish new Green OIZ's and to develop a road map and a comprehensive national framework on Green OIZs	2017-	World Bank Group	Ministry of Industry and Technology	
Global Cleantech Innovation Programme for SMEs in Turkey (GCIP-Turkey)	Promotion of clean energy technology innovations and innovative clean energy technology entrepreneurship in SMEs in Turkey through a Clean Energy Technology Innovation Competition and Entrepreneurship Accelerator Programme.	2014-2018	990,000 USD	MoIT, TUBITAK, MoEU, MoENR, Min. of Dev., KOSGEB, TTGV and UNIDO	
Identifying Potential Benefits of Resource Efficiency in Turkish Manufacturing Industry	The project aimed to demonstrate potential economic and environmental benefits that could be realized through more efficient and sustainable use of raw materials, energy and water in manufacturing industry. The project quantified the potential savings in both monetary and physical terms and at both sectoral and regional levels, together with analyzing the potential environmental benefits that are linked to the quantified resource efficiency potential due to less resource use and prevented pollution. This project constitutes the solid base for future improvements in the Turkish industry in terms of sustainable production practices.	2014-2017	Scientific and Technological Research Council of Turkey (TÜBİTAK)	Ministry of Industry, and Technology (MoIT)	

Capacity Building Technical Assistance Project for Capacity Building and Transfer in F-Gases	The aim of the project is to reduce anthropogenic GHG emissions in order to contribute to global efforts to prevent climate change and to adapt to EU climate policy legislation, the F-gases develop capacity for and legislation to increase the national capacity to prepare climate change in the preventative activities.	2017-2020	1.984.415,00 EUR	Ministry of Environment and Urbanization	
Establishment of Technical and Administrative Infrastructure for the Development of the National Life Cycle Assessment (LCA) Database Project	The aim of the project: to support sustainable development in the Turkish industry to establish administrative and technical infrastructure for development of the National LCA Database as a basis of the national LCA studies.	2017-	Scientific and Technological Research Council of Turkey (TÜBİTAK)	Ministry of Industry, and Technology (MIT)	
Determination of Cleaner Production Options ad Their Applicability in Industry (SANTEM) Project	The aim of the project: to establish policies and strategies for cleaner production and integrated pollution prevention and to draft related legislation. Main objectives of the SANTEM Project were to examine the status, sectoral needs, cleaner production potentiality, incentive mechanisms and legal regulations of the iron and steel and yeast industries, and to evaluate the applicability of various cleaner production opportunities in Turkey.	2016-2017	Scientific and Technological Research Council of Turkey (TÜBİTAK)	Ministry of Environment and Urbanization	

Table 4. 6 Policies and Measures according to the Mitigation Scenario in the Industry Sector

Name of policy or measure/ mitigation action	Objective and / or activity affected	GHG(s) affected	Type of instrument	Status and start year of implementation	Implementing entity or entities	Estimate of mitigation impact in kt CO_2-eq
National Eco-Efficiency Programme	Promotion of eco-efficiency through awareness raising, increasing cooperation among institutions and businesses, capacity building, providing technical and financial support to businesses	All gases	Economic, regulatory, other	implemented (2015-2018)	Ministry of Industry and Technology	
Financial Support Scheme for Energy Efficiency Projects in Manufacturing Industry (VAP)	Increasing energy efficiency in industrial enterprises through provision of financial support for projects that are designed to increase energy efficiency	CO_2	Economic, regulatory	implemented (since 2011)	Ministry of Energy and Natural Resources	
Promotion of renewable electricity use in industry	promoting renewable power generation and use in manufacturing industry	CO_2	Economic, regulatory	implemented (since 2015)	Ministry of Energy and Natural Resources	

Energy Sector Research and Development Projects Support Program (ENAR)	Promotion of sustainable energy policies, supply security, local energy technologies and industry products and systems.	All gases	Economic, other	implemented (since 2010)	Ministry of Energy and Natural Resources	
Supporting Sustainable Energy Project Implementations of SMEs	Provision of support for SMEs that implement sustainable energy projects that reduce GHG emissions	All gases	Economic, other	implemented (since 2015)	General Directorate for Development and Support of SMEs (KOSGEB)	
Taxation based on GHG emissions	Promotion of low carbon emission vehicles through applying various tax levels to vehicles with different GHG emission levels	All gases	Economic	implemented (since 2016)	Min. of Science, Industry and Technology, Min. of Economy, Min. of Environment and Urbanization, General Directorate of Treasury	
Promotion of environmentally friendly vehicles	Promotion of vehicles with alternative fuel types, through legislative arrangements	All gases	Regulatory, economic, other	implemented (since 2018)	EMRA, Min. of Science, Industry and Technology	
Promotion of phasing out of old vehicles	Phasing out of old vehicles through promotion of scrapping and export of old vehicles	All gasses	Regulatory, economic,	implemented (since 2016)	Ministry of Finance	
Promotion of electric and hybrid vehicles	Promotion of vehicles with alternative fuel types (including electric and hybrid vehiscles), through fiscal incentives	All gases	Regulatory, economic,	implemented (since 2018)	Ministry of Finance	

4.3.3.4 TRANSPORT

Turkey's GHG emissions from transport sector has a significant share and an increasing trend compared to other sectors. Therefore, GHG emission reduction policies in the transport sector has a particular importance.

In the transport sector, there has been an improvement of 32.3% in total and 2.4% on annual basis during the period of 2000-2016 in terms of energy efficiency[18].

Turkey's GHG emission mitigation policies have been clearly framed in the INDC as follows:

- Ensuring balanced utilization of transport modes in freight and passenger transport by reducing the share of road transport and increasing the share of maritime and rail transport
- Enhancing combined transport
- Implementing sustainable transport approaches in urban areas
- Promoting alternative fuels and clean vehicles
- Reducing fuel consumption and emissions of road transport with National Intelligent Transport Systems Strategy Document (2014-2023) and its Action Plan (2014-2016)
- Realizing high speed railway projects
- Increasing urban railway systems

- Achieving fuel savings by tunnel projects
- Scraping of old vehicles from traffic
- Implementing green port and green airport projects to ensure energy efficiency
- Implementing special consumption tax exemptions for maritime transport

Besides the INDC, Turkey's Transport Sector Policies are framed with several policy documents starting from 10th National Development Plan to Transport and Communication Strategy, National Climate Change Strategy, National Climate Change Action Plan and National Smart Transportation Systems Strategy Document

The framework of the cross-cutting Policy documents such as 10th National Development Plan, National Climate Change Strategy and National Climate Change Action Plan suggest several policies and targets in the transport sector which can lead to significant GHG emission reduction. In **10th National Development Plan**, Turkey has given priority to transport systems that provide energy efficiency, clean fuel, and the use of environmentally friendly vehicles. The Plan suggests extended use of smart applications in transportation. Improving "Energy Efficiency in Transportation" is one of the important components of the program. Another important component of the Plan is "Disseminating the use of public transportation, small engine volume and electric and hybrid vehicles, establishing smart bike networks in appropriate residential areas and creating pedestrian paths closed to traffic" and "Disseminating the use of low fuel consumption vehicles in the public sector".

National Climate Change Strategy (2010-2023) includes several targets and plans such as increasing the share of railroads, sea routes and air routes and the load factor in freight and passenger transport; encouraging use of environment-friendly vehicles like bicycles; extending the use of alternative fuels and clean vehicle technologies in public transport vehicles; and conducting R&D studies will be applied in order to optimize road networks to ensure lower fuel consumption; and smart transportation systems will be developed.

National Climate Change Action Plan (2011-2023) involved several targets and policies which leads to GHG emission reduction:

- Increasing the share of railroads in freight transportation to 15%, and in passenger transportation to 10% by 2023.
- Increasing the share of seaways in cabotage freight transportation to 10%, and in passenger transportation to 4% as of 2023.

Decreasing the share of highways in freight transportation below 60%, and in passenger transport to 72% as of 2023.

- Preparing and putting in practice the "Transportation Master Plan" until 2023.
- Limiting emission increase rate of individual vehicles in intra-city transport.
- Developing the necessary legislation, institutional structure and guidance documents until the end of 2023 for implementation of sustainable transport planning in cities.
- Promoting alternative fuels and clean vehicles (Time Period: 2020-2023).
- Adopting and putting into practice the strategy to introduce an age limit for public transport vehicles (Time Period: 2015-2023).
- Creating incentive mechanisms in the production of land, sea, air vehicles that have high energy efficiency, supporting investments (Time Period: 2015-2023).

Strategies and policies developed particularly for the transport sector are as follows:

Transport and Communication Strategy (2011-2023)

The Strategy aims to develop a more sustainable transport system including environmental sustainability. The Strategy has aspects on both GHG emission reduction and adapting the transport system to the impacts of climate change. In the Strategy, the following targets have been suggested:

18) Ministry of Energy and Natural Resources, 2018

Table 4. 7 Transport and Communication Strategy targets

Targets until 2023	Targets until 2030
• Increasing the share of railways in freight transport (which was 5% in 2009) to 15% and in passenger transport (which was 2% in 2009) to 10% by 2023; • Decreasing the share of roads in freight transport (which was 80.63% in ton-km in 2009) below 60%, and in passenger transport (which was 89.59 in passenger-km in 2009) to 72% as of 2023; • Increasing the share of maritime in freight transport (which was 2.66% in 2009) to 10% and in passenger transport (which was 0.37% in 2009) to 4% by 2023; • Increasing the share of aviation in freight transport (which was 0.44% in 2009) to 1% and in passenger transport (which was 7.82% in 2009) to 14% by 2023.	• Ensuring balanced utilization of transport modes in freight and passenger transport by reducing the share of road transport and increasing the share of maritime and rail transport; • Enhancing combined transport; • Implementing sustainable transport approaches in urban areas; • Promoting alternative fuels and clean vehicles; • Reducing fuel consumption and emissions of road transport with National Smart Transport Systems Strategy Document (2014 - 2023) • Realizing high speed railway projects; • Increasing urban railway systems; • Achieving fuel savings by tunnel projects; • Scraping of old vehicles from traffic; • Implementing green port and green airport projects to ensure energy efficiency; • Implementing special consumption tax exemptions for maritime transport

National Smart Transportation Systems Strategy (2014-2023)

The vision and overall purpose of the Strategy is defined as "utilizing information and communication technologies in all transport modes to attain a fully integrated, safe, effective, efficient, innovative, human-oriented, environmentally friendly, sustainable and smart transport network". One of the strategic objectives in order to achieve these goals is decreasing emissions and fuel consumption from road transport that accounts higher portion of GHG emissions. Concerning this objective, two actions are identified:

- development of smart transport systems to reduce fuel consumption and GHG emissions
- provision of emission reduction solutions in intercity transport

The preparatory work for the Strategic Plan including 2014-2018 period has been initiated in 2012. It is planned that the establishment of a Transport Institute to fulfill educational and R&D activities of transport sector and collaborating with universities in order to train qualified personnel in the field of transport. R&D work to establish alternative transportation systems will be made in the transport sector. More economical and safe new transportation systems will be provided implemented doing R&D work for the implementation of emerging technologies and new transportation system in railway, highway, maritime infrastructure and superstructure.

Table 4. 8 Policies and Measures according to the Mitigation Scenario in the Transport Sector

Name of policy or measure/ mitigation action	Objective and / or activity affected	GHG(s) affected	Type of instrument	Status and start year of implementation	Implementing entity or entities	Estimate of mitigation impact in kt CO_2-eq	
						2020	2030
Green Port Project	Promoting modern, cost-efficient and environmentally friendly port facilities.	CO_2, NO_2	Economic, regulatory, other	implemented (since 2013)	Ministry of Transport and Infrastructure		
Renewal of Coster Fleet	Promotion of energy efficient ships through renewal of Coster fleet	CO_2, NO_2	Regulatory	planned	Ministry of Industry and Technology		

4.3.3.5 AGRICULTURE

The agricultural sector is among the sectors which provide major contribution to the country's GDP, exports, and rural development. Turkey is an important producer and exporter of agricultural commodities on world markets and is estimated to be the world's 7th largest agricultural producer[19]. Turkey's agricultural vision for the year 2023 is that being a country which provides its population with sufficient, best quality and safe food; improves its net exporter position in agricultural products and; increases its competitiveness in global market aiming to be among the top five overall producers globally. Turkey's vision for its centenary in 2023 includes other ambitious goals; i) agricultural GDP reaching to 150 billion dollars; ii) agricultural exports over 40 billion dollars; iii) sustainable agricultural growth iv) achievement and land consolidation on 14 million ha; and v) modern irrigation systems for all irrigable land[20].

Although Turkey has ambitious targets for increasing agricultural productivity, there are also policies and plans that support reduction of GHG emissions from the sector. Turkey's Intended Nationally Determined Contribution suggests the following measures for reducing GHG emissions in the agriculture sector:

- Fuel savings by land consolidation in agricultural areas
- Rehabilitation of grazing lands
- Controlling the use of fertilizers and implementing modern agricultural practices
- Supporting the minimum tillage methods

Several Strategy Documents and Plans of the former Ministry of Food, Agriculture and Livestock (Now Ministry of Agriculture and Forestry) underlines the thread of climate change impacts on agricultural production and security of food supply. Therefore, over the last decade strategies, policies and plans in agriculture sector have included conducting vulnerability assessments on agricultural products, together with financial support schemes for farmers who has economic losses due to the impacts of climate change.

The level of policies and measures regarding reducing GHG emissions from the agricultural sector can be considered as less advanced compared to measures to adapt to the impacts of climate change. However, many policies and measures that have impacts to increase climate change resilience of the agriculture sector also have GHG emission mitigation impacts. The following policy documents include several measures that target both reduction of GHG emissions and increasing resilience to the impacts of climate change in the agriculture sector:

The 10th Development Plan (2014-2018) stresses establishment of agricultural techno-parks and use of renewable energy in agriculture within the concept of "green growth". Additionally, according to the Plan, uncertainties and inadequacies in duties, powers and responsibilities in environmental management will be resolved.

National Climate Change Strategy (2010-2023) suggests limiting GHG emissions and increase resilience to impacts of climate change by using modern agricultural techniques in subjects such as fertilizer use, irrigation, soil cultivation, agricultural spraying, supporting organic agriculture and drought-tolerant plant types and certificated seed production, encouraging in-field modern pressured irrigation systems (drip/ sprinkler irrigation systems) and land consolidation in short term. In middle term, NCCS suggests crisis management based on agricultural drought estimation, developing soil and land classification standards and observing applications, protecting and developing meadows and pasture areas, fertilization based on soil analysis, developing techniques for increasing carbon capture in soil, selecting adequate feeding methods in stock farming to reduce methane emissions, manure management and good drainage in rice cultivation, taking precautions for reusing treated wastewaters in agriculture. And finally, in the long term, decision on establishing a central geographical information system for all land use classes in Turkey is taken for preparing National Greenhouse Gas Inventory Report in compliance with IPCC guidelines.

In order to obtain updated and accurate land information, studies on creating a National Soil Database by benefiting from remote sensing and geographical information systems and efficient soil use, primarily by agriculture by making land use planning have been started.

19) OECD (2016), Innovation, Agricultural Productivity and Sustainability in Turkey, OECD Food and Agricultural Reviews, OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264261198-en
20) Structural Changes and Reforms in Turkish Agriculture 2003-2016, Ministry of Food Agriculture and Forestry, Ankara

National Climate Change Action Plan (2011-2023) envisages mitigating of GHG emissions through the protection of natural resources and minimization of energy consumption in agriculture. The following actions are involved in the Plan:

- Determining and increasing the quantity of carbon stock captured in the soil;
- Disseminating sustainable agriculture techniques including mitigation and adaptation;
- Increasing the effectiveness of soil management;
- Increasing the effectiveness of pasture management;
- Identifying and increasing above ground and below ground biomass
- Identifying the potential GHG emissions limitation in agriculture sector.
- Slowing down the increase rate of GHG emissions originated from crop and animal production
- Build the information infrastructure that will meet the needs of the agriculture sector in adapting to and combating with climate change.

Strategic Plan (2018-2022)[21] of former Ministry of Food, Agriculture and Livestock (Now Ministry of Agriculture and Forestry) suggests R&D studies to be performed to increase the agricultural production efficiency and quality, where "the number of model/suggestion/systems developed to ensure emission mitigation" is considered as one of the performance indicators.

Energy Efficiency Action Plan 2017-2023 suggests actions to be taken related to increasing energy efficiency in the agriculture sector listed in the section 2.2.5 of the Plan as:

- encouraging the replacement of tractors and harvester with energy efficient ones,
- adapting energy efficient irrigation methods,
- supporting energy efficiency projects in the agriculture,
- encouraging renewable energy sources for agricultural production,
- determination of potential agricultural by-product and waste for the purpose of obtaining biomass,
- supporting energy efficiency in the aquaculture products sector.

There are several measures in agriculture sector which directly or indirectly can contribute to reducing GHG emissions. Increasing carbon capture by reduced tillage, extending crop rotation increasing level of benefiting of crops from nitrogenous fertilizers and using nitrification reducing chemical or natural inhibitors are listed as net Greenhouse Gas emission reducing measures from soil (Kayıkçıoğlu and Okur, 2012).

Also, studies show that in areas which land consolidation is made, as a result of changes in road lengths and routes, farmers' daily road distances are shortened in average of 26.68 km (minimum 6.44 km and maximum 70.24 km) in Turkey (Polat and Manavbaşı, 2012). Reaching to higher yield in unit area by optimizing efficiency of nitrogen fertilizer use and using conservative tillage techniques can reduce N_2O and CO_2 emissions.

Due to increased awareness regarding concepts such as ecological agriculture, organic agriculture, smart agriculture, which are backed up with several legislative documents in line with EU legislation, and policies, programmes, and financial incentives there have been indications of more environmentally friendly agricultural practices. This shift in the agricultural practices are expected to have direct or indirect impacts on GHG emission reductions in the agriculture sector.

In this respect, Organic Agricultural Law, Chemical Fertilizer Control By-Laws, By-Laws on Extending Fertilizer Use Based on Analysis, By-Laws on Fertilizer Usage Control and Good Agricultural Practices targets at avoiding excessive use of nitrogenous fertilizers.

Activities conducted within the framework of Pasture Law, Animal Breeding Law, Law on Veterinarian Services, Crop Health, Food and Feed, Seed Law, Specialized Organized Industry Zones based on Agriculture have direct impact in reduction of methane gas in stock farming sector.

21 Strategic Plan (2018-2022), Ministry of Food Agriculture and Livestock, Ankara, 2017

Within the framework of By-Law on Geothermal Resources and Natural Mineral Waters and Governing Regulations of the Law on Geothermal Resources and Natural Mineral Waters greenhouses in 10 provinces performing geothermal green housing practices are under investigation in terms of economic, social and environmental outcomes.

Within the framework of legislation regarding "Soil Conservation and Land Use and Changes" it is targeted to ensure enough income for each agricultural land sizes and preventing divisions of lands into small fractions which are unfeasible to operate. Through avoiding splitting of agriculture parcels a reduction in GHG emissions is expected due to effective use of the agricultural lands, water, energy, fertilizers and machinery. Monitoring of GHG emission reduction of this measure is planned to be conducted through monitoring of reduced machinery use. Avoiding parcel division is also expected to cause changes in irrigation methods, reducing water loss and increasing irrigation efficiency.

There are many various agricultural subsidy instruments are offered by the government in order to regulate and create an environmentally friendly investment setting in the agriculture sector. The amount of the financial support is constantly increasing from year to year. Below are the significant financial and regulatory tools (including some other tools which support those tools) that aims to support sustainable agriculture practices:

One of the best examples is the **Environmentally Based Agricultural Land Protection Programme (ÇATAK)** to agri-environmental programs. The Programme aims taking necessary precautions for increasing soil and water quality, sustainability of renewable natural resources, avoiding erosion and decreasing negative effects of agriculture, improving soil structure by taking "Minimum Soil Tillage Agriculture" practices, saving energy and water through efficient irrigation practices, in areas where intensive agricultural activities are performed. The Programme also targets raising awareness of producers on agri-environment and increasing agricultural income of the producers by reducing input costs.

ÇATAK is the first Programme to be specifically targeted at addressing the negative impacts of agricultural practices on the environment. The programme is expected to mitigate CH_4 and CO_2 emissions through extension of methodologies mentioned above. The ÇATAK program has some similarities with EU agri-environmental measures in rural development programs. As of 2017, environmentally friendly agricultural practices are performed in 57 cities, and 487.000.945 TL in total support payment is paid to 131.852 producers covering 475.619 hectare area

Programme of **Extending Analysis- Based Fertilizer Use** provides financial support for farmers in order to have fertilizer and soil analysis services at accredited laboratories, and to have advisory services for adequate use of fertilizers. The Programme is expected to contribute to reduction of N_2O emissions that is caused by agricultural practices.

Within the framework of **Fertilizer Usage Control Programme**, Agricultural Credit Cooperatives give information and guidance to technical personnel on determining the fertilizer types, manner, amount and time of application, etc. Agricultural engineers are given in-service training and are specialized in fertilizer and fertilization, and calibration of tools and machinery to be used in fertilization and by this way, producers are prevented from using fertilizers unconsciously. These practices aim to support reducing N_2O emissions from agriculture sector.

With the help of **Farmer Registry System**, a database has been created in 2014 which facilitates provision of agricultural supports in a controllable and traceable way, therefore it enables establishing healthy agricultural policies. The System holds information of farmers engaged in agricultural activities, and assets (land, animal, input, etc.) they use during the activities, product design and average yields. Also, with the help of the System agricultural supports are applied, tracked and controlled.

Also, there are other Agricultural Information Systems such as Farmer Informing Service, Türkvet, Organic Agricultural Information System, Underover Registry System, Beekeeping Registry System. Agricultural Information Systems provide all inventories necessary for tracking and controlling agricultural activities and support traceability and accountability.

Organic agriculture is also being supported within the framework of Organic Agricultural Law and incentives that are implemented by the Ministry of Agriculture and Forestry (former Ministry of Food, Agriculture and Livestock and Ministry of Forestry and Water Affairs). **The Organic Farming Registry System (OTBİS) have been implemented in 2005**, in order to keep updated information about several statistics such as organic agricultural products, producers and land use. The system is integrated with Farmer Registry System. Organic agriculture legislation and programmes also provide financial incentives for organic farmers, such as grants and low interest rate loans. Number of farmers that produce agricultural products increased from 1.947 in year 1996 up to 75.067 in year 2017. Also, the number of types of organic products increased from 26 in year 1996 to 214 in year 2017.

Within the framework of Good Agricultural Practices (GAP) legislation and the GAP Project following the adoption of the legislation, producers can receive good agricultural practices certificates to institutions that are authorized by the Ministry to register their production process. Good Agricultural Practices are important both for a high-quality and productive agricultural production and food safety. GAP allows traceability, sustainability and food safety in agriculture without harming the human health, animal health and environment. GAP Project will provide the implementation of good agricultural practices in 37 provinces, in fruits (citrus fruits, cherry, hazelnut, fig, grape, olive, plum, melon, peach and apple), vegetables (onion, tomato, pepper, lettuce and cucumber), feed plant and aquaculture (trout). The practices will also include training, extension and demonstration activities. In Turkey, good agricultural practices are generally focused on crop production, however, there are also GAP applications for aquaculture and animal husbandry in recent years. Good Agricultural Practices are also conducted in "Special Environmental Protection Areas" according to a protocol signed between Ministry of Environment and Urbanization and former Ministry of Food, Agriculture and Livestock. Urbanization

Support activities are being carried out in 81 cities within the scope of **Program of Supporting Rural Development Investments** to avoid excessive use of production inputs as irrigation water, energy and fertilizer by extending use of modern irrigation machinery and equipment developed for agricultural activities by producers, helping to protect quality and quantity of the soil and water resources, contributing in improvement of quality and productivity in production and reducing labor need. According to the amount of goods purchasing basis to the grant announced every year for real and legal entity applicants provided to be separately, it is made in the rate of the determined donation support (50% -75%). In 2017 65 Million TRY is provided as grant for an arable land of 22,000-hectare area; and cumulatively 131,000 Million TRY is provided for an arable land of 131,000-hectare area since the beginning of the programme.

as of the end of 2013, productivity in agricultural production is increased and negative effects which extreme irrigations on our soil and water resources shall cause are prevented in approximately 750-thousand-hectare area by providing the utilization of modern irrigation methods.

Also, within the scope of the Program of Supporting Development Investments, solar energy is being used as an energy source for agricultural irrigation systems. Initial investment costs of agricultural irrigation systems with solar energy are higher than the diesel systems. Operation and maintenance costs of agricultural irrigation systems are very low and fuel cost is zero.

Modern Irrigation Systems Incentive has enabled a significant progress in irrigation system supplies for the producers to have in-farm modern pressure irrigation system by enabling the producers to use low interest rate loans to meet financial needs, develop agricultural production and increase productivity and quality. Approximately 800 Agricultural Engineers working at the Agricultural Credit Cooperatives have taken applied training and prepared numerous projects. Within this framework, financial support of 43.5 Million TRY has been provided in the form of loans with No interest rate for 11,419 projects which constitute an area of 9700 hectares, through the Agricultural Credit Cooperatives.

Besides the abovementioned programmes, incentives and projects, the following policies and measures are implemented:

Supporting olive cultivation with Law on Olive Grove Rehabilitation and Wild Olive Grafting and applying deterrent penalties for cutting down olive trees increase CO_2 sink basin. With Sustainable Land Management and Climate-Friendly Agricultural Practices Project, it is possible to provide CO_2 capture and protect bio-diversity.

The EU implementation of the IPARD Program is another one which serves environmental protection. 2014-2020 IPARD Programme includes pilot agri-environment measure under Pillar 2 (rural development) which encourages farmers for more environment-friendly agricultural and sustainable implementations. On top of the measures indicated above, the following projects are being implemented by relevant Ministries in order to support the policies, measures and strategy documents in the Agriculture Sector:

Table 4. 9 Projects Implemented to support Policies and Measures in Agriculture Sector

Project Name	Description	Time Period	Budget & Resource of Financing	Implementing Institutions	Estimated GHG Mitigation Impact
Sustainable Land Management and Climate-Friendly Agriculture	To improve agriculture and forest land use management through the diffusion and adoption of low-carbon technologies with win-win benefits in land degradation, climate change, and biodiversity conservation and increased farm profitability and forest productivity.	2012-	5,750,000 USD (GEF-FAO)	Ministry of Agriculture and Forestry	
To scale up integrated natural resources management (INRM) in drought prone and salt affected agricultural production landscapes in the Central Asian countries and Turkey(CACILM - II)	The aim of the project is to disseminate the experiences and good practices of the project partner countries, to improve the cooperation mechanisms between the countries.	2017-2021	GEF-FAO	Ministry of Agriculture and Forestry	

Table 4. 10 Policies and Measures according to the Mitigation Scenario in the Agriculture Sector

Name of policy or measure/ mitigation action	Objective and / or activity affected	GHG(s) affected	Type of instrument	Status and start year of implementation	Implementing entity or entities	Estimate of mitigation impact in kt CO_2-eq	
						2020	2030
Environmentally Based Agricultural Land Protection Programme (ÇATAK)	improving soil structure and reducing carbon emissions by taking "Minimum Soil Tillage Agriculture" practices, saving energy and water through efficient irrigation practices	CO_2, CH_4, N_2O	Regulatory, economic, other	implemented (since 2006)	Ministry of Agriculture and Forestry		
Extending Analysis- Based Fertilizer Use	Reducing N_2O emissions through promotion of efficient fertilizer use		Economic	implemented (since 2017)	Ministry of Agriculture and Forestry		
Farmer Registry System	Creating a database of farmers, assets (land, animal, inputi etc.) used during agricultural activities, yields, financial supports provided, etc.	CO_2, CH_4, N_2O	information, regulatory	implemented (since 2014)	Ministry of Agriculture and Forestry		
Organic Farming Registry System (OTBIS)	keep updated information about several statistics such as organic agricultural products, producers and land use	CO_2, CH_4, N_2O	information, regulatory	implemented (since 2005)	Ministry of Agriculture and Forestry		
Good Agricultural Practices (GAP)	Promotion of good agricultural and animal husbandry practices, through capacity building, certification and financial incentives	CO_2, CH_4, N_2O	Economic, information, other	implemented (since 2010)	Ministry of Agriculture and Forestry		
Program of Supporting Rural Development Investments	Reducing GHG emissions promotion of efficient use of irrigation water, energy and fertilizer; helping to protect quality and quantity of the soil; contributing in improvement of quality and productivity and reducing labor need	CO_2, CH_4, N_2O	economic, regulatory, informative, other	implemented (since 2017)	Ministry of Agriculture and Forestry		
Modern Irrigation Systems Incentive	Promotion of water and energy efficient irrigation systems through financial support and awareness raising	CO_2, CH_4, N_2O	economic, regulatory, informative, other	implemented (since 2017)	Ministry of Agriculture and Forestry		

4.3.3.6 FORESTRY

The roots of Turkey's forestry sector goes back to 1839 with the establishment of Directorate of Forestry in. Protection of forest lands have entered into the legal framework in year 1937 and into the constitution in 1961 which have continued to exist in the constitution of year 1982.

Turkey does not have a determined carbon sink commitment within the framework of UNFCCC processes. However, protection of forests and extension of forest areas have always been a part of Turkey's Strategies and Action Plans in several ways. Turkey's forest stock has shown an increasing trend over the last decades. In the direction of global and national demands, the handling of the economic, ecological, social and cultural functions of forests within an ecosystem integrity and management of forests according to sustainable forest management principles is the basic approach of today's forestry approach.

Turkey's Intended Nationally Determined Contribution suggests the following measures for increasing national carbon sink potential through forestry sector as follows:

- Increasing sink areas and preventing land degradation
- Implementing Action Plan on Forestry Rehabilitation and National Afforestation Campaign

Currently, the National legislation on forestry do not have direct reference to increasing carbon sinks in order to fight against climate change. However, both the legislative framework and the policy documents aim at increasing forest lands, improvement of degraded forest lands and enlarging protected areas, which indirectly serve for the increase in carbon sinks of Turkey.

Turkey's national policies on improvement of forestry is based on a few national policy documents which are summarized below:

Turkey's **10th Development Plan** includes the following targets in order to increase the forest area:

- Forest area will be increased to 21.5 million hectares by year 2018. Ecosystem based functional management plans to be prepared and the capacity of combating forest fires to be increased. Furthermore, priority has been given to biological methods in combating insect pests and diseases while reducing chemical methods; (Target 755)
- Capacity to fight against fires, pests and diseases will be improved; afforestation and rehabilitation activities will be accelerated; (Target 775)
- Measures will be taken to protect high quality agriculture lands and forests, particularly for special protected nature areas. (Target 1053)

Within the context **National Climate Change Action Plan**, overall policies and targets for forestry sector are defined as follows:

- Target 1: Increase the amount of carbon sequestered in forests by 15% of the 2007 value by 2020 (14,500 Gg in 2007, 16,700 Gg in 2020)
- Target 2: Reduce deforestation and forest damage by 20% of the 2007 values by 2020
- Target 3: Integrate the climate change factor in land use and land use changes management strategies by 2015
- Target 4: Identify the amount of sequestered carbon in pastures and meadows in 2012, and increase carbon stock 3% by 2020
- Target 5: Identify the existing carbon stock in wetlands in 2012, and maintain the level until 2020
- Target 6: Make necessary legal arrangements for combating climate change with regard to land use and forestry by the end of 2013
- Target 7: Strengthen institutional capacity in institutions involved in land use and forestry on climate change by 2014

There are also policy documents that specifically target forestry sector. **National Forestry Programme (2004-2023)** has been developed and adopted with the following objectives:

- Protection of forest areas, forest biodiversity and natural habitats
- Extension and improvement of existing forest areas
- Providing sustainability of forest ecology while promoting economic social and cultural activities based on forests taking into account social justice

National Strategy and Action Plan to Combat Desertification (2015-2023) also involves several activities and targets that support Turkey's forest areas:

- Awareness raising activities in order to sustainability of forest lands especially targeting women;
- Conducting studies in order to monitor the impacts of climate change on forests and forest biodiversity and develop adaptation measures with sustainable forest management approach;
- Improving and extending monitoring and early warning systems for protection of forests from fires;
- Rehabilitation of forest lands within the framework of sustainable forest management, and increasing the number of forests which have sustainable forest management certification;

The most updated document for Forestry sector planning is the **Strategic Plan of General Directorate of Forestry [22](2017-2021)**. Within the framework of the plan the following strategic performans indicators are targeted Extension of the fight against forest fires and increasing capacities:

- Monitoring the health of forest ecosystems and search for ways to fight with diseases
- Quality of Wood, seed and fruit efficiency will be improved. Silvicultural maintenance measures for the establishment of healthy forests will be increased.
- Ratio of growing stock per hectar will be increased from 72.9 m^3 to 74.5 m^3 by 2021.

- Increasing the productive forest area from 12,850,000 ha to 13,250,000 by 2021.
- Surface of total forest land is of Turkey will increase from %28,8 to %30 by 2023.
- Combating erosion for reduce the soil loss and enhance the pasture improvement. size of soil loss controlled area will be increased from 1,415,000 ha to 1,677,000 ha by 2021. Rehabilited pasture area will be increased from 222,000 ha to 265,000 ha by 2021.
- The amenajman plan and inventory of 5,605,000 ha forest land will be made in accordance with multi-purpose use.

All policy documents target at effective protection of forests against various factors including fires and harmful diseases, soil conservation, afforestation, rehabilitation studies, extending monitoring practices, extension of sustainable forest management practices, raising awareness among public and development of the institutional capacities of relevant institutions.

On top of abovementioned policy documents, several Action plans have been adopted for various tree types separately. All action plans target at increasing the productivity of forests and extension of forest lands besides species specific targets.

All these efforts have led to several changes in forest areas and their productivity in Turkey over the recent decades. Carbon sink potential of Turkey has shown an increasing trend between 1990 to 2016 with an increase of % 114 reaching 57.6 Mton CO_2-eq.

Also, there have been efforts to develop a forest carbon standard and certification in Turkey, in order to integrate to the voluntary carbon markets.

On top of the measures indicated above, the following projects are being implemented by relevant Ministries in order to support the policies, measures and strategy documents in the Agriculture Sector:

Table 4.11 Projects implemented to support Policies and Measures in Forestry Sector

Project Name	Description	Time Period	Budget & Resource of Financing	Implementing Institutions
Integrated Approach to Management of Forests in Turkey, with Demonstration in High Conservation Value Forests in the Mediterranean Region	The project aims to promote an integrated approach to management of forests in Turkey, demonstrating multiple environmental benefits in high conservation value forests in the Mediterranean forest region.		28,550,000 USD GEF-UNDP-MoAF	General Directorate of Forestry, Ministry of Agriculture and Forestry
Analytic Basis for LULUCF Sector Development	The target of the project is increasing national and local capacities for preparation of National carbon emissions and sinks inventory in LULUCF sector in line with EU and UNFCCC requirements, which will support Turkey's efforts to reach Climate resilient low carbon development in medium and long term. https://www.lulucf-tr.org	Aug 2017 - July 2019	2.000.000 EUR (EU-IPA)	Ministry of Environment and Urbanization
Improving product and service production in Mediterranean forest ecosystems in the context of global changes (ffem) project	Outcome 2: Socio-economic Assessment of the Products and Services Provided by the Mediterranean Forests: Düzlük pinewood	2013-2017	8.500.000 EUR	Ministry of Agriculture and Forestry-Nature Conservation Center

22 Strategic Plan of General Directorate of Forestry (2017-2021), General Directorate of Forestry, Ministry of Forestry and Water Affairs, 2016

Table 4.12 Policies and Measures according to the Mitigation Scenario in the Forestry Sector

Name of policy or measure/mitigation action	Objective and / or activity affected	GHG(s) affected	Type of instrument	Status and start year of implementation	Implementing entity or entities	Estimate of mitigation impact in kt CO_2-eq	
						2020	2030
Actions under National Forestry Programme (2004-2023)	Extension and improvement of existing forest areas and carbon sink	CO_2, N_2O, CH_4	Regulatory	Implemented 2004-	Ministry of Agriculture and Forestry		
Strategic Plan of General Directorate of Forestry (2017-2021)	Increasing the productive forest area	CO_2, N_2O, CH_4	Regulatory	Implemented 2004-	Ministry of Agriculture and Forestry		

4.3.3.7 WASTE

Waste sector plays an important role in climate change and global warming as one of the main sectors generating methane (CH_4) and nitrous oxide (N_2O). GHG emissions from waste sector constitutes %3.26 (NIR, 2018) of Turkey's total GHG emissions excluding LULUCF. GHG emissions from the waste sector result from activities such as municipal waste disposal ("sanitary"/controlled landfilling or "wild"/open dump sites) and wastewater treatment and discharge systems (municipal or industrial), waste incineration and composting. Although in Turkey the waste sector emissions have a small share compared to other sectors, there are significant efforts to reduce the emissions, since waste management is also an issue environmental protection and public health.

In Turkey, the authority for waste management is Provincial Directorates of Ministry of Environment and Urbanization, and implementing institutions are the municipalities or municipality owned enterprises. The local administration unions (solid waste unions) have acquired legal basis to conduct waste management activities. According to the results of Ministry of Environment and Urbanization, 1142 municipalities collects and disposed solid wastes at 88 landfills in 2018 (second quarter). It is calculated that waste management facilities owned by or working for municipalities is serving to a population of 54.9 million[23] . Required investment need for other waste management facilities is estimated to be around 1.7 - 2.9 billion € in the National Waste Management and Action Plan.

INDC of Turkey includes plans and policies to be implemented for the waste sector:

- Sending solid wastes to managed landfill sites
- Reuse, recycle and use of other processes to recover secondary raw materials to utilize them as an energy source or to remove wastes;
- Recovering energy from waste by using processes such as material recycling of wastes, bio-drying, bio-methanation, composting, advanced thermal processes or incineration;
- Recovery of methane gas from landfill gas from managed and unmanaged landfill sites;
- Utilization of industrial wastes as an alternative raw material or alternative fuel in other industrial sectors, through industrial symbiosis approach;
- Conducting relevant studies to utilize wastes generated from breeding farms and poultry farms;
- Rehabilitation of unmanaged waste sites and ensuring wastes to be deposited at managed landfill sites

In Turkish waste legislation, policies and strategy papers there are No direct targets or obligation for GHG emission mitigation. However, reducing amounts of both solid waste and wastewater, diverting waste away from landfills, increasing biological recovery of waste which replaces landfilling, capturing or flaring methane from landfills and wastewater, rehabilitation of old dumpsites, better source separation and collection of municipal waste and increasing the use of nitrogen removal technologies in wastewater treatment contribute to GHG emissions from waste sector.

The following cross-sectoral Strategies and plans include targets for reducing waste generation.

10th Development Plan, has the following targets regarding waste sector:

- Sanitation and wastewater treatment infrastructures in cities will be improved, these infrastructures will be operated in line with the basin specific discharge standards, and reuse of treated wastewater will be encouraged (Target 981);
- Through efficient solid waste management, waste reduction, separation at source, collection, transportation, recycle and disposal stages will be improved as a whole in technical and financial aspects; raising awareness and improving institutional capacity will be assigned priority. Usage of recycled materials in production processes will be encouraged (Target 982);

10th Development Plan suggests within the context of "Program for Increasing Domestic Savings and Avoiding Waste", Component-2: Reducing Waste and Preventing Duplicative Consumption, to encourage the actions given below:

- Identifying the extent of waste
- Protection of consumer rights
- Popularizing conscious consumption
- Efficient market surveillance and supervision
- Getting children and families into saving habit
- Organization of campaigns against waste
- Supporting rational consumption behavior by eliminating cross-subsidies and Non-commercial price cuts in goods produced by public and private sector

National Climate Change Strategy (2010-2023) determined three main strategies as Short Term, Medium Term and Long Term, which are as follows:

Short Term

- Harmonization of legislation governing municipal wastes will be finalized by the end of 2010.

Medium Term

- The amount of waste reuse and recovery will be increased within the framework of the Waste Action Plan (2008-2012).
- 104 sanitary landfill facilities will be established and 76% of municipal waste will be disposed at such facilities by the end of 2012.

Long Term

- Waste management hierarchy of source reduction, reuse, recycling, and recovery shall be implemented more efficiently.
- The amount of organic substances transferred to the sanitary landfills will be reduced, and biodegradable wastes will be used in energy generation or composting.
- Landfill gas will be captured and used for energy generation directly or after being processed; and if these gases cannot be used for energy generation, they will be burned.

Within the context **National Climate Change Action Plan (2011-2023)**, overall policies and targets for waste sector are defined as follows:

- Target 1: Reduce the quantity of biodegradable wastes admitted to landfill sites, taking year 2005 as a basis, by

23 Ministry of Environment and Urbanization, 2018

75% in weight till 2015, by 50% till 2018 and by 35% till 2025

- Target 2: Establish integrated solid waste disposal facilities across the country, and dispose 100% of municipal wastes in these facilities, until the end of 2023
- Target 3: Finalize Packaging Waste Management Plans
- Target 4: Establish the recycling facilities foreseen within the scope of the Solid Waste Master Plan with the EU-aligned Integrated Waste Management approach
- Target 5: Termination of uncontrolled disposal of wastes 100% by 2023

National Waste Management Action Plan (2016-2023) was prepared within the framework of the approximation process to the EU Environmental Acquis. In the action plan, the objective of the waste sector is defined as "ensuring effective waste management". Under the plan; by analyzing the present situation of waste management, it is aimed to separate collection, recycling, recovery by different methods and disposal methods of waste according to the types of wastes. At the same time, it was aimed to determine "sustainable waste management strategies" throughout the country by ensuring recycling and recovery and recycling of waste materials into the economy in order to prevent rapid consumption of natural resources.

National Waste Management Action Plan sets goals for local authorities in all 81 provinces towards an integrated waste management system, which will require more recovering, recycling and energy production from waste and accordingly limit the number of sanitary landfills needed as it aimed at in circular economies. National Waste Management and Action Plan presents general plans in the waste management sector for municipal waste as well as packaging waste, medical waste and hazardous waste. This plan, which is function as a roadmap for investments, also includes information regarding the place, time frame and the required capacity for plants to be built, and afterwards a national strategy is developed on the reduction of the biodegradable waste to be disposed of in landfills. Regional Waste Management Plans will also be prepared taking into account waste management system at national level.

By the year 2023, it is targeted to recycle 35% and to dispose to landfills 65% of the waste produced. For this purpose, Medium and Long-Term targets of National Waste Management Action Plan targets are as follows:

- Increase the proportion of packaged waste collected separately in the source, which is 5.3% in 2014, to 12% in 2023.
- Increase the recycling rate of municipal waste, which is 0.2% in 2014, to 4% in 2023, 4 to 11% in 2023
- Increase the recovery rate of municipal wastes by 0.3% in 2014 to 8% in 2023
- 88.7% in 2014 municipal waste to reduce the disposal rate of wastes by 65% in 2023
- Rehabilitation of Wild Landfill Sites
- To ensure the spread of construction wastes and excavation land management throughout the country
- To increase collection and recovery efficiency in the management of special wastes
- Increase the investment of additional facilities for the recovery and disposal of hazardous wastes

Wastewater Treatment Action Plan (2017-2023), which has been prepared in accordance with the Environment Law and Strategic Plan of Ministry of Environment and Urbanization. In the scope of the Plan, To know the existing water resources and water quality in the basins.In order to make projections, quantity and quality were evaluated on provincial and basin basis.The general condition of each basin was given and the underground and over water resources in the basin were evaluated in terms of both quantity and quality parameters.Considering important parameters such as COD, NH4-N, NO3-N, TP when making classifications and evaluations of these pollutants.

Wastewater Treatment Action Plan aims to strengthen wastewater treatment capacity of Turkey. The Plan also promotes reuse of wastewater and cleaner production technologies for wastewater treatment plants which contribute to climate change mitigation

According to the Wastewater TreatmentAction Plan (2017-2023), 1422 wastewater treatment facilities are planned to be installed by 2023.

Another mechanism of reducing GHG emissions from waste sector is power generation from biogas generated at sanitary landfills. The number of sanitary landfills increased from 32 in year 2007 to 83 in year 2016, receiving %61.2 of the total municipal waste collected in 59 cities out 81 in Turkey. YEKDEM[24] mechanism paved the way for landfill gas collection and electricity generation facilities that have become popular particularly in the last decade. The biogas production (collected gas) on landfills and wastewater treatment has reached to more than 200 MWe installed capacity and 1.5 million MWh annual production capacity including another biological recovery for energy facilities (MoENR, 2018).

Biological treatment of waste is also in developing trend; however annual capacity is currently not satisfactory at a too low level of 1.5 Mt. There exist 8 biological waste recovery facilities (6 composting, 2 bio-methanation) for source-segregated municipal waste; 6 mechanical and biological treatment facilities (1 composting, 4 bio-methanation, 1 bio-drying) for mixed municipal waste and 1 co-incineration plant for mixed municipal waste. These biological recovery facilities are established in only 12 cities out of 81 cities of Turkey (NWMAP, 2016).

Private sector also has been involved in solid waste management investments supported by incentives such as YEKDEM mechanism. The private sector generally focuses on the rehabilitation of old dump sites in the form of long-term (up to 49 years) build-operate-transfer (BOT) contracts with the Municipalities. This public-private partnership (PPP) projects are popular on integrated waste management for a city or a region including landfill gas capturing, biological recovery, and waste to energy facilities.

Recycling strategy of Turkey mostly based on management of packaging material. Because of mentioned feature of the strategy the packaging waste have great influence on both rapid development of recycling sector in Turkey and its competitiveness at national and global level. Recycling rate is expected to increase from 13% in 2018 to 35% in 2023 and also it is envisaged to contribute to 'zero waste vision' of Ministry of Environment and Urbanization in Turkey.

By-Law on Packaging Waste Control has general considerations regarding quantitative and qualitative efficient collection of the household packaging waste at source. Recovery targets are detailed in the legislation which foresees an annual increase of recovery rate starting from 2005 till the end of 2020.

Moreover, certain quotas concerning recycled material to be used as input during production process of the packages are set as to support recycling, to prevent depletion of virgin/raw material as a means of circular economy approach.

As a result, packaging and packaging waste management; are evaluated as a pioneer for waste and resource management which has a positive impact on decreasing GHG emissions by promotion of sustainable resource management as well as higher recycling rates.

24 http://www.yegm.gov.tr/yenilenebilir/YEKDEM.aspx

Table 4. 13 Policies and Measures according to the Mitigation Scenario in the Waste Sector

Name of policy or measure/ mitigation action	Objective and / or activity affected	GHG(s) affected	Type of instrument	Status and start year of implementation	Implementing entity or entities	Estimate of mitigation impact in kt CO_2-eq	
						2020	2030
Actions implemented under Wastewater Treatment Action Plan	Reducing GHG emissions through reuse of wastewater and promotion of clean technologies for wastewater treatment plants	CO_2, CH_4 NO_2	regulatory, other	implemented (since 2015)	Ministry of Environment and Urbanization		
Power generation from sanitary landfills	Reducing methane emissions from landfills and increasing use of biofuels through Power generation from landfill gas	CO_2, CH_4 NO_2	Regulatory, economic, other	implemented (since 2011)	Min of Environment and Urbanization, Min. of Energy and Natural Resources and Municipalities		
Rehabilitation of Landfills	Rehabilitation of existing landfills for recycling and biogas recovery	CO_2, CH_4 NO_2	Regulatory, economic, other	implemented	Private sector-municipalities-Min of Environment and Urbanization		
Zero waste	Promotion of "zero waste" in public buildings	CO_2, CH_4 NO_2	Regulatory, other	İmplemented (since 2018)	Min of Environment and Urbanization		

4.3.4 POLICIES AND MEASURES IN ACCORDANCE WITH ARTICLE 2

4.3.4.1 Maritime Transport and Aviation

Maritime transport

Turkey is involved in several international cooperation incentives regarding maritime transport. Turkey is involved in several technical study group established for the development of maritime lines within the scope of the Organization of the Black Sea Economic Cooperation (BSEC) Secretariat, which is undertaken by the Ministry of Transport and Infrastructure.

Amendments to MARPOL Annex VI on Data collection system for fuel oil consumption of ships, adopted by resolution MEPC.278(70), entered into force on 1 March 2018. Under the amendments, ships of 5,000 gross tonnage and above are required to collect consumption data for each type of fuel oil they use, as well as other, additional, specified data including proxies for transport work.

Within this framework, Turkey has been working on the necessary institutional, administrative and technical preparations in order to comply with the Decision. For the data gathering system to be launched in 1st of January 2019, official communication has been made in September 2018 to maritime enterprises and classification societies in order to take the necessary actions.

In order to prevent the environmental impacts and adverse effects and eliminate to certain extend, the **"Green Port"** Project has been developed by the Ministry of Transport and Infrastructure.in 2013.

Green Port project which is a voluntarily based project is focused primarily on port operations. ISPS Code Compliance Certificate, TS EN ISO 9001 Quality Management System Certificate, TS EN ISO 14001 Environmental Management System Certificate, TS 18001 occupational Health and Safety Management System Certificate and Auditor's technical report prepared by authorized organization are the main documents that figures out compliance with sectorial criteria.

Certificates are being issued to the ports that fulfil these sectorial criteria. Certificate validity period is three years. In this certificate, modern, eco-friendly and cost-efficient ideas to enhance the competitiveness and to promote Green Ports are presented by taking into account the current situation of the ports, as well as the current legislation regarding the protection of the environment.

The "Green Port" application is expected to increase the environmentally friendly port facilities. In 2017, 11 port operators were awarded green port certificate with a ceremony by the Ministry of Transportand Infrastructure.

Aviation

Turkey's INDC frames GHG emission reduction policies as "Implementing green port and green airport projects to ensure energy efficiency". Also, Aviation sector has been considered as one of the priority sectors in 10th Development Plan.

Within this framework, the following developments have occurred in the aviation sector in Turkey:

Green Airport Project was launched by Directorate General of Civil Aviation and has put into implementation in 2009 and have been improved year by year. In the scope of The Green Airport Project, 153 companies achieved to obtain Green Company Certificate and 4 airports (Uşak, Tokat, Adana and Erzincan Airports) succeeded to have Green Airport Certificate as of 2018. If a company achieves to get a Green Company Certificate, it gains 20% reduction on company license renewal fee. If an airport achieves to get a Green Airport certificate, all the companies have the 50% reduction on company license renewal.

The Ministry of Foreign Affairs acts as the focal point and responsible body for implementation of decisions taken by ICAO. Turkey is among the 44 members of the European Civil Aviation Conference (ECAC) which is the largest civil aviation organization in Europe in charge with working closely and cooperatively with other regional organizations and individual Contracting States of ICAO on a range of civil aviation issues of common interest, including security, safety and environmental fields.

As of July 2018, 68 countries, including Turkey, representing over 70% of the world air traffic submitted their intention to take responsibility to reduce CO_2 emissions from international aviation from the pilot and first phase (i.e. between the years 2021-2027) of the **Carbon Offsetting and Reduction Scheme for International Aviation CORSIA** scheme voluntarily. Once fully implemented, CORSIA scheme could keep international CO_2 emissions as 2020 levels (carbon neutral growth from 2020). ICAO Standards and Recommended Practice (SARP) documents regarding to implementation of CORSIA scheme approved at ICAO Council on 27 June 2018 and circulated to Member States. As decided within the ECAC, with Bratislava Declaration, Turkey expressed its intention to implement the CORSIA scheme to compensate international aviation CO_2 emissions from the very beginning in 2021.

Turkey also participates to several international organizations and initiatives regarding civil aviation such as EUROCONTROL, ECAC, International Civil Aviation Organization (ICAO), North Atlantic Regional Aviation Safety Group and JAA TO. Duty

Several airports in Turkey also participated to **Airport Carbon Accreditation Programme** initiated by Airports Council International (ACI). Ankara Esenboğa Airport, Antalya Airport, İzmir Adnan Menderes Airport obtained 3+ level and Istanbul Atatürk Airport have been certified 3rd level of the Programme.

Istanbul New Airport[25] (INA) will be operational in October 2018, substituting Istanbul Atatürk Airport. Starting from the planning stage of INA, environmental sustainability of the operation of the Airport has been a priority, which is expected to keep up with the other main airports in Turkey in terms of low carbon operations. In addition, INA organized all companies to obtain Green Airport Certificate.

On top of participation to international programmes and initiatives, several domestic measures are taken in order to reduce GHG emissions. SMART project that aims to modernize the air traffic system targets to provide energy efficiency. Also, several airline companies are taking measures to reduce fuel consumption per passenger via renewal of their fleets with new and modern and energy efficient airplanes. Ways of shortening flight routes, reducing fuel consumption during taxi and cruise are also being investigated.

4.3.4.2 Minimization of Adverse Effects in Accordance with Art.2 of the Kyoto Protocol

Each Annex I Party shall provide information on how it strives to implement policies and measures under Article 2 of the Kyoto Protocol in such a way to minimize adverse effects, including adverse effects of climate change, effects on international trade, and social environmental and economic impacts on other Parties under Article 4, paragraphs 8 and 9, of the Convention, taking into account Article 3 of the Convention.

In Turkey, policies developed to tackle with climate change are formulated and implemented in a way that minimize the potential adverse impacts on specific sectors of economic activity, industrial sectors or other Parties to the Convention, including the adverse effects on the international trade, social, environmental and economic impacts in developing countries.

Domestic sectoral and national policies, measures and actions that are developed and implemented for GHG emission reduction considers all sectors of economic activity which are related with GHG emissions or with carbon sinks.

4.3.4.3 Minimization of Adverse Impacts in Accordance with Article 3, Paragraph 14 of the Kyoto Protocol

Turkey, as a Party included in Annex I with No commitments inscribed in Annex B to the Kyoto Protocol, has No obligation to report on the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol.

4.3.4.4 Policies and Measures Implemented by Sub-State Actors

On the local level several Local authorities implement policies and measures in order to reduce GHG emissions, increase resource efficiency, increase resilience to climate change impacts and increase public awareness on climate change.

Projects include:

- energy efficiency and solar pv installations in public buildings
- sustainable transport projects including renewal of public transport fleet, optimization of traffic flow, promotion of public transport and bicycle use
- installation of LFG power plants
- preparation of climate change mitigation and adaptation action plans
- promotion of energy efficiency and fuel shift in residential buildings

A list of representative projects that are implemented by local authorities are available in Annex III

25 http://igairport.com/en/about-iga/about-us

5

PROJECTIONS AND TOTAL EFFECT OF POLICIES AND MEASURES

On September 30th 2015, the Republic of Turkey submitted its Intended Nationally Determined Contribution (INDC) to UNFCCC towards achieving the ultimate objective of the Convention, which is set out in its Article 2 and clarifying information, in accordance with decisions 1/CP.19 and 1/CP.20. In this section, the projections of greenhouse gas emissions by 2030 are based on two scenarios: Business-As-Usual Scenario and Mitigation Scenario.

The projections have been prepared based on the works done under the project called "Preparation of Turkey's Sixth National Communication on Climate Change", which was carried out by Ministry of Environment and Urbanization and the Scientific and Technological Research Council of Turkey, Marmara Research Center. TIMES-MACRO model has been used for energy related modeling and industrial processes and product use, while for Non-energy emissions different national models and studies have been used.

5.1 KEY ASSUMPTIONS

The assumptions used to estimate the projections of greenhouse gas emissions are presented in Table 5.1 Turkey achieved 230% increase in GDP between 1990 and 2012. While Turkey's annual GDP growth stood at 2.10% in 2012, it is projected to reach 4% by 2030. Its population has increased to 75.6 million by more than 30% from 1990 to 2012. Turkey's energy demand increases by 6-7% each year. According to the projections by Ministry of Energy and Natural Resources, electricity demand in 2030 will reach 580 TWh under the business-as-usual scenario.

Emission factors used to estimate greenhouse gas emissions are based on 2014 National Inventory Report published by TurkStat, 2006 IPCC Guidelines and collected data provided by various national institutions. Global warming potential on a 100-year timescale used for the calculation of CO_2 equivalent emissions is in accordance with the IPCC's Fourth Assessment Report.

Table 5. 1 Key assumption used in the projections [26]

PARAMETER	2012	2015	2020	2025	2030
POPULATION (in thousand)	75,627	78,151	82,076	85,569	88,427
POPULATION GROWTH	1.38%	1.07%	0.93%	0.75%	0.60%
GDP GROWTH	2.10%	3.50%	4.15%	4.25%	4.12%

5.2 BUSINESS-AS-USUAL SCENARIO (WITHOUT MEASURES)

This scenario projects greenhouse gas emissions up to 2030 based on the case of the mitigation measures which have been legalized, applied or planned since 2012 will not be implemented between 2012 and 2030. Greenhouse gas emissions for 1990-2012[27] and projected emissions up to 2030 are listed in Table 5.2 based on the type of greenhouse gas and sectors. CO_2 emissions are projected to increase about 187% by 2030 compared to 2012[28]. CO_2 emissions, which were 79% of the total emissions in 2012, are projected to be 84% and 87% to total emissions in 2020 and 2030 respectively (excluding LULUCF) due to a gradual increase in energy consumption.

The ratio of CH_4 and N_2O emissions to total emissions is 15% and 5% in 2012. The ratio of CH_4 emissions to total emissions is 11% and 9% in 2020 and 2030 respectively, while the ratio of N_2O emissions to total emissions is 4% and 3% 2020 and 2030 respectively. On the other hand, the ratio of fluorinated gases emissions to total emissions is not expected to change much by 2030.

26) Base year used in the projections is 2012. Key assumptions data given in the table for years 2012 and 2015 are the input data that has been utilized for the projections, therefore they are not updated.
27) The GHG emission projection figures for years 2020 and 2030 are based on Turkey's INDC, which has been submitted on 30 September 2015. The projections have not been updated since then. The base year for the projections is 2012. However, the GHG emission trends for 1990-2015 have been updated based on Turkey's latest GHG Inventory.
28) Emissions trends data have been revised in 2018 in order to keep consistency with information in 3rd Biennial Report. However, the emission projections are based on GHG emissions of year 2012 which are not revised

Table 5. 2 Emissions by sector based on Business-As-Usual Scenario [29] ***(Without Measures) (including LULUCF)***

GHG emission projections-scenarios								
	GHG emissions and removals[30]						Without measures	
	($kt\ CO_2\ eq$)							
Sector	1990	1995	2000	2005	2010	2015	2020	2030
Energy	134,327.90	162,696.10	212330.42	240329.11	292323.66	339721.86	538,886.82	943,547.02
Transport[31]	26968.90	34112.99	36464.87	42,041.16	45,391.99	75797.65	101,189.82	136,512.60
Industry / industrial processes	22,893.94	26128.67	26643.60	34633.97	49215.31	59574.33	94,750.20	169,753.80
Agriculture	42402.30	40987.45	40032.91	40771.65	42826.37	53650.01	51,557.04	59,277.89
Forestry / LULUCF	-28922.68	28906.75	-34739.75	-42652.80	-45956.63	-63668.94	-40,193.25	-38,698.13
Waste management / waste	11090.59	12382.41	14487.23	16919.43	18198.35	16984.25	27,900.00	40,900.00
By Gas								
CO_2 emissions including net CO_2 from LULUCF	117526.58	149349.79	191160.50	218139.32	273417.50	317002.72	561,857.87	1,018,359.96
CO_2 emissions excluding net CO_2 from LULUCF	146507.20	178310.25	226029.84	260897.95	319528.40	380858.09	602,051.13	1,057,058.09
CH_4 emissions including CH_4 from LULUCF	42203.66	42383.98	43525.51	45472.89	52467.16	52,397.82	76,549.20	107,651.46
CH_4 emissions excluding CH_4 from LULUCF	42183.50	42372.39	43484.24	45468.20	52461.56	52,392.72	76,549.20	107,651.46
N_2O emissions including N_2O from LULUCF	21,436.50	20,942.66	22,684.61	23,798.22	26,038.63	29,951.30	25,719.86	33,049.96
N_2O emissions excluding N_2O from LULUCF	21,398.73	20,900.54	22,596.29	23,697.07	25,889.96	29,769.97	25,719.86	33,049.96
HFCs	NO	NO	115.66	1146.88	3054.28	4805.04	7,504.22	13,444.50
PFCs	625.30	611.44	601.00	559.96	461.74	119.72	NE	NE
SF6	NO	NO	667.13	884.09	1167.75	1984.90	1,269.65	2,274.70
NF3	NO	NO	NO	NO	NO	NO	NO	NE
Total with LULUCF	181792.04	213287.87	258754.41	290001.36	356607.05	406,261.50	672,900.80	1,174,780.58
Total without LULUCF	210714.73	242194.62	293494.15	332654.16	402563.69	469930.44	713,094.06	1,213,478.71

29 The GHG emission projection figures for years 2020 and 2030 are based on Turkey's INDC, which has been submitted on 30 September 2015. The projections have not been updated since then. The base year for the projections is 2012. However, the GHG emission trends for 1990-2015 have been updated based on Turkey's latest GHG Inventory.
30 Emissions and removals reported in these columns are as in the latest GHG inventory and consistent with the emissions and removals reported in the 3rd Biennial Report.
31 Emissions trend data have been revised in 2018 in order to keep consistency with information in 3rd Biennial Report. However, the emission projections are based on GHG emissions of year 2012 which are not revised.

In business-as-usual scenario, emissions from energy consumption are projected to increase about 27.3 Mton CO_2-eq. per year for 2012-2020 and about 40.5 Mton CO_2-eq. per year for 2020-2030. Greenhouse gas emissions for 1990-2015[32] and projected emissions up to 2030 for business-as-usual scenario are listed at Table 5.3 based on the type of greenhouse gas.

5.3 MITIGATION SCENARIO (WITH MEASURES)

In mitigation scenario, emissions for 2012-2030 were developed based on mitigation measures from various policy papers and strategic documents. Policies and measures to be implemented are explained in detail in Chapter 4.

Table 5. 3 Emissions by sector based on Mitigation Scenario (With Measures)[32] (including LULUCF)

GHG emission projections-scenarios									
	GHG emissions and removals[34]							Without measures	
	($kt CO_2$ eq)								
Sector	Base Year	1990	1995	2000	2005	2010	2015	2020	2030
Energy	134,327.90	134,327.90	162,696.10	212,330.42	240,329.11	292,323.66	339,721.86	499,335.53	738,265.86
Transport	26968.90	26,968.90	34,112.99	36,464.87	42,041.16	45,391.99	757,97.65	101,112.82	135,994.48
Industry / industrial processes	22,893.94	22,893.94	26,128.67	26,643.60	34633.97	49,215.31	59,574.33	94,785.20	169,753.80
Agriculture	42,402.30	42,402.30	40,987.45	40,032.91	40,771.65	42,826.37	53,650.01	51,557.04	59,277.89
Forestry / LULUCF	-28,922.68	-28,922.68	-28,906.75	-34,739.75	-42,652.80	-45,956.63	-636,68.94	-70,035.88	-69,710.38
Waste management / waste	11,090.59	11,090.59	12,382.41	14,487.23	16,919.43	18,198.35	16,984.25	23,610.00	31,400.00
By Gas									
CO_2 emissions including net CO_2 from LULUCF	117,526.58	117,526.58	149,349.79	191,160.50	218,139.32	273,417.50	317,002.72	494,057.44	790,338.43
CO_2 emissions excluding net CO_2 from LULUCF	146,507.20	146,507.20	178,310.25	226,029.84	260,897.95	319,528.40	380,858.09	564,093.32	860,048.81
CH_4 emissions including CH_4 from LULUCF	42,203.66	42,203.66	42,383.98	43,525.51	45,472.89	52,467.16	52,397.82	71,214.67	91,824.92
CH_4 emissions excluding CH_4 from LULUCF	42,183.50	42,183.50	42,372.39	43,484.24	45,468.20	52,461.56	52,392.72	71,214.67	91,824.92
N_2O emissions including N_2O from LULUCF	21,436.50	21,436.50	20,942.66	22,684.61	23,798.22	26,038.63	29,951.30	25,170.91	31,104.62
N_2O emissions excluding N_2O from LULUCF	21,398.73	21,398.73	20,900.54	22,596.29	23,697.07	25,889.96	29,769.97	25,170.91	31,104.62
HFCs	NO	NO	NO	115.66	1,146.88	3,054.28	4,805.04	7,504.22	13,444.50
PFCs	625.30	625.30	611.44	601.00	559.96	461.74	119.72	NE	NE
SF6	NO	NO	NO	667.13	884.09	1167.75	1984.90	1,269.65	2,274.70
NF3	NO	NO	NO	NO	NO	NO	NO	NO	NE
Total with LULUCF	181,792.04	181,792.04	213,287.87	258,754.41	290,001.36	356,607.05	406,261.50	599,216.89	928,987.17
Total without LULUCF	210,714.73	210,714.73	242,194.62	293,494.15	332,654.16	402,563.69	469,930.44	669,252.77	998,697.55

IThe emission reductions to be achieved by policies and plans, which are explained in detail in Chapter 4, compared to the business-as-usual scenario are presented in the figure below.

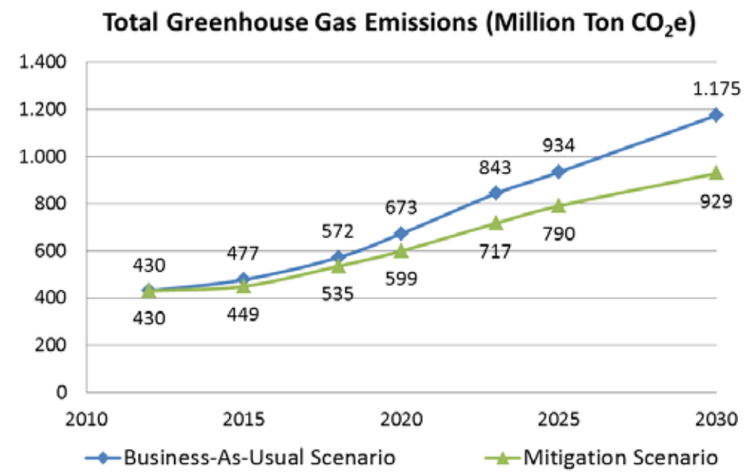

Figure 5. 1 Turkey's GHG emission projections in Business as Usual Scenario and With Measures Scenario

32) The GHG emission projection figures for years 2020 and 2030 are based on Turkey's INDC, which has been submitted on 30 September 2015. The projections have not been updated since then. The base year for the projections is 2012. However, the GHG emission trends for 1990-2015 have been updated based on Turkey's latest GHG Inventory.
33) The GHG emission projection figures for years 2020 and 2030 are based on Turkey's INDC, which has been submitted on 30 September 2015. The projections have not been updated since then. The base year for the projections is 2012. However, the GHG emission trends for 1990-2015 have been updated based on Turkey's latest GHG Inventory.
34) Emissions and removals reported in these columns are as in the latest GHG inventory and consistent with the emissions and removals reported in the table on GHG emissions and trends provided in the biennial report.

5.4 SUPPLEMENTARITY RELATING TO THE MECHANISMS PURSUANT TO ARTICLES 6, 12 AND 17 OF THE KYOTO PROTOCOL

Turkey, as a Party included in Annex I with no commitments inscribed in Annex B to the Kyoto Protocol, has no obligation to report on supplementary relating to the mechanisms pursuant to Articles 6, 12 and 17 of the Kyoto Protocol.

6

VULNERABILITY ASSESSMENT, CLIMATE CHANGE IMPACTS AND ADAPTATION

6.1 INTRODUCTION

This section provides a general outlook on climate changes observed and predicted in Turkey, the expected impacts of these changes, and the relevant risks and vulnerabilities. Furthermore, the framework of the adaptation studies to climate change, including the legal framework, policies, and strategies, was explained. Adaptation actions are presented in the last section.

6.1.1 Observed Changes in Temperature and Precipitation

Climatic observations made by Turkish State Meteorological Service (TSMS) indicate that temperatures increase while precipitation decreases during the summer months in Turkey. The TSMS took the years between 1971 and 2017 as the reference period and determined the long-term annual mean temperature as 13.2°C for the period between 1971 and 2000 and 13.5°C for the period between 1981 and 2010 (Turkish State Meteorological Service_b, 2018). There have been positive temperature anomalies in the mean temperatures of Turkey since 1994 (except for 1997 and 2011). The warmest year was the year 2010 with an anomaly of 2.0°C (Figure 6.1; 6.2; Table 6.1; TSMS, 2015). These findings obtained from the studies of the TSMS are in parallel with the outcomes of the Assessment Reports of the Intergovernmental Panel on Climate Change (IPCC).

I the last few decades Turkey has witnessed annual and seasonal warmest years ever recorded. Turkey experienced the warmest winter and summer in 2010 that has ever recorded. The warmest spring was experienced in 1989; while the warmest autumn was experienced in 2012 (Table 6.1). (Figure 6.1-6.2; Table 1; Turkish State Meteorological Service, 2015). Figure 6.1, Figure 6.2 and Table 6.1 reveal the trends on mean temperatures, mean temperature anomalies and ranking of seasonal and annual warmest decades.

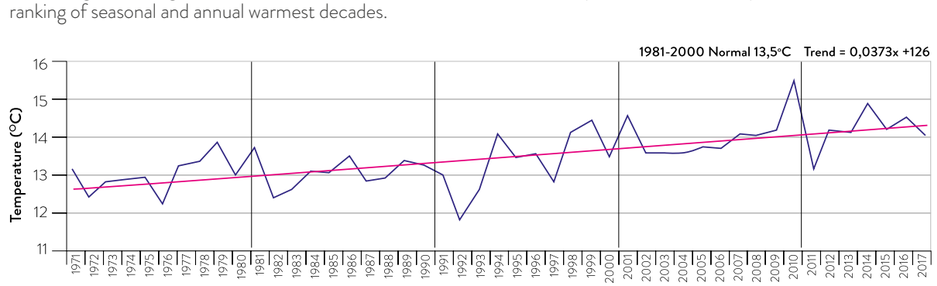

Figure 6. 1 Distribution of the Annual Mean Temperature Data of Turkey between the years (1971-2017)
Source: Turkish State Meteorological Service_a, 2018

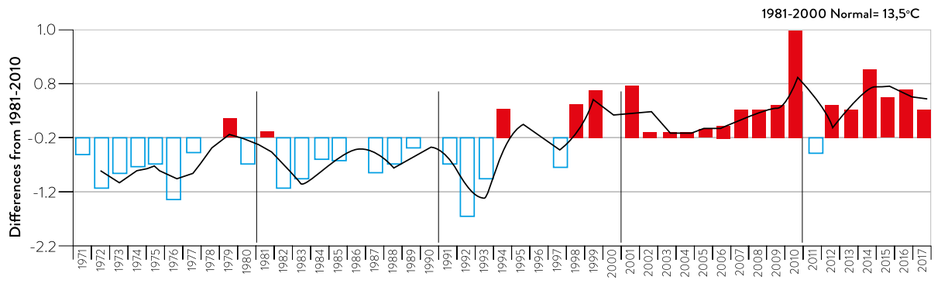

Figure 6. 2 Annual Mean Temperature Anomaly of Turkey (according to 130 stations)
Source: Turkish State Meteorological Service, a_2018.

Table 6. 1 Ranking of the Seasonal and Annual Warmest Decades

Winter			Spring			Summer			Autumn			Average		
Year	Temperature	Anomaly	Year	Temperature	Anomaly	Year	Temperature	Anomaly	Year	Temperature	Anomaly	Year	Temperature	Anomaly
2010	6,8	3,1	1989	14,0	0,2	2010	25,2	1,7	2012	16,9	2,1	2010	15,5	2,0
2013	5,4	1,7	2008	13,9	1,9	2007	25,0	1,4	2010	16,5	1,8	2014	14,9	1,4
1979	5,3	1,6	2013	13,7	1,7	2012	24,7	1,2	1994	16,0	1,2	2001	14,6	1,1
1999	5,3	1,6	2001	13,7	1,7	2008	24,7	1,1	1998	16,0	1,2	1999	14,5	1,0
2001	5,2	1,5	2014	13,6	1,6	2001	24,7	1,1	2008	15,5	0,8	2009	14,2	0,7
2011	5,2	1,5	2010	13,4	1,4	2006	24,6	1,0	2002	15,5	0,8	2012	14,2	0,7
1994	5,0	1,3	1994	13,2	1,2	1998	24,5	1,0	2007	15,4	0,7	1998	14,2	0,7
1984	5,0	1,3	2006	12,9	0,9	2014	24,4	0,9	2009	15,4	0,6	2013	14,1	0,6
1997	4,9	1,2	1999	12,8	0,8	2000	24,2	0,6	2004	15,4	0,6	2007	14,1	0,6
1986	4,8	1,1	1975	12,6	0,6	1999	24,1	0,6	1974	15,2	0,5	1994	14,1	0,6

Source: Turkish State Meteorological Service, 2015.

According to the observations and data of the TSMS, the annual areal total precipitation in Turkey was 574 mm for the period between 1981 and 2010 (Turkish State Meteorological Service_b, 2018). The rainfall time series indicates that there is no significant increase or decrease in annual total precipitation averages across Turkey. However, when Turkey's long-term precipitation averages are examined, it is observed that dry and wet periods follow each other (Figure 6.3). The year 2013was one of the driest years. In the period examined, it was observed that the rainiest year was 2009 (710mm) and the driest year was 2008 (450 mm) and that a dry period was experienced between 2006 and 2008 while a rainier period was experienced between 2009 and 2012. In Figure 6.3, blue colouredcolumns show the amount of precipitation, and the red horizontal line shows the long-termaverage of Turkey. .

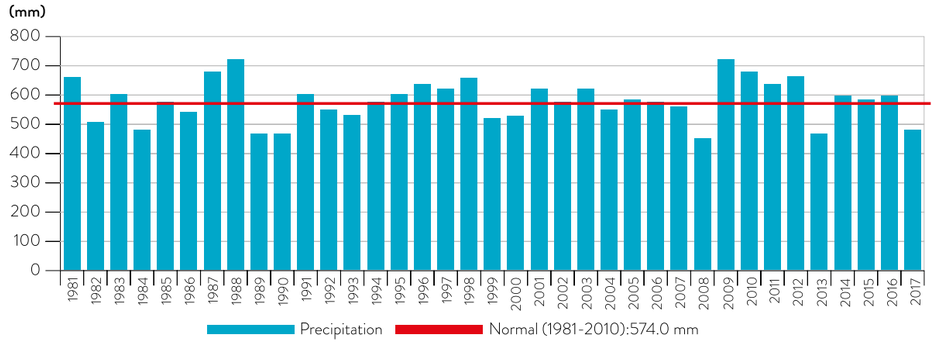

Figure 6. 3 Annual Areal Precipitation across Turkey (1981-2017)
Source: Turkish State Meteorological Service, b_2018.

6.1.1.1 Temperature Trend Analysis

In general, there is an increasing trend that also affects maximum and minimum temperatures across the country. However, it is observed that there are irregularities in the precipitation change patterns. Although the mean annual total precipitation decreases, the amounts of one-day maximum precipitation increase.

In the studies carried out by Şensoy et al. (2008; 2013), various climate index trends were determined using the data of 109 stations of the TSMS for the period between 1960 and 2010 in Turkey (Turkish State Meteorological Service, 2015). According to the results of this study, the numbers of summer days, warm days, warm nights and tropical nights were increased while decreases were observed in the numbers of frosty days, cool days and cool nights. The growing season length was increased except for the coastal regions that were already high. The result indicates a significant increase in Turkey's temperatures. Most of the temperature index trends were found to be statistically significant at the level of 95%. Accordingly,

- The number of summer days is increasing in entire Turkey. In particular, the trends of the northern stations are high. Kendall's tau-based trend estimation indicates that the mean increasing trend is 39 days/100 years and that most of the trends are significant at the level of 95%.
- The number of tropical nights is increasing with the exception of the Euphrates Basin. They had a significantly decreasing trend after the construction of the Elazığ Keban Dam. In particular, coastal stations have a big trend. The mean increasing trend calculated is 37 days/100 years, and most of them are significant at the level of 95%.
- The number of warm days is increasing in entire Turkey. The mean increasing trend calculated is 14 days/100 years. Most of the trends are significant at the level of 95%.
- The number of warm nights is increasing outside the Euphrates Basin. The greatest increases are on the Mediterranean coast. The mean increasing trend calculated is 15 days/100 years. Most of the trends are significant at the level of 95%.
- The number of cool days is decreasing at most of the stations. Only 10 stations are showing an increasing trend. The mean decreasing trend calculated is 6 days/100 years. Most of the trends are statistically significant at the level of 95%.
- The number of cool nights is decreasing at most of the stations. Only 20 stations are showing an increasing trend. The mean decreasing trend calculated is 15 days/100 years. Most of the trends are statistically significant at the level of 95%.
- While the number of frosty days shows an increasing trend at 55 stations, especially in Central Anatolia, it shows a decreasing trend at 53 stations. The mean decreasing trend calculated is 14 days/100 years. Most of the trends are statistically significant at the level of 95%. There is also an increasing trend in Erzurum, Uzunköprü, Çorum, Sivrihisar, Balıkesir, Isparta, Burdur and Diyarbakır.

In another study on this subject, an increasing trend was observed in the daily maximum and minimum temperature values for the years 1961-2008 of 165 stations across Turkey while a decreasing trend was observed in daily maximum and minimum temperature differences. Observations show that the temperatures started to increase at the beginning of the 1980s (Toros, 2012).

6.1.1.2 Precipitation Trend Analysis

Various climate index trends were determined using the data of 109 stations of the TSMS for the period between 1960 and 2010 in Turkey (Şensoy et al., 2008; 2013; Turkish State Meteorological Service, 2015). According to the results of this study, it was observed that the annual total precipitation increased in the northern parts of Turkey while it showed a decreasing trend in the Aegean, Mediterranean and Southeastern Anatolia regions and that the maximum number of rainy days, the number of wet days and one-day maximum precipitation showed an increasing trend at many stations outside the Aegean and Southeast Anatolian regions. Accordingly,

- Annual total precipitation trends have an increasing trend in the North of the country and a decreasing trend in the Southeastern Anatolia, Mediterranean and Aegean regions.
- The number of days with heavy precipitation tended to increase at most of the stations except for the Aegean and Southeastern Anatolia regions. The mean increasing trend calculated is 17 days/100 years. Regarding the number of days with heavy precipitation, a strong increasing trend is observed in the Eastern Black Sea region while a strong decreasing trend is observed in the Southeastern Anatolia region.
- The number of days with extreme precipitation tends to increase at most of the stations except for the Aegean and Southeastern Anatolia regions. The mean increasing trend calculated is 119 mm/100 years.
- One-day maximum precipitation tends to increase at most of the stations except for the Aegean and Southeastern Anatolia regions. The mean increasing trend calculated is 17 mm/100 years.

In the study carried out by Efe et al. (2015), tendency analysis was performed by examining the annual total temperature and precipitation data for the period between 1950 and 2013 across Turkey. According to these analyses, as it is seen in Figure 6.4, there is an increasing trend in precipitation across the entire coastline, especially in the Black Sea and the Marmara regions. The fact that annual total precipitation has a decreasing trend in almost all terrestrial regions may be a preliminary indication of the conditions leading to drought. No trend was observed in annual total precipitation at 13 stations.

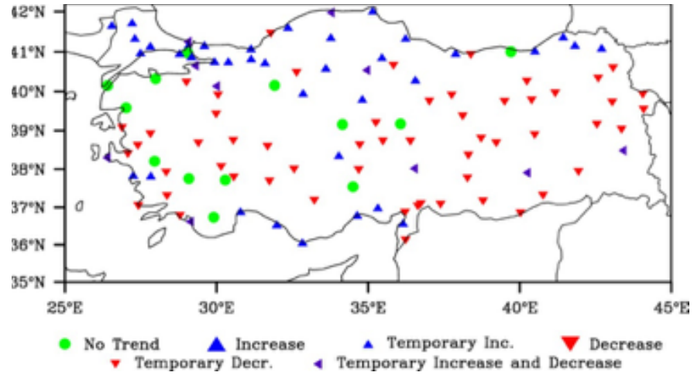

Figure 6. 4 Tendency Analysis for Annual Total Precipitation (Source: Efe et al. 2015)

6.2 CLIMATE MODELLING, PROJECTIONS AND SCENARIOS

Social and economic losses caused by weather and climate-related extreme events and disasters have been increasing along with a significant areal and inter-annual variability in many regions of the world and in Turkey. The nature, intensity and impact power of extreme weather and climate events and disasters closely depend on economic, social, geographical, demographic, cultural, institutional and governance (e.g., adaptation), environmental and ecological factors, as well as exposure (aspect) and vulnerability levels varying at areal and temporal scales.

A large part of Turkey is located in the dry summer subtropical Mediterranean climate zone. Turkey is among medium-high risk countries in terms of both climate change and variability, and future climate. In this context, there is a need for studies on the issues of monitoring the climate, climate change and variability, and adaptation to be conducted against the adverse impacts of climate change.

6.2.1 Climate Projections of Turkey

The TSMS produced regional climate projections for Turkey until 2100 using the dynamic downscaling method, in accordance with the scenarios used in the IPCC 5th Assessment Report, Working Group 1 report. In regional climate projections produced by the TSMS using the downscaling method, it is based on the global models prepared by 20 climate modeling groups, members of the World Climate Research Program (WCRP), within the scope of the Coupled Model Intercomparing

Project Phase 5, CMIP5, and new generation concentration scenarios used in the IPCC 5th Assessment Report (Representative Concentration Pathways, RCP). Moderate radiative forcing (4.5W/m2) RCP4.5 scenarios and high radiative forcing (8.5W/m2) RCP8.5 scenarios were used for the years 2016-2099in the projection, and the climate projection model HadGEM2-ES developed by the Hadley Research Center of the UK Meteorological Office was produced by downscaling the global model results with the regional climate model system (The Regional Climate Model system, RegCM4). The model resolution, study area, vulnerability analyses, and projection period related to the global (HadGEM2-ES) and regional model (RegCM4) used, and detailed information about the scenario used are presented in Table 6.2 (Turkish State Meteorological Service, 2014; https://www.mgm.gov.tr/iklim/iklim-degisikligi.aspx?s=projeksiyonlar).

Table 6. 2 Main features of modelling studies

Phases	GCM	RCM	Resolution (km)	Domain Size	Sensitivity Analysis (1971-2000)	Projection Period	Scenario
PHASE-1 Generating Projections	HadGEM2-ES GFDL-ES-M2M MPI-ESM-MR	RegCM.3.4.	20x20	130x180	* CRU *UDEL *UDEL-C *GSMs RAW DATA	1971-2000 RF 2013-2040 2041-2070 2071-2090	RCP4.5 RCP8.5
PHASE-II Transmitting to Users	A practical internet interface is being developed to reach all users from all sections. It shall be possible to reach this interface from every place having a reliable internet connection.						

Source: Turkish State Meteorological Service, 2014 [34]

The project entitled "The Impact of Climate Change on Water Resources" was launched by the Ministry of Agriculture and Forestry (former Ministry of Food, Agriculture and Livestock and Ministry of Forestry and Water Affairs) General Directorate of Water Management (GDWM) in 2013, and the project was completed in June 2016 (General Directorate of Water Management, 2016). Within the scope of the climate projections, the first stage of projection studies, RegCM4.3 regional climate model was run with the outcomes of three global models selected from the CMIP5 archive, which forms the basis of the 5th Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), and RCP4.5 and RCP8.5 release scenarios to include the whole of Turkey. A total of 8 parameters and projections of 17 climate indices representing extreme conditions were selected in river basin scales in the whole country through model simulation, and the differences of the studied parameters until 2010 were calculated as seasonal and annual averages for 10 and 30-year periods based on the reference period accepted as the simulations of 1971-2000. 3 global climate model results with 10x10 km resolution were obtained for Turkey for the first time in this project.

Within the scope of the hydrologic projections, the second stage of the projection studies, the water potentials of all river basins in Turkey were calculated for the first time using the hydrologic model. The precipitation values were converted to river flow values by running hydrologic models with the outcomes of the climate models, and water potential modelling/calculation study was conducted by taking into account the current situation of surface water and groundwater sources in all river basins and the estimated situation for projected periods.

6.2.1.1 Reference Period and Area Selection for Climate Projections

The climate projections produced by the TSMS for a domain covering Turkey and its vicinity will be discussed in this section. Projections were produced based on RCP4.5 and RCP8.5 scenarios. The scenarios used are also the most preferred scenarios in the IPCC 5th Assessment Report. The 1971-2000 period was selected as the reference period for the projections produced in 20 km resolution, and the years 2016-2099 were selected for the projections. The 2016-2099 projection range was studied in periods of 2016-2040, 2041-2070, 2071-2099.

34 https://www.mgm.gov.tr/iklim/iklim-degisikligi.aspx?s=projeksiyonlar

The temperature averages of global models that were used within the scope of the CMIP5 on Turkey were compared to produce high-resolution regional projections for Turkey and its vicinity and to see the general characteristics of models' climate change projections.

According to the average temperature comparison results of the global climate models for Turkey and its vicinity, it is observed that HadGEM, GFDL, and MPI global models are among the models that ideally represent the average temperature values in Turkey. According to the results of HadGEM, Geophysical Fluid Dynamics Laboratory (GFDL) and Max Planck Institute for Meteorology (MPI) global model data used by the TSMS, the average temperatures achieved as a result of regional climate projections are consistent with global models (Turkish State Meteorological Service, 2015). Therefore, HadGEM, GFDL, and MPI global models were preferred in the TSMS's studies to produce regional climate projections. In the evaluation, it is observed that the coldest model is INMCM4 and the warmest model is MIROC for RCP4.5 and RCP8.5.

As a result of the comparisons and investigations performed, the outcomes of 3 of the global models that produced appropriate results for Turkey and its vicinityunder CMIP5 (HadGEM2-ES, MPIESM-MR, and GFDL-ESM2M) were selected. Regional climate projections were obtained by using the downscaling method through these 3 models RegCM4 regional climate model (Turkish State Meteorological Service, 2015). The main features of the global and regional models used in the TSMS studies are presented in Table 6.3. The TSMS produces results with 20 km resolution using the results of the global model HadGEM with 112.5 km resolution in the RegCM model.

Table 6. 3 General Features of the GCM and RCM Used in TSMS Study

GCM	HadGEM2-ES	MPI-ESM-MR	GFDL-ESM2M
Global Model Resolution (km)	112,5	210	220
Source Institute	Hadley Center	Max Planck	Noaa-GFD Lab.
RCP	4.5-8.5	4.5-8.5	4.5-8.5
Reference Period	1971-2000	1971-2000	1971-2000
Projection Period	2016-2099	2016-2099	2016-2099
RCM	RegCM	RegCM	RegCM
Resolution of produced projections (km)	20	20	20
Final Status	Completed	Completed	Completed

Source: Turkish State Meteorological Service, 2015.

Testing (parametrization) of the model is extremely important in terms of reflecting the observed climatic values closest in each grid. For example, humidity and temperature values in each grid affect the cloud formation, and the amounts of aerosol affect the amount of precipitation. Therefore, the result of a well-parameterized model will help decision-makers to take decisions on adaptation activities for climate change. For this purpose, parametrization tests were first performed by the TSMS, and then the model was run by selecting 4 different periods. The regional model takes the initial and bouındaryconditions from the global model and provides a transition from the low-resolution topography of the global model to a more detailed topography of the regional model. The region located between 27.00°-51.00° North latitudes and 5.00°-55.00° east longitudes was selected as the domain where the models would be run, in order to encompass the movement paths of air masses that affect Turkey. The first 3 grids in all directions (east, west, north, south)of the domain area were not taken into consideration to ignorethe regional climate model bondaryconditions errors (Turkish State Meteorological Service, 2015).

6.2.1.2 Regional Climate Projections for Turkey

An important stage in regional climate projection studies is the comparison of the outcomes of the reference period model with the raw data of the global model and global observation data. This analysis shows the margins of error between the regional climate model (RCM) and observation data. In this context, the results of 1971-2000 regional climate projection produced with the data of HadGEM2-ES, MPI-ESM-MR and GFDL-ESM2M global models for Turkey were tested with some globally accepted global observation datasets (CRU and UDEL).

According to the results of the comparison made with the projection results of the HadGEM2-ES global model data for the 1971-2000 reference period obtained by the dynamic downscaling method using the RegCM4 regional climate model, and the observation data of CRU and UDEL for the 1971-2000 period, a significant convenience attracts the attention in temperatures, especially in summer and winter temperatures. Furthermore, model results in spring and autumn seasons were found to be lower between 1.5°C and 2°C lower than the observation data. Regarding the annual mean temperatures, it was observed that regional model results were lower than global model results and observations.

Although precipitation values of the regional climate model in the reference period are in close agreement with the other model results and observation data in winter, it is observed that they are different from model results and observations in spring and autumn. In Table 6.4, mean temperature and total precipitation results for the 1971-2000 reference period are compared seasonally with different observation datasets. When precipitation values are examined, it is observed that model results are compatible with other observation data, especially in winter. In spring and autumn seasons, precipitation values of the model are higher than the observation data. In general, when the average of Turkey is considered, model results give approximately 12%-19% more precipitation compared to other observation datasets.

Table 6. 4 Comparison of the seasonal mean temperatures and daily precipitation data for the 1971-2000 reference period with observation data (Turkey/HadGEM2-ES/RegCM4.3.4)

Season	Temperature (°C)			Precipitation (mm/day)		
	RCM	CRU	UDEL	RCM	CRU	UDEL
Winter	0,436	0,561	-0,076	2,159	2,126	2,35
Spring	8,294	9,712	9,309	2,622	1,974	2,098
Summer	20,792	20,859	20,7	0,947	0,686	0,742
Autumn	10,412	12,480	11,961	1,830	1,333	1,454
Average	9,987	10,906	10,474	1,886	1,531	1,664

Source: Turkish State Meteorological Service, 2015.

6.2.1.3 Temperature and Precipitation Projections According to RCP4.5 Scenario

According to temperature (Figure 6.5) and precipitation (Figure 6.6) projections produced by the TSMS for Turkey using the RCP4.5 scenario HadGEM2-ES global data by considering the reference period covering the years between 1971-2000;

2016-2040 period

- It is projected that warming is generally limited to 2°C, and this warming will be 2-3°C in the Marmara and Western Black Sea regions during summer,
- While an increase is observed in precipitation in the Coastal Aegean, Eastern Black Sea and Eastern Anatolia regions during winter months, precipitation will decrease by approximately 20% in mostparts of the country except for the Coastal Aegean and the east of Eastern Anatolia during spring precipitation.

2041-2070 period

- While warming is approximately 2-3°C in spring and autumn, it is projected to increase by 4°C during the summer months.
- It is projected that winter precipitation will decrease by approximately 20% in the Eastern and Southeastern Anatolia and Central and Eastern Mediterranean regions,
- There will be a decrease of approximately 30% in Eastern Anatolia where summer precipitation is important,
- There will be decreases in autumn precipitation in the whole country except for a small part of the coastal Aegean and Central Anatolia regions.

2071-2099 period

- While a 2°C increase in winter temperatures and a 3°C increase in spring and autumn temperatures are observed, it is remarkable that there will be temperature increases exceeding 4°C in summer temperatures in the Coastal Aegean and Southeastern Anatolia regions.
- *I*t is remarkable that there will be decreases of approximately 20% in precipitation except for the Coastal Aegean, Central Black Sea and Northeastern Anatolia regions in spring precipitation,
- There will be a 10% increase in winter precipitation, especially on the coastline,
- There will be decreases of up to 40% in summer precipitation except for the Aegean, Marmara and Black Sea coasts,
- There will be decreases in autumn precipitation almost in the whole country (Turkish State Meteorological Service, 2015).

HadGEM2-ES RCP4.5 TEMPERATURE PROJECTIONS (20km)

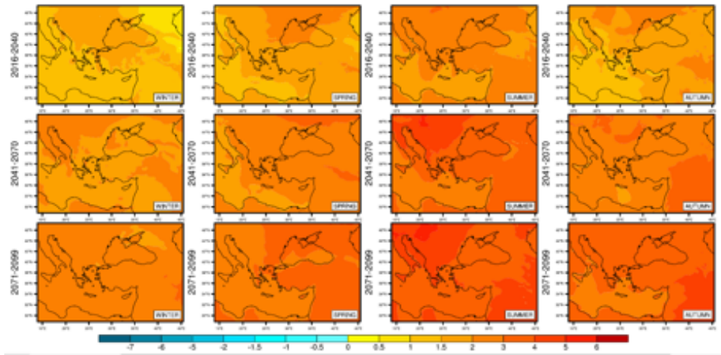

Figure 6. 5 TSMS temperature projections according to RCP4.5
(Source: Turkish State Meteorological Service, 2015)

HadGEM2-ES RCP4.5 PRECIPITATION PROJECTIONS (20km)

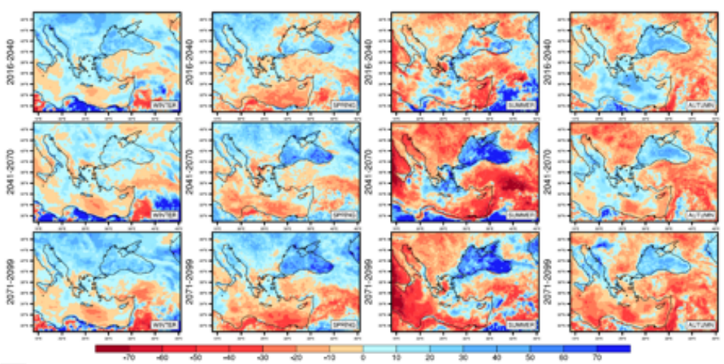

Figure 6. 6 TSMS precipitation projections according to RCP4.5
(Source: Turkish State Meteorological Service, 2015)

According to the RCP4.5 scenario, the annual mean temperatures of Turkey are expected to increase in the range of 1.5°C – 2.6 °C on average in the 2016-2099 period. It is projected that the mean temperature anomaly will be between -0.9°C and 4.1°C in the first half of the century and that the annual mean temperatures will increase by 1.4°C on average. In the second half of the century, it is expected that the mean temperature anomaly will be between 0.6°C-4.1°C and that temperatures will increase by 2.2°C on average (Figure 6.7).

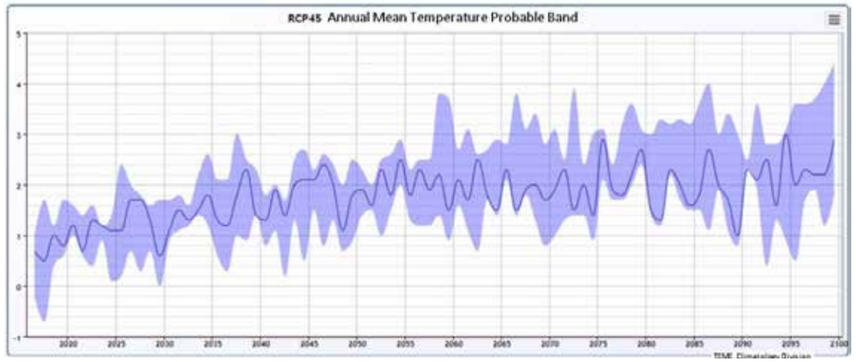

Figure 6. 7 Annual mean temperature change graphic, according to RCP4.5 scenario projections
(Source: Turkish State Meteorological Service, 2015)

According to the RCP4.5 scenario, Turkey's annual total precipitation anomaly is expected to decrease by 3% and 6% on average in the 2016-2099 period. The average change in precipitation anomaly is projected to be in the range of 1% and 6% in the first half of the century and 5% and 6% in the second half of the century.

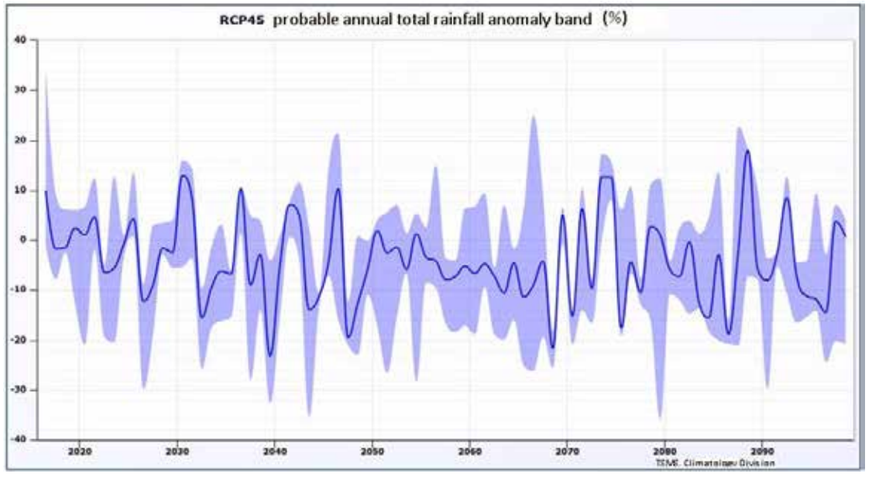

Figure 6. 8 Annual total precipitation change graphic according to RCP4.5 scenario projections

6.2.1.4 Temperature and Precipitation Projections According to RCP8.5 Scenario

According to temperature and precipitation projections produced using the HadGEM2-ES based on the RCP8.5 scenario;

2016-2040 period

- Warming is projected to be approximately 3°C, especially in the spring and summer seasons.
- It is remarkable that there will be decreases in autumn precipitation in the whole country, and there will be decreases in spring precipitation in the west of Mersin-Ordu line,
- There will be increases of up to 40% in summer precipitation in all coastal regions except for the Western Mediterranean region.

2041-2070 period

- It is projected that temperature increases that reach 2-3°C during the winter months and 3°C-4°C during the autumn and spring months will reach 5°C during the summer period.
- It is projected that there will be increases in winter precipitation except for the Coastal Mediterranean, Southeastern Anatolia regions, and the south of Eastern Anatolia,
- There will be decreases of approximately 20% during spring in the whole country except for the Coastal Aegean and Northern-Eastern Anatolia regions,
- There will be decreases of approximately 50% in summer precipitation in the whole country, especially in Eastern Anatolia, except for the Aegean, Marmara, West and Eastern Black Sea regions,
- Precipitation will decrease all over the country in autumn.

2071-2099 period

- Temperature increases exceeding 6°C are remarkable, especially in summer temperatures. Nevertheless, temperature increases reach 6°C during the spring and autumn months especially in Southeastern Anatolia, and it is projected that there will be 3-4°C increases during the winter months on the west side of Trabzon-Mersin line and 4°C-5°C increases in the east of this line.
- It is remarkable that there will be decreases in winter precipitation in the Central and Eastern Mediterranean region and Southeastern Anatolia region and increases in other regions, especially in the Central and Eastern Black Sea coasts.
- It is remarkable that there will be decreases of approximately 20% during the spring months in the regions other than the Coastal Aegean region, the western part of the Central Black Sea region and Eastern Black Sea, and there will be decreases that reach up to 40% and sometimes up to 50% in autumn in the whole country except for the Marmara coasts.
- While increases are expected in summer precipitation in the Marmara and Western Black Sea regions, it is remarkable that there will be decreases in precipitation, especially in the Mediterranean and Eastern Anatolia regions (Turkish State Meteorological Service, 2015).

HadGEM2-ES RCP8.5 TEMPERATURE PROJECTIONS (20km)

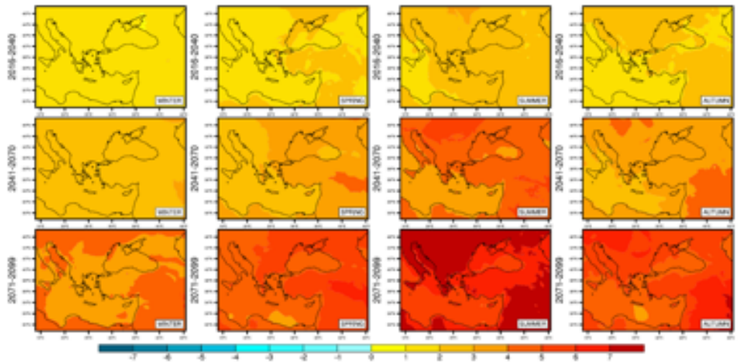

Figure 6. 9 TSMS temperature projections according to RCP8.5
(Source: Turkish State Meteorological Service, 2015)

HadGEM2-ES RCP8.5 PRECIPITATION PROJECTIONS (20km)

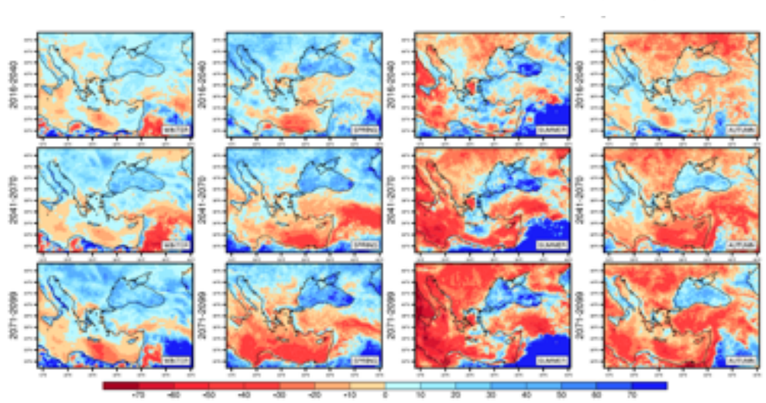

Figure 6. 10 TSMS precipitation projections according to RCP8.5
(Source: Turkish State Meteorological Service, 2015)

According to the RCP8.5 scenario, the annual mean temperatures of Turkey are expected to increase in the range of 2.5 – 3.7 °C on average in the 2016-2099 period. It is projected that the mean temperature anomaly will be between -0.4 and 3.8°C in the first half of the century and that the annual mean temperatures will increase by 1.7°C on average, and in the second half of the century, it is projected that it will be between 1.4 and 6.6°C and that there will be an average increase of 3.8°C.

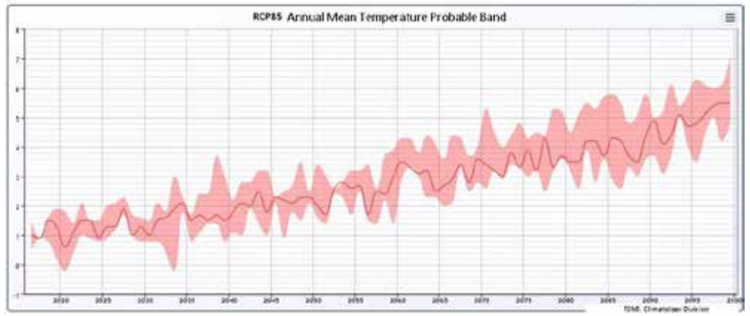

Figure 6. 11 Annual mean temperature change graphic, according to RCP8.5 scenario projections
Source: Turkish State Meteorological Service, 2015.

According to the RCP8.5 scenario, the annual total precipitation anomaly change of Turkey is expected to be in the range of +3% and -12% on average in the 2016-2099 period. The average change in precipitation anomaly is projected to be between +5% and -1% in the first half of the century and between +1% and -18% in the second half of the century.

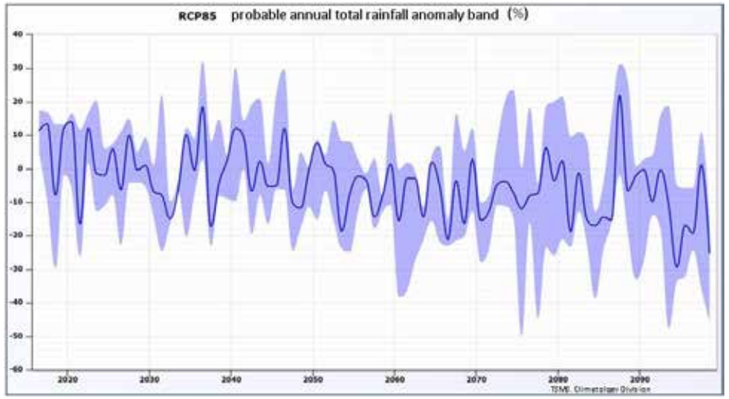

Figure 6. 12 Annual total precipitation change graphic according to RCP8.5 scenario projections.
Source: Turkish State Meteorological Service, 2015.

In brief, according to the results obtained from two scenarios of Three Global Circulation Models (RCP4.5 and RCP8.5), the annual mean temperature increase in Turkey is projected to be between 1°C - 2°C for the 2016-2040 period, between 1.5°C - 4°C for the 2041–2070 period, and between 1.5°C - 5°C for the last 2071-2099 period. In some scenarios, the temperature increase during the last thirty years of the 21st century (2071-2100) is projected to reach 3°C in winter and 8°C in summer (Turkish State Meteorological Service, 2015).

With respect to precipitation, increases are projected in the amount of precipitation throughout the country for the winter season in all periods while decreases are projected in the amount of precipitation during spring except for the coastal and Northeastern parts of the country in all periods. While decreases are expected during summer except for the western coastal and Northeastern parts of the country in all periods, a decrease is generally expected in the amount of precipitation during autumn. Although there is No regular increase and decrease tendency in the amount of precipitation during the projection period (2016-2099), the irregularity of precipitation regime is remarkable (Demircan et al., 2017).

6.2.1.5 Seasonal Differences

When temperature projections produced using RCP4.5 and RCP8.5 scenarios based HadGEM2-ES are seasonally compared, it is projected that:

- the temperature increase will generally be limited to 2°C according to the RCP4.5 scenario for the 2016-2040 period, this value will increase slightly in the Marmara and Western Black Sea regions in summer,
- the temperature increase will be around 3°C, especially in the spring and summer seasons, according to RCP8.5,
- the temperature increase will be around 2-3°C in spring and autumn and around 4°C in summer according to RCP4.5 for the 2041-2070 period,
- the temperature increase will be around 2-3°C in winter, around 3-4°C in spring and autumn and around 5°C in summer according to RCP8.5,
- the temperature increase will reach 2°C in winter, 3°C in spring and autumn and 4°C in summer according to RCP4.5 for the 2071-2099 period,
- the temperature increase will reach 6°C in summer, along with a temperature increase of 3-4°C in the western regions and an increase of 4-5°C in the eastern regions during winter according to RCP8.5.

6.2.1.6 Regional Differences

When the precipitation projections of RCP4.5 and RCP8.5 scenarios are compared, it is projected that:

- precipitation will decrease in mostof the country according to the RCP4.5 scenario in the 2016-2040 period,
- decreases will be observed in autumn precipitation in the western regions while increases of up to 40% will be observed in summer precipitation in most of the coastal regions, according to RCP8.5,
- there will be decreases in autumn precipitation throughout the country and approximately 30% decreases in summer precipitation in Eastern Anatolia, according to RCP4.5 for the 2041-2070 period,
- there will be an increase in winter precipitation in a large part of the country, there will be decreases of approximately 20% in precipitation during spring throughout the country, and precipitation will decrease in autumn in the whole country, according to RCP8.5,
- there will be decreases of approximately 20% in spring in the whole country, there will be 10% increases in winter precipitation in the whole country, there will be decreases of up to 40% in summer precipitation, and there will be decreases in autumn precipitation in the whole country, according to RCP4.5 in the 2071-2099 period,
- there will be decreases of approximately 20% in spring precipitation across the country and decreases of approximately 40% during autumn in a large part of the country, and there will be an increase in winter precipitation in a large part of the country, according to RCP8.5.

Within the context of climate change, serious risks are predicted to occur in Turkey's river basins under changing climate conditions. One of these is the decrease in the amount of precipitation in the basins in the southern and inner parts of Anatolia, especially in the Euphrates-Dicle basin. The second one is that increasing temperatures lead to changes in precipitation type and the snow in winter turns into rain. Snow is an important source of water throughout the year. Furthermore, increased temperatures will lead to early melting of snow during spring. The third problem is the risk of extreme precipitation in the western and Northern coastal areas of Anatolia, especially in summer. This extreme precipitation may cause floods as it has been in recent years. Furthermore, increased temperatures may lead to an increase in the number and severity of extreme weather events such as storms, hail, and tornadoes (Demircan et al., 2017).

The results regarding the temperature and precipitation projections for the RCP4.5 and RCP8.5 scenarios of the project entitled "The Impact of Climate Change on Water Resources" carried out by the General Directorate of Water Management (GDWM) are as follows (General Directorate of Water Management, 2016):

Temperature Projections

- 10-year annual results of four seasons of RegCM4.3 regional climate model solutions based on HadGEM2-ES, MPI-ESM-MR and CNRM-CM5.1 models for RCP4.5 and RCP8.5 scenarios across Turkey were calculated.
- In all three models, the mean temperature anomaly values according to the RCP4.5 and RCP8.5 scenarios during the projection period (2015-2100) give positive results for the four seasons compared to the reference period.
- It is observed that all simulations based on three global climate models and both emission scenarios indicate a significant warming over Turkey at the seasonal and annual scale in the 2015-2100 projection period.
- Although much smaller temperature variations in some regions and even cooling in some years are observed in the first years of the 2015-2100 period, the climate forcing caused by the increase in greenhouse gases in the following years accelerates the increase of temperatures in a more dominant way than regional climate variability.
- In both scenarios, it is predicted by all three models that winter temperatures will be at least 1°C higher after the 2050s compared to the 1970-2000 period.
- Temperature increases in the RCP4.5 scenario, especially between the year 2091 and 2100 over Turkey, were found to be 3.4°C, 2°C and 2.5°C, respectively, for RegCM4.3 coupled with HadGEM2-ES, MPI-ESM-MR, and CNRM-CM5.1 models.
- In RCP8.5, which is a higher emission scenario, these temperature increase values are 5.9°C, 4.5°C and 4.3°C, respectively.
- Although temperature increases across Turkey, in the RCP8.5 scenario, are slightly above the RCP4.5 scenario until the 2050s, the RCP8.5 scenario shows higher temperature increases after the 2050s.
- Temperature increases are higher in summer and spring than in winter and autumn (General Directorate of Water Management, 2016).

Precipitation Projections

- 10-year annual results until 2100 of regional, seasonal and annual changes of precipitation across Turkey under the RCP4.5 and RCP8.5 scenarios of RegCM4.3 regional climate model solutions based on HadGEM2-ES, MPI-ESM-MR, and CNRM-CM5.1 models were calculated.
- Precipitation projections of the HadGEM2-ES, MPI-ESM-MR, and CNRM-CM5.1 models for the RCP4.5 and RCP8.5 scenarios show that there may be regional increases and decreases in precipitation during the projection period (2015-2100) depending on ground system models.
- In general, variations between -50 mm and 40 mm for the RCP4.5 scenario and variations between -60 mm and 20 mm for the RCP8.5 scenario are predicted in ten-year seasonal precipitation averages during the projection period.
- These variations occurring in precipitation may show significant differences from each other depending on the considered periods and the RCP4.5 and RCP8.5 scenarios. For example, the MPI-ESM-MR model indicates that there will be precipitation decreases ranging from 7.7 mm to 28 mm, as well as seasonal 10.6 mm precipitation increases on the basis of 10-year averages across Turkey between 2015-2100.
- Furthermore, while there is no consistency among the models in the 2015-2040 period, HadGEM2-ES and MPI-ESM-MR models predict decreases in precipitation according to both emission scenarios during the 2041-2070 projection period.
- These precipitation decreases become more severe in the case of RCP8.5. In the last thirty years of the projection period, similar precipitation decreases are expected to occur across Turkey (General Directorate of Water Management, 2016).

6.3 EXPECTED IMPACTS AND VULNERABILITY

6.3.1 Water Resources

Turkey's current water potential that can be used sustainably is 112 billion m^3 which consists of 94 billion m^3 of surface water and 18 billion m^3 of groundwater. In Turkey, approximately 50% of this potential is used at the present time. Total water consumption, which was 54 billion m^3 in 2016, corresponds to 48% of Turkey's net water potential. 39 billion m^3 of total use is met by surface water while 15 billion^3 is met by groundwater.

While the water used in agricultural irrigation has the highest share of 74%, 13% of water is used for domestic purposes, and 13% of it is used in industry (Figure 6.13). Therefore, in terms of quantity, 40 billion m^3 of water for irrigation, 7 billion m^3 of water for domestic use and 7 billion m^3 of water for the industry were used in 2016 (Turkish Water Institute, 2017).

The whole 112 billion m^3 of available water in Turkey is predicted to be used in 2023.Water consumption amounts for 2023 have been projected to be a total of 112 billion m^3 consisting of 72 billion m^3 for irrigation, 18 billion m^3 for drinking and utility water and 22 billion m^3 for the industry. According to these data, it is predicted that the share of water use for agricultural irrigation will be reduced to 64%, and that the share of industrial use and the share of domestic use will increase to 20% and 16%, respectively, until 2023 (Figure 6.13; Ministry of Environment and Urbanization-a, 2012; General Directorate of State Hydraulic WorksState Hydraulic Works (DSİ), 2009; Turkish Water Institute, 2017).

According to the projections of the Turkish Statistical Institute (TSI), Turkey's population is predicted to reach approximately 93 million in 2030 (Turkish Statistical Institute-a, 2018). In this case, the amount of available water per capita, which is Now 1.302 m3/year, will decrease to 1.204 m3/year in 2030 (General Directorate of State Hydraulic WorksState Hydraulic Works, 2009). It is possible to predict the pressures on water resources with the effects of the factors such as the current growth rate of the country, and the change in water consumption habits. Furthermore, all these predictions may be the case if available resources are transferred without destruction until that year.

In this sense, contrary to common belief, Turkey is not a water-rich country in terms of the amount of available water per capita. According to the Falkenmark index which classifies countries in terms of water potential per capita, Turkey is a "water stress" country since it has 1.000-1.500 m^3 of annual water potential per capita, and the amount of water per capita is below the world average. When the same index is taken into account, the country will have water scarcity if the water per capita in the country falls below 1.000 cubic meters. In the light of this fact, Turkey will be under the risk of water scarcity in the near future (General Directorate of State Hydraulic WorksState Hydraulic Works, 2009; Turkish Water Institute, 2017). It is predicted that this figure will become even smaller in the future, without considering the impact of climate change..

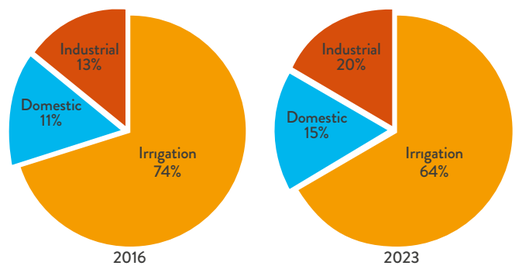

Figure 6. 13 Sectoral Water Consumption in Turkey
Source: Turkish Water Institute, 2017.

Assuming that the amount of available water does not change during the 21st century (in other words, without the impact of climate change), the amount of water per capita in 2050 will be further reduced compared to today because the population will increase. According to Turkey's population projections updated by the Turkish Statistical Institute in 2018, the population is predicted to be approximately 104 million in 2050 and 107 million in 2075 (Turkish Statistical Institute, 2018). Accordingly, the amount of water per capita will decrease to 982 m^3/year in 2050 and to 957 m^3/year in 2075. These figures will include Turkey among the countries with "water scarcity" (Şen, 2013).

It is scientifically predicted that the most significant impact of climate change will be on the water cycle and that climate change, in the future, will lead to a decrease across water resources in Turkey (Şen, 2013; General Directorate of Water Management, 2016; Kadıoğlu et al., 2017). It is stated that there is a decrease in precipitation and a significant increase in temperature and thus a decreasing trend in flows in some river basins. For example, it is predicted that 50% of surface waters in the Gediz and Büyük Menderes Basins may disappear within this century, thus extreme water scarcity will occur for water users in agriculture, at home and in industry (Ministry of Environment and Urbanization, 2012; General Directorate of Water Management, 2016; Kadıoğlu et al., 2017). In this case, the amounts of water per capita will be even less than the above-mentioned figures in the future. Based on a pessimistic scenario (A2), model projections show that there will be reductions of 16% and 27% in 2050 and 2075, respectively, in the water potential of Turkey. When we consider these figures instead of constantly available water throughout the present century, it is inevitable that the amount of water per capita in 2050 and 2075 will be even less than the figures mentioned above (Şen, 2013).

Across Turkey, decreases in total precipitation are predicted to be felt more especially after the year 2041. While precipitation decreases significantly in the southern parts of Turkey, especially in the Eastern Mediterranean, Seyhan and Ceyhan basins, a slight increase is expected in precipitation (up to 150 mm) in the North and especially in the Eastern Black Sea, West Black Sea and Yeşilırmak Basins. Decreasing precipitation trends between the years 2015 and 2100 in the Konya, Akarçay, Burdur, Kızılırmak and Sakarya Basins, which are partially away from the coastline, are similar in all models. Thus, new problems will be added to Turkey's current water resources problem, and there will be great troubles in irrigation, drinking and utility water (Kadıoğlu et al., 2017). This change in the order of the water cycle in this way will lead to significant changes in the quality and supply of water resources and will affect many climate-dependent sectors, including food production in which water is of vital importance. The impacts such as the increase in summer temperatures, decrease in winter precipitation (especially in western provinces), the loss of surface water, frequent droughts, soil degradation, and erosion and floods on the coasts that are caused by climate change in Turkey directly threaten the existence of water resources (Ministry of Environment and Urbanization-a, 2012).

6.3.2 Agriculture and Food Security

6.3.2.1 Crop Production

Turkey's climate and landforms enable the growth of many different types of cereals, fruits, and vegetables. Agricultural lands constitute 23.7 million hectares of Turkey's 77.9 million hectares of land assets. As of 2016, 31.4% of the cultivated agricultural lands can be irrigated while dry farming is performed in the remaining 68.6% of them. For this reason, agricultural production directly depends on precipitation (TOBB, 2013; Turkish Statistical Institute-b, 2018).

21.5% of Turkey's population lives in rural areas[35]. As of 2016, the ratio of the population working in agriculture is 19.5%. Agriculture constitutes 6.2% of GDP and 19.4% of employment. The share of agricultural products in exports is 3.8%, and agricultural and food products exports constitute 10.8% of the total export when the exports of food products based on agriculture are added to this figure. The share of crop products in agricultural and food products is 82% (CSBB, 2018; Turkish Statistical Institute-c, 2018; Turkish Exporters Assembly, 2018). Although the share of agriculture in GDP in Turkey decreased by years, its added value has regularly increased over the years. According to the data of the World Bank, Turkey, the 18th biggest economy in the world, is ranked ninth in agricultural production in the world (Turkish Exporters Assembly, 2017). Therefore, the agricultural sector still holds an important place among other sectors.

It is thought that climate change may affect the food production in the Mediterranean region, where there is also Turkey, in many ways in the future. Direct effects may appear in the form of an increase in the amount of carbon dioxide in the atmosphere and the rise of sea level. However, food production in many areas will be much more affected by climate change due to the factors such as desertification, increase in fire risk, the rapid spread of diseases and pests, and the changes to be experienced in the world market. On the other hand, the possible effects of climate change on food production are not exactly known because comprehensive integrated studies that will thoroughly reveal the effects of

35) The main reason for big differences in the populations of "provincial and district centers" and "towns and villages" as a result of the decrease in the ratio of rural population, which was 22.7 in 2012, to 8.7 in 2013, and the fact that this ratio was given as 7.5 in 2017 is the changes in administrative division according to Law No. 6360. Most of the administrative settlements that are administratively affiliated to the metropolitan municipality at the present time and administratively have the "neighborhood" status are functionally rural settlements. For this reason, the rural population ratio of the country was calculated as 22.7.

climate change at different levels have not been addressed. The great majority of the studies conducted focused on a limited number of food products and took into account the conditions in which up to 2 times more carbon dioxide will be present in the atmosphere with today's tillage methods compared to these days. Nevertheless, available pieces of evidence reveal that climate change will adversely affect food production in the entire region and will increase food prices, and that food security will be under threat in the whole region (Ministry of Environment and Urbanization, 2016).

Despite the importance of the agricultural sector, the sustainability of rainfed agricultural lands in Turkey is not high. The impacts of climate change have begun to be observed in Turkey, and this situation is expected to become more evident in the upcoming period. The gradual increase in temperature and change in the precipitation cycle negatively affect the agriculture in the country. Indeed, increasing mean air temperatures may lead to large losses in agricultural production systems by drying the soil causing increases in annual evapotranspiration, and leading to dry winter months, increased sudden/short extreme precipitation and hail events in the spring and increases in pests and diseases, and agricultural production potentials may change. In Turkey, it is assumed that there will be shortening in the plant growth periods due to climate change across the country, that there will be a shift to an earlier time in phenological periods and accordingly decreases in yield, and that the amount of production will decrease due to decreases in the yield. It is predicted that there will be changes in production patterns and cultivation areas by regions, wheat and sunflower exports will decrease, maize and cotton imports will increase, there will be significant increases in yield losses as a result of increases in severe weather events such as drought, flood, and hail in terms of their severity and incidence, the area where they are effective, and duration, and the product costs will increase within the country (Kadıoğlu et al., 2017; Koç et al., 2016; Silkin, 2014; Türkeş, 2014).

Based on climate change projections, changes that may occur in the production values of wheat, barley, corn, sunflower and cotton that are widely cultivated in Turkey and the economic reflections of these changes were investigated (Dellal et al., 2011). In the study, according to projections for the year 2050, it was predicted that there would be a 7.6% decrease in wheat and barley yields, a 10.1% decrease in corn yield, a 3.8% decrease in cotton yield, and a 6.5% decrease in sunflower yield across the country. With respect to the cultivation area, it was reported that there would be reduction in wheat and sunflower cultivation areas and enlargement in barley and corn cultivation areas, and that there would be an 8.2% decrease in wheat, a 2.2% decrease in barley, a 9.1% decrease in corn, a 4.5% decrease in cotton, and a 12.9% decrease in sunflower in terms of national production values. It was predicted that there would be increases in product prices between 0.1% and 12.6% in parallel with a decrease in the production and that this increase would decrease consumer and total welfare while increasing producer welfare.

In Turkey, agriculture has great importance in terms of food security both within the country and on a global scale, in addition to its importance in the economy. However, it is projected that climate change will lead to negatively significant changes in the income obtained by the country in terms of agriculture, and in employment (Kadıoğlu et al., 2017; Şen, 2013, Koç et al., 2016; Soylu and Sade, 2012; Ustaoğlu and Karaca, 2014). The increase in unemployment due to this negativity in the agricultural sector may negatively affect the country's economy and will threaten the food security. Especially when the fact that the country's population, which is 81 million Nowadays, will reach 104 million in 2050 and 107 million in 2075 is taken into account, the risk that may arise with respect to food security becomes more important.

6.3.2.2 Livestock Production

In Turkey, livestock production is mainly performed in the form of pasture-based extensive livestock production. For this reason, livestock production is performed based on natural conditions. Supply and demand balance in meat and other animal products based on bovine and ovine breeding have been disrupted due to the inadequacy of livestock production in recent years.

In Turkey, the demand for animal products has increased depending on the increase in population and welfare; however, the supply has fallen behind this demand. Therefore, the import of livestock and dead meat has significantly increased especially in recent years to meet this demand (Somuncu et al., 2012). This situation is reflected as an additional burden on the economy of Turkey, which has previously been one of the self-sufficient countries in terms of agricultural production. Indeed, when the data in the period since 1991 in Turkey are examined, it can be observed that livestock production has experienced periodic decreases and increases. While Turkey's bovine animal existence was 12.34 million in 1991, it decreased to 9.92 million in 2002 and decreased by 19.5%. However, the number of bovine animals, which regularly increased along with the increased support for livestock production since that year, increased to 15.9 million in 2017.

In Turkey, the number of ovine animals, which was 51.2 million in 1991, decreased to 31.9 million with a steady decrease until 2002. The sheep and goat existence, which followed a horizontal course between 2002 and 2007, decreased to 26.9 million animals in 2009 with the effects of drought experienced in 2007 and 2008. However, the number of sheep and goats, which started to increase after 2009, increased to 44.2 million in 2017 (Ministry of Food, Agriculture and Livestock, 2015; Turkish Statistical Institute-c, 2018). However, while Turkey's population was 44 million in 1980 and the total number of bovine animals and sheep and goats was 84 million in that year, the population increased to 80 million and the total number of bovine animals and sheep and goats was determined to be 60 million in 2017. This is a concrete example of how supply and demand balance has been disrupted.

The livestock sector has undertaken significant economic functions such as providing raw materials to different production branches, providing increases of value to the development of employment, logistics sector and retailing, the realization of rural development, and basing development financing on equity capital, in addition to its contribution to the nutrition of the population (Ministry of Food, Agriculture and Livestock, 2015). For example, there is still a structure in which small family-owned businesses in the rural area are predominant in livestock raising activities and dairy farming, which has been performed on a larger scale in recent years. Accordingly, although it is not possible to reach a definite conclusion about employment in the sector, it is considered that the livestock sector provides employment to 1.5 million people (Aşarkaya, 2015). On the other hand, it is thought that 80 thousand people are employed in livestock raising businesses where medium and large-scale productions are performed.

In livestock production of such great importance, there are two main reasons for the fluctuations that occur in production. The first one of these is the decrease in animal production depending on rural-urban migration. The second issue is the increase in production costs, especially in recent years, due to the problems caused by climate change, and its reflection on the livestock sector.

Climate change has direct and indirect effects on livestock production. Drought, floods, landslides, yield losses and physiological stress are some of the direct effects. Indirect effects are feed quality and quantity, the availability of drinking water, the increase in epidemic diseases, and the increase in input prices (Koç et al., 2016). Observations show that there is an increase in temperature while model projections show that there will be increases in the frequency, duration, and extent of drought. Significant problems will arise for livestock production when temperature persists above 40°C for a long time (Koyuncu, 2017). The ruminants grazing in natural areas such as meadow-pasture may be directly and further affected by the increasing air temperature, rather than the animals such as sheep and goats. The decrease in yields in natural grazing areas especially due to drought may negatively affect the lives of animals due to nutrition and may lead to a decrease in the production of forage plants that need water, such as corn and alfalfa, and an increase in feed prices. Therefore, it is thought that heat-resistant species and breeds will gain more importance in breeding in the future (Kadıoğlu et al., 2017).

Livestock production is also closely associated with plant production. For example, in Isparta province, which is located in the Mediterranean transition climate, in 2008, the height of cereals remained short due to little precipitation, and the amount of straw obtained also decreased significantly due to the fact that combine harvesters could not harvest at very low levels. In that year, agricultural enterprises engaged in livestock raising in and around Isparta had serious problems, and the necessity to bring straw from other provinces in Turkey arose. While there was a decrease in the total number of livestock during the period until 2010, a regular increase began to take place between 2011 and 2013. Naturally, feed requirements also increase in parallel with the increase in the number of livestock. For this reason, the negative effects of climate change on agricultural productivity may also affect the livestock sector negatively (Ministry of Environment and Urbanization, 2016).

6.3.2.3 Fisheries and Aquaculture

Turkey is a country surrounded on three sides by the sea. For this reason, fisheries is an important area of economic activity in terms of the nutrition of the population and being one of the basic sources of income for coastal regions. Fisheries in coastal regions make a significant contribution to food security and is an important source of protein, in addition to the fact that it has a traditional structure, is performed with low capital and is usually the occupation of the population with low income and education levels (Ministry of Development, 2014).

The production of fisheries in 2017 was 630.820 tons in Turkey. This amount consists of 322.173 tons of marine capture production, 276.502 tons of aquaculture production and 32.145 tons of inland capture production (Turkish Statistical Institute-d, 2018). The fisheries sector provides employment opportunities for about 250 thousand

people. When aquaculture is examined by years, a rapid increase in aquaculture is remarkable although fluctuations are observed in production from sea capture fisheries. Nevertheless, the capture production obtained from the seas and inland water resources does not increase despite the high fishing effort, and consequently, it is accepted that the fisheries figures obtained are Now at the upper limit (Ministry of Development, 2014). Climate change is expected to increase this negativity further. Climate change will lead to changes in marine ecosystems and also economic and social adversities. Since aquatic animals are very sensitive to changes in the aquatic environment, it will become inevitable that climate change causes damage in the fisheries and aquaculture sectors (Kadıoğlu et al., 2017; Turkish Marine Research Foundation, 2017; Mol and Doğruyol, 2012; Kayhan et al., 2015).

Tropicalization Now takes place in the Mediterranean, which affects the whole of the basin (Kayhan et al., 2015). The warming of seawater also, negatively affects aquaculture. In recent years, there has been an increase in the number of alien species emerging in Turkey's seas (Mol and Doğruyol, 2012). It has been stated that 63 Lessepsian species are transferred from the Red Sea to Turkish waters. 11 of them have economic value. For this reason, in recent years, marine fisheries in the Mediterranean have been partially improved in an economic sense. This situation, which seems to be positive from an economic point of view, will actually result in the fact that Lessepsian species get into competition with local species by sharing natural ecological niches and that they will restrict the living and breeding areas of the local species (Kayhan et al., 2015).

One of the main reasons why all these species enter the eastern Mediterranean and get into competition with the local species for the area by forming a colony is the increase in the water temperature in the Mediterranean. Already Now, many fish and Caulerpa taxifolia, which is a tropical species and known as killer algae, are successfully growing in the basin and are gaining space because the surface water temperature has increased by 0.2°C over the past decade in the Western Mediterranean. This increase poses a threat to deep-sea fish that are accustomed to living at a constant temperature of 13°C (Turkish Marine Research Foundation, 2017).

In a study carried out, it has been reported that the water temperature of the İskenderun Gulf has increased in recent years and therefore both natural fishing and aquaculture of the species with economic value, such as Sea Bream and Sea Bass, have become difficult (Başusta and Erdem, 2000). While alien species caught in the İskenderun Gulf constitute 20% of total catch, this ratio is expected to increase in the near future. In other words, the entry of new fish species into the Mediterranean has led to changes in fishing over time. Firstly, fishing species have changed, and many alien species of the Indian Ocean origin have begun to be fished because of their commercial value (Turkish Marine Research Foundation, 2017).

Due to the warming of the Black Sea, there have been occasional difficulties in catching anchovies, which have a significant economic value, in recent years. While this leads to difficulties for fishermen, the price of the product sometimes increases by two to three times compared to previous years, and the product reaches the consumer expensively. It is considered that it may not be possible to see the anchovy in Turkey's waters in a close future (Mol and Doğruyol, 2012).

It has been recently determined that more Mediterranean origin species have entered the Black Sea depending on the climate change. This phenomenon, which is still being observed, is considered as the Mediterraneanizing of the Black Sea, and this process is considered to be a development that may negatively affect the ecosystem (Turkish Marine Research Foundation, 2017).

In a study carried out in Turkey, it has been reported that Gorgon populations, a soft coral species, have decreased significantly due to the increasing temperature in the Mediterranean and the Aegean Sea (Kayhan et al., 2015). In these species susceptible to cold water, gorgon's death is observed when surface waters go below the thermocline layer (Turkish Marine Research Foundation, 2017).

It is considered that it is not sufficient to reduce the impacts and possible impacts of climate change on our seas only to the change in biodiversity. It is stated that a different wind and current system will emerge in our seas along with the atmospheric rhythm disrupted, transportation will be hindered in some of our ports, the navigation of our fishing fleets and all kinds of marine vehicles will become difficult, fish farms will be exposed to severe waves, access to the islands will be disrupted, and the marine environment will become riskier than the terrestrial area. Since 27 of our provinces are at the seaside, it is reported that coastal structures and fishing activities in these provinces will be seriously damaged (Turkish Marine Research Foundation, 2017).

6.3.3 Extreme Weather Events and Disasters

A growing number of studies in recent years indicate that climate change has increased the power of destructive meteorological events. Projections also show that climate change will further strengthen such events (Şen et al., 2018). In this regard, the relationship between extreme weather events, climate change, and disasters has been understood better in recent years because climate change causes extreme weather events, and extreme weather events also cause disasters in places where socio-economic conditions are unfavorable. Therefore, studies on adaptation to climate change can contribute to reducing disaster risks, and studies on reducing disaster risks also can contribute to adaptation to climate change (Kadıoğlu, 2012).

According to IPCC AR4, more frequent, severe and long-lasting droughts, heat waves and forest fires are projected to be observed in Southern Europe, including Turkey in the 21st century. Furthermore, it is projected that there will also be significant increases in flash floods along with the increase in the number of days with short-term but heavy showers. The expected increase in the frequency and severity of these weather events are expected to have negative impacts on agriculture and water resources and to cause loss of life and property.(Kadıoğlu, 2012).

Changes that are similar to global changes are also observed in the climate of Turkey, which is located in the Mediterranean Basin. In particular, decreases in winter precipitation, increases in temperatures, and drought, floods and overflows that we have recently been exposed to can be considered to be among them. The results of the regional climate model studies performed for Turkey show that these changes will also continue in the future. According to a study cited from the report published by the World Bank, it is stated Turkey will be the 3rd country that will be mostly exposed to extreme climate events in the Europe and Central Asia region towards the end of the 21st century (Kadıoğlu, 2012).

Although there has been essentially no change in the number of the formation of geological or geophysical disasters in recent years, there have been significant increases in the numbers of the formation of meteorological, climatic and hydrological disasters along with the impacts of global climate change. Due to global climate change, continuous and very significant increases have been observed in the number of disasters with meteorological character among large-scale natural disasters, which have been called "catastrophe" in recent years, since 1980 (Turkish State Meteorological Service, 2017).

In our country, a total of 731 meteorological disasters, a total of 654 meteorological disasters and a total of 698 meteorological disasters were reported in 2015, 2016 and 2017, respectively. When the long-year distribution of disasters covering the period of 1971-2017 is examined, the number of disasters is observed to be quite high (Figure 6.14). This has also been affected by the changing climatic conditions as it is all over the world. When the long-year distribution of disasters (1971-2017 period) is examined, it can also be observed concretely that there has been a significant increase in the number of disasters since 2000. The year 2015 is the period during which the highest value has been reached since 1971 with 731 meteorological disasters. (Figure 6.14; Turkish State Meteorological Service, 2016; 2017; Turkish State Meteorological Service-b, 2018; Turkish State Meteorological Service-c, 2018).

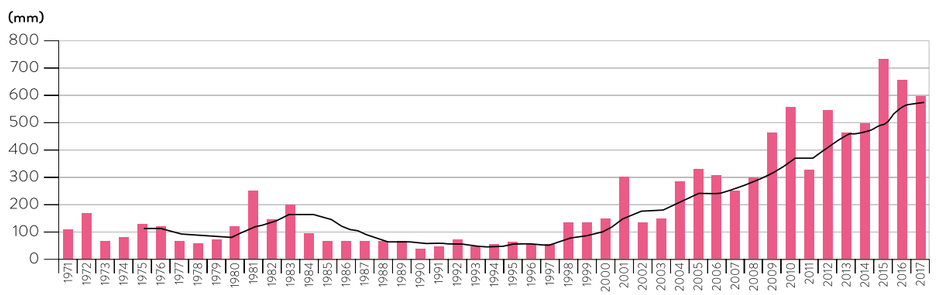

Figure 6. 14 Total numbers of annual extreme meteorological events in Turkey.
Reference: Turkish State Meteorological Service-b, 2018; Turkish State Meteorological Service-c, 2018.

The spatial distribution map of natural-induced disaster events between the years 2010 and 2017 has been created by the Disaster and Emergency Management Presidency (AFAD) (Figure 6.15; Disaster and Emergency Management Presidency, 2018).

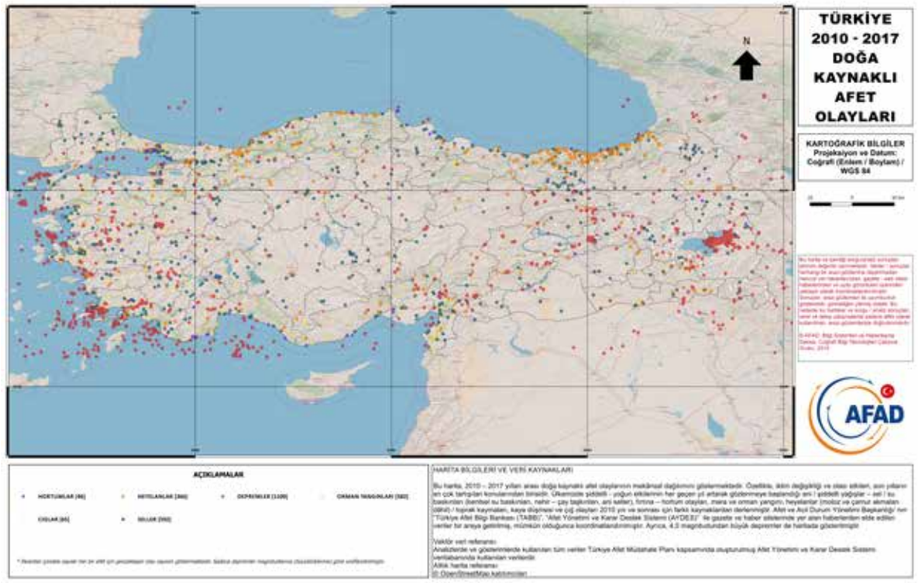

Figure 6. 15 Distribution of natural disaster events between the years 2010 and 2017 in Turkey
Reference: Disaster and Emergency Management Presidency (AFAD), 2018.

On the map, the numbers of tornado, avalanche, landslide, flood and earthquakes and losses of lives in these events are shown as the natural-induced events at the disaster level during the specified period. In Turkey which is tectonically active and has high seismicity, the highest number of disasters between the years 2010 and 2017 belongs to earthquakes, and the total number of earthquakes with a magnitude of 4.0-7.10 has been determined to be 1109. The earthquakes are followed by 592 floods, 582 forest fires, 366 landslides, 65 avalanches and 46 tornados as the events at the disaster level (Disaster and Emergency Management Presidency, 2018). When losses of life and property caused by these disasters, as well as their numbers, are taken into account, it is clear that the future risks in this regard are great and that it is necessary to be prepared against these risks.

According to the proportional distribution of extreme events with meteorological character that caused damage in 2017, storm and tornado were 36%, heavy precipitation and flood were 31%, hail was 16%, heavy snow was 7%, lightning was approximately 4%, avalanche and frost were approximately 1.5%, and the others were less than 1% (Figure 6.16). When the spatial distribution of extreme events with meteorological character is examined, Istanbul, Balıkesir, Antalya, and Kahramanmaraş stand out as the provinces where maximum numbers of extreme events with meteorological character were observed in 2017 (Turkish State Meteorological Service-b, 2018).

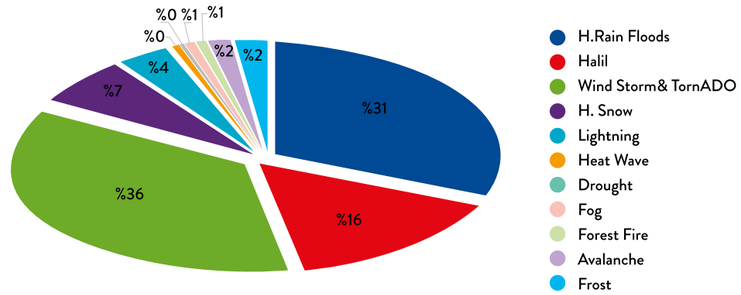

Figure 6. 16 Proportional distribution of weather-induced extreme events in 2017
Source: Turkish State Meteorological Service-b, 2018.

In 2017, Turkey's mean temperature was 14.2°C, which was 0.7°C higher than 13.5°C, the average of 1981-2010. The year 2017 was the warmest ninth year since 1961 with an average temperature of 14.2°C. There are positive temperature deviations that have persisted since 1998 (except for 2011) in Turkey's mean temperatures. The warmest year was 2010 with a deviation of 2.0°C (Turkish State Meteorological Service-b, 2018).

In 2017, the minimum temperature was observed by -35.9°C in February in Göle-Ardahan while the maximum temperature was observed by 46.9°C in August in Cizre. Maximum temperatures were highly observed in the large part of the Southeastern Anatolia region, Antalya, Aydın, and Manisa. On the other hand, Kars, Ardahan, and Ağrı stand out as the provinces with the lowest minimum temperatures. In 2017, maximum temperatures at 14 stations exceeded the average maximum values for long years. The great majority of these stations are located on the coasts of the Marmara, Aegean and Mediterranean regions (Turkish State Meteorological Service-b, 2018).

According to the analyses of the results of the statistical methods applied to long-term observation series, average air temperatures of Turkey tend to increase in a manner similar to the global average surface air temperature. However, the temperature increase, which has been globally ongoing since the 1980s, has been observed more clearly since the mid-1990s in Turkey. Significant increasing trends are observed in average air temperatures in the Mediterranean and Southeastern regions of Turkey (Ministry of Environment and Urbanization, 2012). In particular, the increasing trend in summer average air temperatures is statistically significant at most of the stations (Kadıoğlu, 2012).

The highest number of heat waves (1027) occurred in 2010, which was the warmest year in Turkey. The highest number of cold waves occurred in 1992, which was the coldest year in Turkey, following the explosion of the Pinatubo volcano. The lowest heat wave in recent years with a number of 100 accompanied the negative temperature deviation in 2011 (Turkish State Meteorological Service-b, 2018).

In 2017, daily precipitation exceeding 100 mm took place in the coastal regions of the Eastern Black Sea region and Marmara region, and in Ordu, Kocaeli, Istanbul, Muğla, Antalya, Mersin, Samsun, and Osmaniye. This value is close to 200 mm in some centers especially in the Eastern Black Sea, Antalya, Muğla, Osmaniye, and Kırklareli (Turkish State Meteorological Service-b, 2018). The floods resulting from excessive precipitation cause major problems in agricultural lands and lead to losses of life and property especially in metropolitan cities such as Istanbul, Ankara, and Izmir, in other cities and rural areas (Somuncu, 2018). For example, the hail event that affected Istanbul on July 27, 2017 caused a loss of about 250 million dollars (Şen et al., 2018).

Turkey is among the risk group countries in terms of the potential impacts of global climate change. Natural disasters that are predicted to increase due to climate change in Turkey are listed as extreme weather events, forest fires, storms, floods, hail, heat waves, landslides, and avalanches. In Turkey, economic losses caused by floods due to climate change have become equal to economic losses caused by earthquakes. It has been determined by the data that losses of lives caused by thunderbolts that are observed only with storms have increased significantly in recent years and reached 400. Accordingly, it was determined that the number of meteorological disasters that took place in the 2000s increased 3 times compared to the 1960s, increased 15 times in terms of insurance losses, and 9 times in terms of economic losses (Kadıoğlu, 2012).

It is difficult to predict the exact extent, severity, and tempo of the future impacts of climate change; however, it is clear that the climate change will affect social security along with the events that will occur at the disaster level. In particular, it is projected that the increase in frequency and severity of extreme weather events such as storms, floods, and drought may threaten the human life and health, physical assets and vital social functions.

6.3.4 Ecosystems and Biodiversity

Turkey has three biogeographical regions that are called Europe-Siberia, Mediterranean and Iran-Turan, and their transition zones. The facts that the country is located between the continents, and that elevation, landforms and climate characteristics change at short distances enable it to have a very rich characteristic in terms of living species, genetic characteristics and the diversity of ecosystems. Turkey has different forms and combinations of these ecosystems with its forest, mountain, steppe, wetland, coastal and marine ecosystems (Ministry of Environment and Forestry, 2008).

Climate changes would cause changes in the structures and functions of ecosystems, because the most important factors that determine an ecosystem type are the temperature and the precipitation regime. In the last terms, the effects of climate change on species and ecosystems has started to be felt more gradually. It is thought that especially the species with restricted habitats and sensitive ecosystems will be affected more by the climate change.

In this chapter, in which the effects of climate change on ecosystems and findings of the national studies about the subject are given, ecosystems are considered under three subtopics as inland water, terrestrial, and marine ecosystems.

6.3.4.1 Inland Water Ecosystems

Turkey has inland water resources with its rivers and lakes on approximately a 10,000 km2 area, which are very important for keeping biological diversity alive. The inland water potential of Turkey consists of 33 rivers, more than 120 natural lakes, 825 dam lakes and ponds. Van Lake, which is the biggest and deepest lake, has an area of 3,712 km2. The second biggest lake, Tuz Lake in Middle Anatolia, is 925 m high from the sea, its area is 1,500 km2, and is a shallow lake. There are primarily four regions in which the lakes reside; these are Lakes Region (Eğirdir, Burdur, Beyşehir, and Acıgöl), South Marmara (Sapanca, İznik, Ulubat, and Bird Lakes), Van Lake and around, and Tuz Lake. There are nine rivers that are longer than 500 km in Turkey; these are Kızılırmak, Fırat, Sakarya, Murat, Aras, Seyhan, Dicle, Yeşilırmak, and Ceyhan.

There are 48 wetlands in Turkey as being of national significance and 14 wetlands which are protected by the Ramsar Convention. Besides, inventory studies are ongoing in order to determine the wetlands with international and regional importance as a requirement of "By-Law on Protection of Wetlands" that was renewed in 2014. Lakes, swamps, deltas, marshes, and mudflats are very important for wildlife, especially for birds. More than half of the bird species in Turkey are migratory birds. Wetlands are a critical habitat type for many species of birds who use them for breeding, feeding, wintering, or as migratory stopover sites. The Meriç, Gediz, Büyük Menderes, and Küçük Menderes Deltas formed by rivers that discharge into the Aegean Sea, and Göksu, Seyhan, and Ceyhan Deltas, formed by rivers that discharge into the Mediterranean Sea, provide suitable habitats for a large number and variety of water birds, especially as lakes in Anatolia freeze in winter. The delta formed by the Kızılırmak which discharges into the Black Sea has great importance especially for migratory birds that pass directly over the Black Sea.

The expected effects of climate change on inland water ecosystems are summarized below;

The expected effects of climate change on inland aquatic ecosystems are the loss of area and volume of water bodies, decreasing of fresh water resources, and decreases in current and flow rate and these effects would cause becoming arid, water shortage and inadequacy, deterioration of biological diversity and habitats, yield decreases in agriculture, and food inadequacy.

Wetlands are one of the most fragile ecosystems against climate change. Terrestrial fresh water wetlands will be affected by the changes in the rains and the more frequent and intensive droughts, storms, floods, and inundations. The changes in timing and amounts of precipitation that feed river systems change the water procuration in the coastal wetlands such as deltas and estuaries.

When the levels of the effects of climate change are regionally investigated, trends such as increase in temperature and evaporation and decrease in precipitation are seen in Mediterranean River Basin and Mediterranean Climate areas, in which Turkey resides (Türkeş et al, 2000).

The increase in the concentrations of the nutritional salts as the result of the decrease in the lake waters with the warmer temperature causes harmful algae blooms and especially toxin-producing cyanobacteria blooms. During dry periods, rapid increase in the population of algae (especially cyanobacteria populations) and eutrophication in the lakes of Turkey are completely parallel to the expectations for lakes in dry climate regions together with global warming. Because the concentration of nitrogen and phosphor that comes from the rivers that feed inland waters will increase because of the increased drought, the same situation will be faced also in the lakes. Algal blooms will also deteriorate the ecological balance in the lakes and will cause the decrease of water plants, fishes, and birds.

Narrowing will be observed in the lake surface areas in wetlands in Inner Aegean and Middle Anatolia to a large extent and in Marmara and East Anatolia to a smaller extent. Even though narrowing is expected in the surface areas because of the evaporation that originates from temperature increase, there may not be very much change in the situations of deltas and lagoons in the sea fronts because of the sea level that is expected to increase. However, because of the increasing salinity and changing flora elements, there will be a certain change and loss in the fauna and bird species that feed on these.

When the studies investigating the relationships between the climate changes in Turkey, level changes of lakes, and changes of water resources are taken into consideration, in the study by Cengiz and Kahya (2006), in which the trend and harmonic analyses of some lakes in Turkey are done, it is stated that there will be an increase in the lakes in the North part of In Turkey, a decrease in the lakes in Middle Anatolia and Mediterranean Regions, and No trend in the lakes in Marmara Region.

In a study on the relationship between the level change in Acıgöl, which resides in the south west part of Turkey, and climate change, it is highlighted that there is a strong significance between drought and lake level. Besides, a continuous decrease in the lake level and a loss of area by 2/3, which are related to the increase in temperature and the decrease in raining, are found in this area in the term between 1975 and 2010 (Özdemir and Bahadır, 2009).

In the study, in which the statistical analysis of level and volume changes of Kovada Lake that is in Isparta in Mediterranean Region and the change in the climate elements are investigated, increase in temperature and evaporation and decrease in precipitation amount are found in Kovada Lake river basin in long yearly term (1975-2010). This change in the climate elements has reflected to lake level and volume as loss and decrease has occurred in the level and volume of the lake in the same term. In the study area, a 0.7 °C increase in temperature, 120 mm increase in evaporation, and 20 mm decrease in precipitation amount have occurred. When the relationship between climate elements and the changes in the level and volume of the lake are investigated, a negative relationship with medium significance is found between temperature and level (-0.502) and volume (-0.473) change. A positive relationship with strong significance is found between the precipitation and lake level (0.758) and volume (0.751) changes and a negative relationship is found between evaporation and lake level (-0.476) and volume (-0.426). According to the analyses done, it is found that the level and volume changes of Kovada Lake are related to the changes in precipitation rather than the changes in temperature and evaporation (Bahadır, 2012) (MoEU, 2016).

In the study, in which the effects of climate change on water resources are investigated, literature data about the decreases in water levels in Tuz Lake, İznik, Eğirdir, Manyas, Van, Ladik, and Sapanca lakes are collected. In this evaluation, it is reported that there was a 35% decrease in the surface area of Tuz Lake between 1987 and 2005, an approximately 23% decrease in the water potential of Beyşehir Lake, an approximately 10 m decrease in some coastal areas of İznik Lake, a 56 cm decrease in the level of Eğirdir lake, and an approximately 0.4 m decrease in the depth of Manyas Lake. Besides, it is reported that the 2 meters level decrease in Van Lake has resulted in an increase in the salinity and soda level of the lake water (Yüksel et al., 2011).

In another study, in which climate data and satellite photographs are tested, it is reported that the water and salt reserves have decreased between 1987 and 2005 related to drought and uncontrolled water usage (Ekercin and Örmeci, 2010).

In the study, in which the minimum, maximum, and average changes in the water levels are investigated with Non-parametric Mann-Kendall and Sen's T methods, statistically significant and increasing trends were determined in all of the maximum, minimum, and average yearly water levels according to both of the methods and decreasing trends were determined in the water levels of Beyşehir, Eğirdir, and İznik lakes according to both of the methods. Statistically significant trends are not found in the yearly maximum and average water levels in Tuz Lake, because the results of Mann-Kendall and Sen's T test are lower than the critical value of 1.96.

In the study, in which the effects of climate change on water resources in the last 45 years term is investigated by taking hydrology, temperature, and precipitation data in Büyük Menderes River Basin in the west of Turkey essentially,

important decreases are recorded in the current values that have strong relationships with the changes in temperature and precipitation on the main arms of Menderes river, especially between 1985 and 1998 (Durdu, 2010).

Especially in the river basins that are fed by snowing, the early melting of the snow affects the currents of the rivers. The increase in temperature causes the change of hydrological regimes and the climate conditions of the region by causing the early melting of snow. In the study, in which the early melting of the snow is analyzed with center-time method for 15 river monitoring stations that are picked from Fırat, Dicle, Aras, and Çoruh river basins between 1970 and 2010 (Güventürk, 2013) meteorology stations that represent current stations according to river basin characters are also picked to be used in the analyses. Trend analyses are applied to temperature, precipitation and current data in order to relate the change in the center times with temperature and raining and the number of days, in which the temperature is lower than 0 ºC, freezing point, and the number of rainy days in these days are analyzed until the center time day. In the study, it is determined that the changes about the regional temperature, precipitation cause important early snow melting and distinctive early melting is determined in eight of the fifteen stations in Fırat, Dicle, and Aras river basins in the region.

6.3.4.2 Terrestrial Ecosystems

The terrestrial ecosystems in Turkey consist mainly of agricultural ecosystems, steppe, forest, and mountain ecosystems.

6.3.4.2.1 Agricultural Ecosystems

Agricultural ecosystems (cultivated areas), make approximately 35% of the total surface area of Turkey and most of them reside in steppe regions. 70% of the total agricultural area consists of grains, 5% of it consists of fruit gardens, 2.7% of it consists of vegetable gardens, 2% of it consists of vineyards, and 2% of it consists of olive groves (Ministry of Environment and Forestry, 2008).

Turkey's main ecological zones in terms of agriculture are the Mediterranean Coastal region, Aegean Coastal region, Black Sea Coastal region, Thrace and Marmara regions, Central Anatolia region, Southeastern Anatolia region, Eastern Anatolia region, and transition zones. This zoning system based on climate elements such as precipitation and temperature include the agricultural product diversity and the regional and phenological characteristics of agriculture. Coastal regions can generally be defined as the agricultural production regions located in the Mediterranean climate zone. The Central, Eastern and Southeastern Anatolia regions are the regions dominated by harsh continental climate, and agricultural product characteristics also have the effects of these ecological regions. Transition zones are the agricultural zones that cover several provinces in transitions from the middle of Central Anatolia to the other regions and that are more or less different from each other in terms of climate factors and general agricultural characteristics (Ministry of Environment and Forestry, 2008).

The data of the projections for changes in air temperature and precipitation to be caused by climate change for all basins in the country and for the next three periods until 2100 in Turkey have been presented in the project report carried out by the GDWM. In the study, with the data of the future obtained from global climate change models, frosty days, plant growth season and soil moisture balance analyses were performed for 30 agricultural basins (General Directorate of Water Management, 2016; Kadıoğlu et al., 2017). The results show that the amount of water will be limited in a large part of Turkey during spring and summer months and that the balance between precipitation and evapotranspiration will change. Nevertheless, the greatest impact on ecosystem hydrology is the length of plant growth season and increasing growth day rate. Therefore, changes may occur in vegetation. The increasing evapotranspiration rate, along with the expected snow and precipitation deficiencies, will increase stress in water resources and therefore in agricultural and forestry sectors. Thus, with the rapid increase in heat waves and the decrease in precipitation, vulnerability possibilities of agricultural, tourism and industry sectors competing for water and drinking and utility water sectors are expected to be at very high levels as of the year 2015, the beginning of the climate projections period (Kadıoğlu et al., 2017).

One of the important issues that affect agricultural ecosystems and are expected to affect them in the future is drought and desertification. When climate factors and vegetation are taken into account, arid lands that are prone to desertification in Turkey involve a significant part of the terrestrial inner and eastern regions and the Southeastern Anatolia region. A large part of the Mediterranean and Aegean regions are accepted as the sub-humid areas that may be further affected by desertification processes in the future due to improper land use. The fact that the changing trends towards dry conditions observed in precipitation and drought index series, as well as the long-term and severe summer droughts and high air temperatures, increase the desertification force of climate factors in the Mediterranean and Aegean regions supports this idea (Türkeş, 2012).

In brief, while winter precipitation and spring precipitation decrease in the Aegean, Central Anatolia and Mediterranean regions, both air temperatures during summer months and evapotranspiration increase. However, due to a rapid increase in summer plants like sunflower and corn and the planting of alfalfa in Central Anatolia, the amount of irrigation water needed may increase significantly compared to today. Even if irrigation is performed, decreases are expected especially in the yields of summer plants since plants will be exposed to higher and extreme temperatures during flowering and grain filling periods (Kadıoğlu et al., 2017).

6.3.4.2.2 Steppe Ecosystems

Steppe Ecosystems, steppes and meadowlands that are described as areas covered with gramineous plants cover a 21 million-hectare area in Turkey. In Middle Anatolia, Aegean, and Mediterranean ecosystems, generally one or more year gramineous plants are common. Floristic composition of steppe vegetation is very rich and there are many endemic plants in it. In the high parts of East Black Sea Mountains and in the North and North east parts of East Anatolia, subalpine and alpine meadows cover large areas.

While the steppe ecosystem in Middle Anatolia is a narrow line near the forest boundaries in the North and south, the steppe areas that cover large areas today will easily turn into a desert ecosystem in a large area surrounding Tuz Lake. Because Middle and South East Anatolia are dry areas predisposed to desertification with their sparse vegetation, desertification would easily occur in these regions. However, because there will be an improvement in the direction of sub-humid climate conditions in the North parts of Middle Anatolia, it may be expected that the present forest boundary will go down to south to a small extent.

6.3.4.2.3 Forest Ecosystems

Forest Ecosystems, according to 2015 data, forest ecosystems cover 22.3 million hectares field in Turkey. In Aegean and Mediterranean regions, there are meadows and maqui's, humid and semi-humid coniferous and dry forests (oak, larch, and Turkish pine) together with coniferous and broadleaf forests (General Directorate of Forestry, 2015).

The expected effects of climate change on forest ecosystems are summarized below with the findings obtained from the results of the studies about the subject.

- A 1ºC increase in the global average temperature will affect the species composition and the functions of forests importantly. New forest types may form with the formation of new species compositions. Besides, effects such as disease and fire will increase related to the increase in temperature. North forests will be affected by the increased temperatures more than the tropical forests.
- Especially the habitats of the species that spread in coastal areas and low altitudes and ecosystems will slide to higher altitudes.
- Forest fires are the most important factors threatening the ecosystem. When the records of the 12-year period between 2005 and 2016 are examined, a total of 99600 hectares of forest land were burned as a result of 28006 forest fires that occurred. 33% of the areas burned in the fires breaking out during this period were burned only in 2008. As a result of 2135, forest fires that broke out in 2008, 29749 hectares of forested land were damaged. In 2016, 3188 fires occurred, and a total of 9156 hectares of forest land were burned (Turkish State Meteorological Service, 2017). There are various reasons for forest fires. The meteorological factors that reduce relative humidity and increase the temperature in forest fires increase the fire potential and danger. These factors lead to a fire outbreak sometimes alone or sometimes together, and they also control the course of the fire. This usually leads to forest fires during summer; however, they may also lead to forest fires outside of the fire season under appropriate atmospheric conditions, and sometimes in winter.
- Increases are expected in the frequency, duration, and intensity of forest fires with the increase in the temperature and the decrease in the precipitation. Besides, the area of the forests that are very sensitive to fires, which consist of 60% of the forests of Turkey today, will widen.
- The change of life cycles of insects and pathogens and deterioration of forest trees and ambient conditions as a result of increasing temperature and drought will cause the increase of the numbers of secondary pests. The increase in the damage done by insects to the Fir and Spruce forests in Turkey can be considered in this scope. Besides, the biotic pests that Normally do not exist in Turkey can enter In Turkey through the neighbor countries.

It is predicted that the deaths observed in Boxwood forests in East Black Sea in the last couple of years have occurred with the effect of the fungus species named Cylindrocladium buxicola and Volutella buxi (Tolunay et. al, 2014).

- Plant and animal species may migrate to areas with appropriate ecological conditions in order to adapt to the changing climate conditions. The vegetation zones observed in mountain areas in Turkey and forest boundaries may slide to higher altitudes. However, because there is generally No soil in the zone above forests and there are lots of rock areas, it can take very long times for the forest boundary to spread towards alpine zone. There may be problems because of habitat fragmentation and ecological barriers, especially in the migration of animal species.
- With the increase in temperature, the vegetation periods will start earlier and will take longer by also covering autumn season. Some species will not be able to adapt to the changing conditions.
- The increase in the storms in the last years in Turkey are causing the falling down of the trees in the forests or getting damaged by being broken. In 16-17 October 2011, when the trees haven't shed their leaves yet, the snow and then the storm caused a lot of trees to fall down. The process of getting the fallen trees out of the forest is still going on and the estimated damage is 200 thousand m^3. According to the records of General Directorate of Forestry, approximately a 9.7 million m^3 tree property on a field above 1 million ha has been damaged by snow, wind, landslide, overflow, and drought between 2009 and 2013 (General Directorate of Forestry, 2014).
- One of the negative effects of climate change in Turkey is the decrease of precipitation. This situation may especially cause the trees to shed their leaves early in order to adapt to summer drought. According to the defoliation ratio observations that are done in the scope of Forest Ecosystems Monitoring Program, the highest defoliation ration is observed in 2008, in which the decrease of precipitation is on the peak.
- In Turkey, alluvial forests generally reside in the areas in which the rivers fall off to the seas and their estimated total area is 11 thousand ha (Çiçek, 2004). The water that the rivers, whose flow rate increase because of the melting snow and raining in spring months, carry is very important for alluvial forests. At the same time, the increasing water amount of the rivers in the spring months also opens the river openings, which were closed with sand piles in the dry seasons. However, the amount of water that the rivers carry has decreased because of the decrease in snowing in Iğneada, in which important alluvial forests of Turkey reside. This situation affects the ecology of alluvial forests negatively. Besides it is also predicted that the decrease in the flow rate of the rivers and the increase in the sea levels will cause salting-related damage to the alluvial forests and riparian vegetation.

6.3.4.2.4 Mountain Ecosystems

Turkey is usually a high and mountainous country with an average altitude of 1132 meters. The mountain chains that are the extension of the Alpine-Himalayan mountain system run parallel to the coastline in the south and North of the country. In the inner parts, there are many high volcanic mountains, the highest of which is Mount Ağrı (5137 m).

The types of mountain ecosystems in Turkey change according to biogeographical regions, formation way, and altitude. These rich terrestrial ecosystems that Turkey has provides habitat for lots of endemic plant species, important bird species and a lot of wildlife species. Again, in these ecosystems, wild relatives of a lot of cultivars that are important in terms of agricultural biodiversity are present.

The most obvious effects of climate change in mountain areas are related to the retreat of glaciers, the mass loss in glaciers, the reduction of permanent snow cover, and the melting of permafrost in periglacial areas. In Turkey, there are still glaciers in some high mountains. Mount Ararat at a level of 5137 meters is one of them. There is a large ice cap on the top of Mount Ararat. In a study carried out, the glacier of Mount Ararat was evaluated using the remote sensing method between 1976 and 2011 (Sarıkaya, 2012). Findings indicate that the glacier lost 29% of its surface area by -0.07 km/year in a year during the specified period. The long-term atmospheric warming trend observed at nearby meteorological stations is compatible with the shrinking trend in the glacier.

In another study, small glaciers in Turkey were reported by examining their situation in the period from the 1970s to 2012-2013 (Yavaşlı et al., 2015). In the study in which 72 Landsat, 5 ASTER and 41 commercial satellite images were used, it was determined that the area of glaciers in Turkey decreased from 25 km^2 to 10.85 km^2 in 41 years. Five glaciers disappeared until 2012-2013, and it was determined that five of them had a surface of 0.5 km^2, one of them had a surface of 0.8 km^2, and only two of them had a surface of 3.0 km^2. The retreat of glaciers in the period from the 1970s to 2012-2013 in Turkey has been attributed to the increase in summer minimum temperatures without any change in precipitation during this period (Yavaşlı et al., 2015).

These data indicate that the effects of climate change observed in mountain systems are likely to increase their size in the upcoming years. The decrease in precipitation and temperature increase will lead to significant changes in the mountainous hydrological regime. In conclusion, the hydrogeological risk and the availability of water resources will be seriously affected. Furthermore, since stable areas where there are neve and glaciers will be more exposed to collapses and landslides, an increase is expected in the risks in these regions.

6.3.4.3 Marine Ecosystems

The coastline of Turkey which is surrounded by the Mediterranean, Aegean, Marmara and Black Sea is 8,592 km in length (excluding islands) of these shores are under protection. These long sea and shore areas show different properties and have very rich biological diversity values in them. About 5000 plant and animal species were found in the territorial waters of Turkey until today.

Coastal ecosystems are very special in that they are important sudden transition regions (ecotones) in which marine and terrestrial ecosystems intersect. 4.1% of terrestrial resources that make the surface area of the country consist of coastal ecosystems. The difference between the alignment patterns of the mountains to the sea and the shore topographies in the shores of Turkey gave rise to various shore ecosystems such as dunes, caves, deltas, lagoons, calcareous terraces that differ according to different regions. Mediterranean Sea, which has the highest salinity and temperature rate among the seas of Turkey, is the region in which the biological diversity is the richest. There are 400 species of fish in the waters of Turkey in Mediterranean Sea, 300 species of fish in Aegean Sea, 200 species of fish in Marmara Sea, and 151 species of fish in Black Sea. The coastal areas in the East Mediterranean region are rich ecosystems with a very high flora and fauna diversity with 3000 species (Ministry of Environment and Forestry, 2008).

While the protected areas system of Turkey has a lot of sea and coastal protection areas, these areas have terrestrial and marine connections in many places. 1,444,293 Hectare marine area including Special Environment Protection (OCK) national parks, nature protection areas, wetlands etc. in order to maintain the sustainability of their sea and coastal biodiversity. The effects of climate change on marine ecosystems show themselves especially as the increase in seawater temperature and seawater level, changes in the salinity, density and currents, destruction of biological diversity, alien species invasion, and loss of natural resources and the changes observed in the seas of Turkey are given below.

6.3.4.3.1 Temperature Increase

Mediterranean Sea has a 0.82% ratio among the ocean surfaces of the world and has 4-18% of the world's sea biodiversity. Besides its being a closed sea, it is defined as "miniature ocean" by physical oceanography. Climate modellings show that Mediterranean basin will be one of the regions that will be affected by the global warming trend with the increase of extreme events. A lot of studies done about the risks that the Mediterranean biological diversity is face to face with the temperature increase in the sea water verify this evaluation (Bethoux et al., 1990; 1999; Vargaz-Yanes et al., 2008; Turkish Marine Research Foundation, 2017).

6.3.4.3.2 Increase in the Number of Alien Species

All of the aquatic organism show distribution according to their salinity and temperature tolerances. Natural barriers in the seas, such as temperature, salinity and big lands prevent the species from being dispersed and cause them to remain in specific regions. This situation forms the natural biogeographical regions in the seas of the world. The changing of ocean currents, climate conditions, and a lot of other environmental conditions cause the changing of natural dispersion events. And this causes the development of the species, the change of the bio geographies and biological diversity, and as a result, the change of global ecosystem. The direct effect of temperature increase is observed as increase in the abundance of the species that can tolerate the temperature increase and decrease in that of stenothermal species. This change is found by the differences in the distribution ratios of the species since the first years of 1980s.

In the last years, the increase in the water temperature because of the tropical current from Strait of Gibraltar to Mediterranean Sea and climate change have caused the water of Mediterranean Sea to become tropical. The increase in the number of alien species that enter from the Suez Canal has also an important role in this change. Mediterranean Sea has become the sea, in which the most biological diversity change has occurred with the increase in the number

of alien species that enter from Suez Canal, in the last years and has become a region, in which the effects of climate change on the biological diversity can be ideally observed. Whereas the number of species that enter, settle, and disperse from Suez Canal to Mediterranean Sea was very little until mid-20th century because of the temperature and salinity barriers between the Red Sea and Mediterranean Sea (Zenetos et al., 2008), there was a very remarkable increase in this number later. This increase is directly related to the temperature increase in the water of Mediterranean Sea. Today, the number of species that has come from Suez Canal and settled in Mediterranean Sea is above 600. Some of the alien species cause changes on biological diversity with No return by competing with the indigenous species, collapse of the fishing industry, deterioration of the stocks of culture fishing, increase of the production costs, and the human health to be affected.

Çınar et al. (2011) have prepared an alien species inventory for Turkey coasts by considering alien species vectors and their origin seas by carrying out a detailed study by investigating scientific articles and reports, in which the alien species records of Turkey coasts between 1865 and 2011 are given. 400 foreign species record is given for the coasts of Turkey and 330 of these species are on Mediterranean, 165 of them are on Aegean, 69 of them are on Marmara, and 20 of them are on Black Sea. 74% of the 300 species, for which record is given in Mediterranean Sea, are Lessepsian species that have been carried by Suez Canal (Çınar et al., 2011).

In Figure 6.17, the increase in the alien species transportation number on Turkey-Mediterranean coasts with 10-year periods is seen. In the last 20 years, more than two times this increase has occurred. In the report that was prepared about alien species in Turkey in 2015 by the Ministry of Forestry and Water Affairs, the number of alien species in East Mediterranean Sea is considered 450 (Uysal and Boz, 2015).

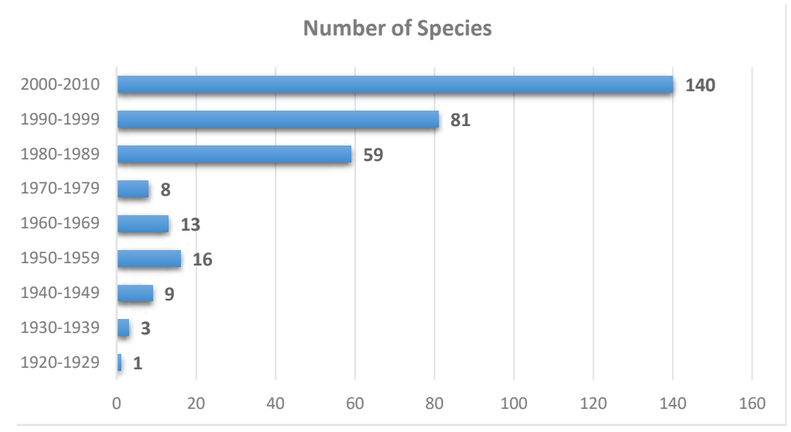

Figure 6. 17 Alien Species Transportation Number on Turkey-Mediterranean Shores with 10-year periods.
Source: Ministry of Environment and Urbanization, 2016.

6.3.4.3.3 Effects on Biological Diversity

Posidonia oceanica (Linnaeus) Delile is an endemic species of Mediterranean Sea and it can form beds down to depths of 40 m in clean and light waters. Posidonia is a species, which is under the protection of Barcelona Convention and the beds that it forms are considered among the habitats with priority in 92/43/EEC Habitat Directive. Posidonia, which is a marine flowering plant and is endemic to Mediterranean Sea, can live in shores down to 30 meters depth (it can even form barriers like reeves) and it has an effect of preventing coastal erosion to a large extent with the help of its subterrestrial body (rhizome). Posidonia meadows are an important component of biological diversity as habitats in which a lot of sea creatures ovulate and raise their offspring. This sea plant also plays a basic role in the fixation and storage of carbon (blue carbon) and has a very high primary production. It is an important species, which is used in the evaluation of water quality.

In the terms, in which the environmental conditions are not suitable, one species can change places with another. The basic pressures on Mediterranean seagrass meadows originate from the development on the shores, excessive consumption of live resources, solid and liquid wastes, cruise boats, and tourism. However, especially the invasion of exotic foreign species, the increase in the temperature of surface water, and the increase in the sea level, which are among the new pressures that are directly or indirectly related to climate change, cause important collapses of sea grass habitats (Jordà et al., 2012).

The entering and settlement of macrophytes with exotic invader property to Mediterranean Sea and the competition of these species with the endemic sea bed species cause a very important effect. Especially the alien species from Red Sea that enter Mediterranean Sea through Suez Canal find very suitable conditions, in which they can continue their lives, because of the tropicalization of the water of Mediterranean Sea. Caulaerpa taxifolia, C. racemosa var. cylindraca species, which are invasive species in Mediterranean Sea, are causing negative effects on C. Nodosa, P. oceanica, and Zostera Noltei, which are endemic species that started to deteriorate because of various effects. C. racemosa has started to take the place of posidonia meadows, which have been damaged in the shores of Turkey in the last years (Pergent et al., 2014).

Water temperature is a highly determining factor in the distribution of sea meadows. Because of the increasing temperature of Mediterranean Sea, there are differences in the distribution of these meadows and these changes are ongoing. The absence of P. oceanica in the south east basin of Mediterranean Sea is closely related to the increasing surface water temperature in the summer term. In the south east shores, there is a sudden decrease in P. oceanica meadows (Çelebi et al., 2006). The anomalies recorded in temperature values in the summer terms of 1999, 2003, and 2006 have caused important decreases in the liveliness of sea meadows.

Because phytoplanktonic organisms are the basic providers of organic materials both in seas and fresh waters, they are the primary producers of aquatic ecosystem. For this reason, they both make the food of aquatic animals and provide protein, carbohydrate, fat, vitamins, and mineral salts to the zooplanktons, which are primary consumers. There are close relationships between the productivity of the aquatic medium and the planktonic organisms. It is known that there are relationships present between all of the feeding steps and these relationships are directly or indirectly affected by the properties of the medium, in the food chain that starts from phytoplankton and continues to fish. Naturally, the changing of organisms in the food chain by amount or variety affects the living creature groups in the upper steps of the food chain. The strongest and fastest changes that occur in the structure of the aquatic ecosystem are seen in phytoplankton.

In Integrated Pollution Monitoring in Seas Project – Marmara Sea Pollution Monitoring Study, which is supported by Ministry of Environment and Urbanization, it is determined that the phytoplankton data obtained monthly between 2007 and 2010 in Marmara Sea shows differences between years. Increases are observed in terms of the diversity and the fecundity of the species. While the phytoplankton of diatom group are observed in February 2008, they are observed the most in September 2009 and April and September 2010. And while the phytoplankton of dyno flagella group were dominating in spring, summer, and autumn months in 2008, it is determined that their domination slides to winter months in 2009. It is obvious that these observations in different times are related to the climate changes in the environmental conditions (Tüfekçi et al., 2010).

6.3.4.3.4 Increase of Water Level

In a study done by Kuleli et al. (2009), it is reported that the increase in the sea level is not very important on the coasts of Turkey, just like it is in a lot of regions of the world, and the coasts have regionally high sensitivity related to topography and collapses. In another study done by Kuleli et al. (2010), it is reported that Mediterranean shores of Turkey is the area, which will lose the most land in the case of an increase in sea level. When these findings are considered in terms of the natural resources and richness of Mediterranean Sea, it is predicted that especially the wildlife that uses the shore and the plants will be affected by this change importantly. There will be losses in the nesting areas of the turtle species, Caretta caretta and Chelonia mydas, whose number on Mediterranean shores is 21 and which are under protection. By the same way, coastal living areas of Mediterranean Seal, which is under protection as “critically threatened”, will vanish.

Another important effect of the increase in the sea level is the loss of resource and biological diversity that will occur in the increasing salinity in the coastal areas.

6.3.5 Coastal Areas

The total length of the shores of Turkey is 8592 km (excluding islands). The population density approximately doubles in the cities on the coastal line in Turkey. Besides this, the pressure on coastal cities is even more because of intensive migration. It is predicted that climate change will affect coastal areas, which show more sensitive properties and structure compared to the inner parts, very much. Coastal erosion, flood, and inundation are of the important problems on our sea fronts in Middle and East Black Sea, North Aegean and East Mediterranean regions, especially when the near past is considered. Touristic and coastal cities are especially under threat.

Water need is usually met from underground reserves in coastal areas. Excessive use of underground water causes salty water entrance and increase in water resources used for purposes such as agriculture. Aquifers in and around Istanbul can be shown as examples to this (Öztaş, et al., 1995).

The effects of climate change will be very much on the coastal areas. Coastal and shore areas, on which the pressure of urbanization is the most intensive, are more sensitive to the effects of climate change compared to the other areas. With a possible increase in the sea level, wetlands close to the shore may face the threat of disappearing by mixing with sea water. It is put forward that especially the settlement areas at sea level and up to 10 m above sea level are under threat, 2% of the world consists of these areas, approximately 10% of the population (approximately 600 million) of the world lives in these areas, and 13% of the urban population (approximately 360 million) lives in these areas (Tacoli, 2011; Çobanyılmaz and Yüksel, 2013).

Since sea level changes are the main indicators of global climate change due to global warming, sea level data have gained importance in geodetic, oceanographic and meteorological studies for the investigation of the causes and the impact of climate change. In addition, tide gauge sea level data are used as a dataset that is complementary to seismic and geophysical measurements for the tsunami early warning systems.

Tide gauges in Turkey are established and operated by General Command of Mapping in order to determine mean sea level for vertical datum and meet the sea level data needs of scientific and engineering purposes. Sea level observations had been carried out by float-operated gauges until 1998, and since then they have been upgraded and changed with acoustic ones that have sounding tubes and Radar sensors. At present, Turkish National Sea Level Monitoring Network (TUDES) consists of one data center and 20 tide gauge stations.

On March 2016, TUDES Web Portal (tudes.hgk.msb.gov.tr/tudesportal) was created to provide sea level data to the users effectively. With the use of the portal, accessing sea level data at the local datum has been freely opened to users. Users can also reach the sea level data at the national vertical datum after paying a standard annual subscription fee.

Sea level data is also provided to Boğaziçi University Kandilli Observatory and Earthquake Research Institute in the "Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North Eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS) Initiative".

In order to determine the general risk situation of coastal regions against sea level increase and disasters, CVI (Coastal Vulnerability Index) analysis is applied to all of the coastal regions. In the evaluation, affectability indexes are estimated with a simple model by using coastal population density, vegetation percentage, topography, and human development situation indications. In the end of this study, Adana, Çanakkale, Samsun, Balıkesir, and Aydın, which have delta areas, were determined as the riskiest regions. There are studies about land losses that can be expected in Turkey according to the sea level increase scenarios. The results of the study show that the places to be affected the most by climate change on the coasts of Turkey are coastal deltas, in which agricultural production is the highest, wetlands, and tourism regions with low altitudes (Demirkesen et al, 2008; Alpar, 2009; Kuleli et al., 2009; Kuleli, 2010a; 2010b; 2010c; Simav et al., 2013).

According to the studies of Kuleli (2010a; 2010b; 2010c), the regions are listed as the Mediterranean, Aegean, Marmara and Black Sea regions from maximum to minimum in terms of risk. In terms of provinces, the first four provinces are listed as Izmir, Antalya, Muğla, and Istanbul. Furthermore, it has been concluded that an altitude of 0-10 m on the coasts of the whole of Turkey is directly associated with 28 provinces, 191 districts, 181 settlements (town-village), 25 million population and approximately 7320 km2 area. To determine the national and regional policies related to wetlands, low flooding zones and our country's short, medium and long-term sea level rise in terms of various sector investments built almost at sea level, and to integrate these policies into the planning process of the coasts are thought to be important in terms of minimizing the risks that may arise.

6.3.6 Health

The effects of climate change on human health may be direct or indirect. Whereas extraordinary climate events such as flood, extremely hot waves, and storm affect human health directly, the long-term effects of climate change have indirect effects on human health by causing water, food, and shelter problems. Climate change can cause changes in the distribution of vectors that carry contagious diseases by disrupting ecosystems and population density, and in this way, an increase in the frequency of the diseases that are transmitted by vectors (Estrada-Peña et al., 2010).

6.3.6.1 The Effect of Extreme Climate Events

The negative effect of hot waves on human health are well known. Especially children, elderly people and people with underlying chronic heart and lung diseases are affected very much (Lowe, et al., 2011). When extremely high temperatures are in question, especially the admission of people in this risk group to the hospitals and deaths increase. There is not enough data about this issue in Turkey. A study done by Oktay et al. (2009) in Antalya shows that the frequency of people with congestive heart failure admitted to the emergency services is higher in hot months.

An expected effect of climate change is the floods that occur as a result of sudden raining and especially take place in cities. According to the data of international disaster database (EM-DAT), 1350 people died because of the floods occurred between 1970 and 2014 in Turkey and about 2 million people were affected by these floods (EM-DAT, 2015, Ministry of Environment and Urbanization, 2016).

6.3.6.2 Diseases that are Transmitted by Vectors and Rodents

Climate changes can cause increase in the population of the vectors and rodents that carry microorganisms causing diseases in people. As a result of this, serious increases occur in the frequency of the infections that these microorganisms cause in people. Among these infections, tularemia, malaria, and Crimean-Congo hemorrhagic fever are diseases candidate to generate public health problem in Turkey.

Tularemia: Tularemia is a disease that is transmitted to people by water and food that is contaminated with the urine and other excretions of rodents and present with high fever and lymphadenopathy. There is a remarkable increase in tularemia cases in Turkey over the recent years. According to the results of a large scaled study about this subject, 866 (60%) of the 1441 patients, who were diagnosed in the 75-year time period between 1936 and 2011, were diagnosed in the last ten years (Gürcan, 2014). Most of the tularemia cases in the last 10 years were found in south east of Marmara Region and North parts of Middle Anatolia Region, in which a temperature increase trend is observed. It is possible to claim that the increase in the tularemia cases are because of the increase in the temperature, when the fact that the average temperature curve of Turkey shows a regular increase since 1995 is considered.

Malaria: Malaria is the first one of the diseases that are known to be related to climate change (Lowe et al., 2011). However, climate change is not the only factor determining the malaria case numbers and health services are also deterministic besides this. As a result of this, Malaria case numbers have decreased distinctively in the last 10 years in Turkey.

Crimean-Congo Hemorrhagic Fever: Crimean-Congo hemorrhagic fever is a disease, which is especially seen in Asia, Africa, Middle East, and East Europe, and it was seen for the first time in Kelkit valley in 2002 in Turkey.

According to the official records, 8742 people were diseased and 409 people died because of Crimean-Congo hemorrhagic fever between 2008 and 2017 in Turkey. Corum, Kastamonu, Tokat, Yozgat, Karabuk, Samsun, and Sivas are the cities in which the disease is the most common and more than 80% of the cases in Turkey are being reported from Middle and North Anatolia regions. Among the reasons for the disease to be this much common, the increase in the number of ticks that carry the disease virus because of the climate change, turning forests into agricultural areas, and the increase in the number of rodents that play the role of blood resource for the ticks, again because of climate change (Estrada-Peña et al., 2010).

6.3.7 Settlement Areas and Tourism

6.3.7.1 Settlement Areas

The settlements are directly affected by climate change and indirectly affected by the events that occur related to the change (temperature increase, increase in the sea level, change of raining regimes and wind velocities, hot waves, heat island effect, and disasters like tsunami, flood, overflow, erosion and landslide, and drought). This response has effects especially towards urban life quality and sustainable development. The central role and importance of the settlements in climate change have come into subjects with international priority starting from IPCC Third Evaluation Report. Controlling the direct and indirect urban emissions has a high potential of decreasing total greenhouse gas emissions (Ministry of Environment and Urbanization-b, 2016; McKinsey and Company, 2009).

When the urbanization experience of Turkey is investigated as related to climate, the unbalanced distribution of the increasing population to the settlements is one of the first urbanization problems about climate change. Because the urban population absorbs the general population increase and a part of the rural population, it is expected that the rural population will decrease in the world in general starting from the next ten years (Ministry of Development-b, 2013).

The present spatial development types and consuming habits in Turkey and the increasing urban population continue to be a source of greenhouse gas release. Because its adaptation capacity is not high, Turkey, which is one of the developing countries, is more vulnerable in terms of its being prone to damage against the effects of climate change (İDKK, 2009; Çobanyılmaz, 2013). The demographical and spatial development fashions and the general structure towards urban habits that determine this condition is given in the reports (Ministry of Development-c, 2013) that the Ministry of Development has prepared.

The urbanization ration, which was about 24% in the country in general during the first years of the republic, it has reached 53% in 1985 and 78,5% in 2017 and it is expected that the urbanization ratio will swiftly increase in the west of the country in the next term. According to the projections urban population is expected to continue to increase in Turkey. For this reason, the number of large settlements and their ratio in the total population are swiftly increasing (Ministry of Development-a, 2013).

When it is investigated in terms of urban density, an important portion of the population prefers to live in the settlements in the west regions, especially parallel to the development differences between the regions. While the population density increases in the west and coastal parts of the country, it decreases in eastern parts.

Turkey has significant gaps in local level actions on climate change. The absence of local strategy and action plan for metropolitan cities is one of those gaps. Although legal regulations were made on related issues, the enforcement of those regulations is problematic and does not work efficiently sometimes. Although in some cities local climate plans and strategies have already developed, the acknowledge of local studies on climate change adaptation and mitigation is still limited. In other words, the recognition of climate change impacts has already started but the practice, enforcement and related studies are not enough.

In the study carried out by Aygün (2015), Istanbul was selected as an example metropole city of the urban climate change studies. Istanbul is selected being the biggest metropolitan city and being lack of comprehensive climate change resilient study. For more comprehensive approach, the sectors that are important for city development, viability in the future and supplying the main services are selected referring to Istanbul's development plan. In that direction, 11 sectors and 26 planning areas are analyzed using the methodology of vulnerability assessment and risk assessment that are defined in the literature.

According to the results of the study show that the most prior sectors are public safety (urban risk areas), health (heat), water resources (water supply), ecology and biodiversity (biodiversity) and infrastructure (storm water management). The vulnerability and the risk factor of those sectors are highly related to the urban development pattern of Istanbul. Uncontrolled urban development, formal and informal settlements in the river basin, earthquake areas that are not suitable for urban development increase the vulnerability of the sector public safety. The dense settlements creating urban heat island effect and being lack of wind corridors, green areas increase the vulnerability of the settlement to the heat. That situation makes the health sector more prior. The increasing population, the sprawl of the city in the peripheral areas, the pressure on the natural resources cause an increase in the vulnerability of water resources and ecology and put those resources at risk of extinction. The infrastructure of the city is not sufficient for the population especially in dense and old settlements area. In any adverse weather event, the infrastructure cannot work efficiently because of not balancing the density and capacity of the system in those areas (Aygün, 2015).

In the study by Çobanyılmaz and Yüksel (2013) was determined of the vulnerability of Ankara metropole city to Climate Change. In this study with the aim of determining the damage of the city of Ankara from climate change, the damage of the city by its social, economic, environmental, institutional and spatial structure has been examined and it has been reached that the city can "suffer damage at a high degree". It has been determined that the systems in the city are unprepared against possible risks and threats of natural disasters that may arise due to possible climatic changes in the city.

6.3.7.2 Tourism

There is a reciprocal interaction between tourism and environment. Tourism sector is different from a lot of sectors in that it both affects the natural environment and it gets affected by the natural environment which it uses as a resource. Greenhouse gases that are released during tourism activities are causing climate change and climate change is affecting tourism activities. Tourism is responsible for 5% of the human- sourced CO_2 emissions in the whole world. In the case that the sector does not change its structure in a way that it will decrease the greenhouse gas emissions, this amount will double in the next 25 years (OECD, 2013). According to the report of World Bank about climate change, which was published in 2012, a 4°C increase in the air temperature will cause a 13.5 billion US Dollar yearly GNP loss in tourism and agriculture sectors in the whole world in 2080. In the same report, it is stated that the sea level will increase by 0.5-1 meter and this would affect coastal tourism negatively (World Bank, 2012).

Tourism is a sector, which is highly sensitive to climate. Climate conditions play a role in the determination of a lot of facts such as the suitability of the locations for the touristic activities, tourism season, and costs. Temperature increase, increase in the sea level, and extreme weather events will directly affect mass tourism. Drought and desertification, forest fires, water shortage, biodiversity losses, coastal erosion, diseases observed because of extreme weather events, and observation of contagious diseases originating from vectors affecting tourism activities are the indirect effects of climate change on tourism (Simpson et al., 2008). In Climate Change and Tourism Policy in OECD Countries report, which was published by World Tourism Organization and United Nations Environment Program in 2008, there are hot summers, water stress, biodiversity losses in terrestrial and naval ecosystems, and contagious diseases among the events that may be observed in Mediterranean river basin because of the effects of climate change (WTO-UNEP, 2008). There are striking predictions for Mediterranean basin in the results charter of the Climate Change and Tourism Conference that World Tourism Organization has organized in Tunisia in 2003. According to this charter, it is stated that the temperature will increase by 0.3 to 0.7°C every decade, heat index (Temperature-Relative Humidity Index) will increase, and the number of days above 40°C will increase (WTO, 2003).

Turkey is a country that will be most affected by the direct effects of climate change and is under risk since tourism is mainly dependent on nature-based tourism. Tourism types, such as winter tourism, especially coastal tourism, are affected by climate change, and this effect is expected to increase further in the future. Therefore, it is essential to determine the risks of tourism caused by climate change in Turkey and to develop precautions for it (Somuncu, 2016).

Tourism activities, which are more generally with sea-sand- sun axis in Turkey, concentrate on Mediterranean and Aegean coasts. In these regions, Antalya being the first, Muğla, Aydın, and İzmir are important tourism centers. When the average temperatures of 1990-2011 years of Antalya, which is the city that receives the highest number of foreign visitors in Turkey, are investigated, the increasing trend is obviously seen (Figure 6.18).

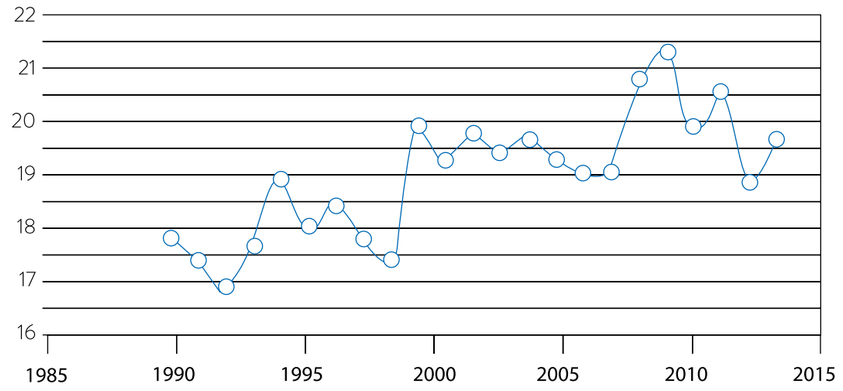

Figure 6. 18 Antalya Yearly Average Temperatures (oC) (1900-2012)
(Source: Ministry of Environment and Urbanization, 2014)

Yearly average temperature value is determined as 17.90C for 1990-1999 term and yearly average temperature value is determined as 19.40C for 2000-2009 term. The average of the second 10-year term is 1.50C higher than the average of the first 10-year term and this value is considerably higher compared to the predictions that World Tourism Organization has made in 2003.

According to Viner and Agnew (1999), there will be big increases in the number of days in which extreme temperatures above 400C are measured in 21th century on Mediterranean shores of Turkey and these regions will not be able to meet the need of resting and relaxing, which are the characteristic properties of mass tourism because of the extreme temperatures. Heat index values of Antalya are estimated by using the meteorological data of 2011. Heat index calculator of American National Oceanography and Atmosphere Department is utilized for the heat index calculations (NOAA, 2015) and heat index values estimated by using average and maximum temperatures are shown in Table 6.5. Heat index scale and information about the results that can emerge according to the felt temperatures are in Table 6.6. (Ahrens, 2000; MMO, 2015).

Table 6. 5 Antalya Heat Index Values according to the average and maximum temperatures (2011)

Months	Average Temperature (°C)	Maximum Temperature (°C)	Average Relative Humidity (%)	Heat Index (°C) (According to the Average Temperature)	Heat Index (°C) (According to the Maximum Temperature)
May	19.9	30.6	65.7	20	35
June	25.1	38.5	57.1	25	55
July	28.6	42.2	60.1	30	72
August	29.6	41.5	50.0	30	60
September	26.7	37.6	50.3	27	48

Source: Ministry of Environment and Urbanization, 2012

Table 6. 6 Heat and Humidity Index Scale

Felt Temperature (°C)	Category	Effects
27-32	Attention	Weakness, irritability, and a lot of disturbances in cardiovascular and respiratory systems can occur because of the thermal stress related to physical activity and the duration of being affected in these conditions.
32-41	Extreme Attention	Heat stroke, heat cramps, and heat exhaustions are possible together with strong thermal stress related to physical activity and the duration of being affected in these conditions.
41-54	Danger	Sun stroke, heat cramps, or heat exhaustion. Heat stroke together with intensive thermal stress related to physical activity and the duration of being affected in these conditions.
54	Extreme Danger	Heat or sun stroke, sudden thermal shock may occur.

Source: Ahrens, C. D. (2000)

For 2011, heat index values estimated according to the average temperatures are in the "Attention" category, which is shown with yellow color in July, August, and September. Even in average temperatures, it is possible that the negative health conditions will obstruct touristic activities because of the weather conditions. Heat index values estimated by using the maximum temperature values are in the level of "Extreme Danger", which is the last category and shown with red color, in June, July, and August. The maximum temperatures felt in September are in the level of "Danger", which is shown with dark orange and the maximum temperatures felt in May are in the level of "Extreme Attention", which is shown with light orange. In the light of these data, it is possible to say that even the heat index values in 2011 are in the level that would constitute threat for tourism. If we think about the fact that the summer temperatures on Mediterranean shores will be above 40°C in the future because of climate change, the felt temperature will be 55°C (Extreme Danger level) in the case that the humidity ratio will be at least 50% (Ministry of Environment and Urbanization_a,2016).

Various mathematical methods were developed in order to be able to measure the effects of climatic factors on tourism. One of them is tourism climate index. Tourism climate index, which is estimated by using maximum and average daily temperature, minimum and average relative humidity, amount of rain, insolation time, and wind velocity, is used in order to determine the comfort level of people and developed by Mieczkowski in 1985 in order to determine the suitability of the tourism location for the outdoor activities. This index, which can be used in order to measure the feasibility of the mass tourism based on sea, sun, and sand trio, cannot be used for winter tourism. As tourism climate index score, 80 indicates ideal climate conditions for tourism and between 60 and 80 indicate good and very good conditions. In a study done by Amelung and Viner (2006), it is indicated that tourism climate index scores of Turkey were "summer peak" (highest in summer months according to the other seasons) in 1970s. According to Emission Scenarios Special Report for 2020s, 2050s, and 2080s, which takes place in the same study, it is seen that the tourism climate index scores of Turkey on Aegean and Mediterranean coasts will show a bimodal distribution starting from 2050s. In another study, in which tourism climate index scores of the term between 1975 and 2006 are estimated for the coastal regions of Turkey (Deniz, 2011), it is seen that the tourism climate index scores on Aegean and Mediterranean coasts show bimodal distribution (higher in spring and autumn, lower in summer). In the study, it is stated that tourism will be negatively affected because of the high temperatures in the Aegean and Mediterranean coasts in the summer months and it will be positively affected in spring and autumn.

Today, tourism season is extending to spring months and the season is partially getting longer with the increase in temperature. However, in 2050s, even though spring months are suitable for tourism activities, it may not be possible to carry out tourism activities on Aegean and Mediterranean Coasts. Especially because tourists go on vacation in summer months, in which the schools are on holiday, the south and west coasts of Turkey are face to face with the danger of not being preferred tourism destinations in summer months. Besides, the tourists that come to Turkey from the Northern countries may not need to go abroad in the case that the regions in which they live become suitable for mass tourism.

In the light of all of this information, it can be predicted that the effect of climate change on the mass tourism of Turkey will be positive at first and then it will cause loss on a serious scale (Sevim and Zeydan, 2007; Ministry of Environment and Urbanization-a, 2016).

During the process from the 1980s to the 2000s, Turkey made significant moves in tourism and experienced a significant quantitative growth especially in mass tourism based on sea-sand-sun and culture products. The growth in these two areas continued with the 2000s; on the other hand, hard efforts were made to diversify tourism and thus spread fairly to seasons and regions. In this context, significant improvements have been provided in the types such as health, cruise, and golf tourism. Nowadays, another type of tourism which is projected to contribute to these efforts is ski tourism or winter tourism (Demiroğlu, 2015; TÜRSAB, 2016).

Winter tourism, which depends on snowing, is also experiencing loss because of the negative effects of climate change, besides the mass tourism with sea-sand-sun axis. Because winter tourism centers are generally on mountains and high altitudes, investment, transportation, and raw material obtaining are under very difficult conditions. However, the real difficulty is that the economic activities of these centers depend completely on the presence of snow. For this reason, the changes that will occur on the climate conditions as a result of climate change are one of the biggest risks in front of winter tourism (Zeydan and Sevim, 2008; Ministry of Environment and Urbanization-a, 2016).

Ehmer and Heymann (2008) used a scoring model to determine the "winners" and the "losers" of climate change in 2030. According to the model, the Northern destinations in Europe such as Denmark, Germany and the United Kindom were at the top of the list. These countries are in the winners' group. On the other hand, the Mediterranean countries consisting of Spain, Portugal, Turkey, Greece, and Malta were at the bottom of the list and constituted the losers (Abegg and Steiger, 2011:271; Ehmer and Heymann, 2008). These data on climate change reveal that the Mediterranean and Aegean coasts, which are the locomotive of tourism in Turkey, have an extremely sensitive and fragile structure in terms of climate change, and that it is necessary to be prepared for its consequences.

The average altitude of Turkey is 1131 m, which reaches 1600 meters in Anatolia, and approximately 60% of the country's land consists of mountainous areas (Vanat, 2017). The fact that topography and climatic conditions are suitable for winter tourism is an advantage in terms of tourism diversification efforts in the country. This advantage has begun to be utilized properly, and ski tourism in Turkey has entered into a rapid change process especially in recent years. The investments in the construction and renovation of ski areas and centers spreading all over the country are increasingly going on, and the introduction and popularity of skiing and snow sports have started to increase gradually in the Turkish society (Demiroğlu, 2015). According to the latest data, the number of ski centers where there are 5 and more mechanical facilities in ski areas is 43. There are 807.000 national skiers in the country. The ratio of foreigners visiting 1.200.000 ski centers annually is 15% (Vanat, 2017). After Uludağ where the first important development on winter tourism was experienced in the country, planning, investment, and infrastructure studies for the development of winter tourism are going on in 45 ski centers, including Mount Erciyes and Mount Palandöken.

As it is explained in detail above, snow sports tourism or winter tourism is a type of tourism that is highly dependent on climate change and also sensitive to climate change. Since Turkey is a country open to the effects of climate change in terms of tourism, the studies in this regard should not be limited only to coastal regions, and it is vital to carry out scientific research on climate change and its effects in mountainous areas and winter tourism centers.

6.4 ADAPTATION MEASURES

6.4.1 Domestic Adaptation Policies and Strategies

Since the publication of the Sixth National Communication in 2016, Turkey has made progress in the studies on adaptation to climate change. This progress has been made at the national level, in local administrations, and in different sectors.

The Strategic Environmental Assessment (SEA) By-Law entered into force with its publication in the Official Gazette dated April 8, 2017, and numbered 30032. While the environmental impacts of point-based projects were assessed by the EIA By-Law that existed before the publication of this regulation, the environmental, economic and social impacts of plans and programmes which are prepared in the field of agriculture, forestry, fishery, energy, industry, transport, waste management, water management, telecommunications, tourism spatial planning and which sets framework for

the projects and activities defined in Annex I and II of the EIA Regulation will be assessed with the SEA Regulation.

The CCAP (Climate Change Action Plan) has been reflected in corporate documents, and this situation gives information about Turkey's approach to the process. In the Strategic Plans for the periods between 2013 and 2017 and between 2018 and 2022 of the Ministry of Environment and Urbanization, climate change mitigation and adaptation activities are among the main strategic objectives (Ministry of Environment and Urbanization, 2017).

The Ministry of Environment and Urbanization supports municipalities and district authorities in their studies and conducts various capacity building and support activities on climate change adaptation. In addition to public institutions, organizations both in private and voluntary sectors make significant contributions to climate change adaptation studies.

Provinces and regions have admitted the need for adaptation either through independent plans or strategies, or as a part of larger climate change plans or strategies, and have made investments to support adaptation initiatives.

6.4.2 Information, Capacity Building and Education

Enhancing Required Joint Efforts on Climate Action Project and Capacity Building in the Field of Climate Change in Turkey Grant Scheme

Several projects concerning climate change adaptation and related issues have been con¬ducted. "Enhancing Required Joint Efforts on Climate Action Project" started in August 2017. The goal of the Project is, by means of increasing public understanding and enhancing stakeholder capacity, to foster the joint efforts in mitigating climate change in Turkey, gradually aligning with the EU climate policy and legislation. To reach this goal, focus is on: increasing national and local technical capacity in the field of climate change, raising the awareness of the target group on the climate change and the immediacy of joint climate action and providing project implementation support to the Grant Beneficiaries of "Capacity Building in the Field of Climate Change in Turkey Grant Scheme" for generating solutions at local level.

The consortium led by Project Group International implements "Enhancing Required Joint Efforts on Climate Action Project" which is co-financed by the European Union and the Republic of Turkey and beneficiary institution is the Ministry of Environment and Urbanization. The Contracting Authority of the project is Central Finance and Contracts Unit and the duration of the project is 30 Months (14 august 2017 – January 2020) with a budget of 1.865.000 Euro.

Within the scope of the project, in order to support the Ministry of Environment and Urbanization in terms of better response to global climate issues and achieving international reliability, technical assistance is provided on capacity building through an extensive training programme. Effective communication with climate-related stakeholders, and awareness raising activities are conducted and local climate change actions are realized through a grant scheme of 37 projects.

Awareness Raising on Climate Change Project

The "Awareness Raising on Climate Change Project," which was conducted by Yıldırım Beyazıt University between the years 2015 and 2017, was completed under the coordination of the Ministry of Environment and Urbanization. The project has two components: education and local administrations.

Within the scope of the education component, it was aimed to provide awareness raising education on climate change for students and teachers in primary and secondary education institutions operating within the Ministry of National Education, to ensure the changes in target attitudes and behaviors on climate change, and to increase the widespread effect of the program applied during education. In this context, education, science camps, seminars and various activities on climate change and adaptation were organized for students, teachers and preservice teachers in 16 provinces.

Within the scope of the capacity building of local administrations component, activities like seminars, education, and meetings were held to build climate change mitigation capacity of municipalities and public institutions and private sector and Non-governmental organizations in 14 provinces (Ministry of Environment and Urbanization-b, 2016).

6.4.3 Implementations and Actions

6.4.3.1 Water Resources

Impact of Climate Change on Water Resources Project

With the Impact of Climate Change on Water Resources Project, it is aimed to identify the impacts of climate change on surface water and groundwater in Turkey on the basis of water basins and to determine the adaptation activities. Despite the increasing water demand due to rapid population growth, the problems caused by the lack of appropriate resource availability, overutilization that occurs in parallel with developing industrial and agricultural activities, declines in groundwater reserves, and pollution require a long-term and basin-based planning with regard to water. Therefore, the Ministry of Agriculture and Forestry (former Ministry of Forestry and Water Affairs), General Directorate of Water Management, Department of Flood and Drought Management has aimed to identify the impacts of climate change on surface water and groundwater on the basis of basins and to determine the adaptation activities. The projection period of the studies carried out for 25 river basins covers the years between 2015 and 2100.

With the Impact of Climate Change on Water Resources Project, the impacts of climate change on surface water and groundwater on the basis of water basins have been identified, and adaptation activities have been determined. The implementation area of the project is 25 river basins covering the whole of Turkey, and the projection period covers the years 2015 and 2100.

Major studies carried out within the Impact of Climate Change on Water Resources Project are as follows:

- In all basins, climate change projections were prepared by running a regional climate model with 3 global climate models and RCP 4.5 and RCP 8.5 release scenarios. Temperature, precipitation, evaporation, and flow projections were formed with the outcomes of the model on all basins scale.
- The surface flow data in the basin were determined by running a hydrologic model with the outcomes of the climate projections. The precipitation values were converted to flow values by the hydrologic modeling approach. Subsequently, the surface water capacity along the determining river system in the basin and in the side tributaries was determined. Furthermore, the amounts of groundwater potential specific to the basins were calculated for the periods (2015-2100) projected by taking into account the results of groundwater potential data and climate change projections.
- The flow values were converted to water level values along the determining river system in the basin and in the side tributaries by running a hydrologic model with the outcomes of the hydrologic model.
- Water potential was calculated within the framework of changes in hydrometeorological data with the impacts of climate change for groundwater and surface water by conducting water potential modeling studies in all basins.
- Studies on the sectoral impact analysis (for drinking water, agriculture, industry, ecosystem main sectors) were carried out in 3 basins in terms of water resources of climate change.
- Recommendations for adaptation activities were developed for the elimination of the negative effects of climate change on water resources, by taking into account all basins.
- A “Climate Water Database” containing all the data produced within the scope of the project was created. Climate change impacts and the entire hydrological projections can be accessed from the Climate-Water Database with a GIS application. (http://iklim.ormansu.gov.tr)

The project was launched in 2013 and completed in 2016.

Increasing Storage Capacity

It is aimed by DSİ to decrease the indefiniteness in the amount of water resources that can be faced in climate change and drought conditions in a balanced fashion by increasing the capacities of the sites with storage areas. Potential water holding capacity is increased, water shortage is prevented, and controlled usage of water is maintained by building dams and ponds for meeting the needs for drinking and tap water and for industrial and irrigation purposes. Since the end of 2017, 1258 storage sites (788 dams, 470 ponds) are built and investments are being made. 727 dams are aimed to be completed by the end of 2023.

Lake-Water Project

In the scope of 1,000 Lakes in 1,000 Days Project (Lake-Water Project), it is aimed to transform to water agriculture in rural areas out of big irrigation projects and to reduce the effect of drought in agricultural irrigation.

1.7 million decares of land were irrigated and protected from floods by storing 611 million m^3 of water within the scope of the 1st Lake-Water Project conducted between the years 2012 and 2014. An annual revenue increase of 1.7 billion TRYs is provided with these ponds which were put into service with a total investment value of 3.3 billion liras. With the project, new job opportunities have been developed, and contributions have been made to the prevention of flood damages and prevention of soil erosion, the protection of groundwater, and the reduction of the negative effects of climate change.

As a result of the success achieved in the Lake-Water Project, the initiation of the second stage of the project was brought to agenda. With the 2nd Lake-Water Project, 1071 ponds will be completed and put into service by the end of 2019. When this project, which has an investment value of 14 billion TLs, is completed, 1.7 billion m^3 of water will be stored and 2.5 million decares of land will get water with these facilities.

Basin Protection Action Plans

According to Water Framework Directive, water management is based on managing water sustainably in the framework of the usage purpose of water in terms of its amount and properties by using integrated water basin management principles. Integrated river basin management suggests forming a management plan that will include all the components including considering all biological, chemical, physical, hydro morphological, and hydrogeological properties of river basins as a whole and including all the river basin or the sub-basins.

The studies on preparing Basin Protection Action Plans were started in 2009 and completed for all basins (25 Basins) in 2013. The controlled and sustainable use of water resources is aimed by means of the Basin Protection Action Plans developed by determining short, medium and long-term goals on the basin basis (General Directorate of Water Management, 2018).

Transforming Basin Protection Action Plans to River Basin Management Plans

The purpose of River Basin Management Plans is to carry out the study on transforming Basin Protection Action Plans into River Basin Management Plans and to develop the national capacity in this process. With River Basin Management Plans, it was aimed to perform the categorization and classification of basin-based water bodies, which were not performed in Basin Protection Action Plans, in accordance with the Water Framework Directive, to determine the hydromorphological pressures with ecological assessments and biological parameters, and to clearly reveal the monitoring method of all these parameters.

The project was launched in 2014 and completed in 2018. With this project, the study on transforming Basin Protection Action Plans in the Konya, Susurluk, Büyük Menderes and Meriç Ergene Basins into River Basin Management Plans in accordance with the European Union Water Framework Directive and other sister directives was conducted, and the national capacity was increased in this process.

With the River Basin Management Plans prepared in four pilot basins, the basin was addressed as a whole, and all factors affecting water management were evaluated. As a result of the evaluations made, a total of 1.700 measures were developed so that water resources in basins would reach environmental objectives. The costs of the relevant measures and the institutions and organizations responsible for the implementation of the measures were determined.

Studies on Protecting Drinking Water Basins

The By-Law on the Protection of Drinking-Utility Water Basins was issued on October 28, 2017. The purpose of this By-Law is to regulate the procedures and principles for the protection and improvement of the quality and quantity of all surface and groundwater resources from which drinking-utility water is supplied or planned to be supplied. The By-Law covers all surface and groundwater resources from which drinking-utility water is supplied or planned to be supplied. The By-Law imposes many obligations on the relevant authorities, especially the adoption of a participatory approach in the preparation of the drinking-utility water basin protection plan for the protection and improvement of the quality and quantity of surface and groundwater resources from which drinking-utility water is supplied or planned to be supplied, and the integration of these plans with the river basin management plan.

Saving Water in Irrigation

When the current structure of irrigation systems developed by DSİ (State Hydraulic WorksState Hydraulic Works) is examined, it is observed that 35% conventional system, 40% canalette system and 25% piped closed system are applied. This ratio is projected to reach 45-50% in all irrigation projects with the new projects to be carried out to ensure efficient irrigation management and a significant amount of water saving, and the rehabilitation of old irrigation systems.

Within the scope of this policy, the areas where the piped irrigation system is used in Turkey were 278 thousand hectares in 2009 and came close to approximately 1 million hectares in 2017. The piped water distribution network is intensely used in new irrigation projects. The irrigation projects in the investment program are reviewed, and the possible open irrigation systems are transformed into closed irrigation networks. Farmers are encouraged to move to these systems, and the necessary facilities are provided.

The aim of the State Hydraulic WorksState Hydraulic Works (DSİ) is to open up all our economically irrigable land which is 85 million decares for irrigation until 2023. The ratio of the piped system, which is 25% today, is aimed to increase to 36% in 2019 and 94% in 2023. The "Effective Use of Water in Agriculture Program" studies are continuing. Detailed information on this program is given under the title of 6.4.3.2.

Drought Management Studies

The projects of preparing drought management plans for basins have been started to reduce the negative effects that will be faced in the case of possible drought risks, to determine the precautions to be taken in water shortage, and to determine the precautions to be taken before, during, and after drought in order to solve drought problems in the shortest time possible. Drought Management Plans are prepared specifically for basins by the General Directorate of Water Management.

The Konya and Akarçay Basin Drought Management Plans were completed in 2015; furthermore, as of 2018, studies are being conducted in 13 basins (Eastern Mediterranean, North Aegean, Küçük Menderes, Western Mediterranean, Antalya, Burdur, Lake Van, Euphrates-Tigris, Seyhan, Ceyhan, Asi, Gediz and Büyük Menderes Basins). It is aimed to prepare drought management plans for all basins until 2023 in Turkey.

The "National Drought Management Strategy Document and Action Plan," which was prepared for the purpose of minimizing the negative effects of drought, was published in the Official Gazette dated August 31, 2017. The studies on preparing the "By-Law on the Preparation, Implementation and Monitoring of Drought Management Plans" have been initiated.

Drinking, Domestic, and Industrial Water Supply

The "Drinking, Domestic, and Industrial Water Supply Action Plan for 81 cities (2008-2012)" was prepared in 2008. Then, the Action Plan was revised in 2010, 2013 and 2015. Furthermore, the Action Plan of the settlements with a population of 50.000 and above was also prepared in the relevant years. According to the Action Plan covering the years 2015-2019, until which year the needs could be met was determined by identifying the amount of available drinking water and the long-term drinking water need of 81 city centers, district centers with a population higher than 50.000 and district centers with a population of between 25.000 and 50.000.

According to the action plan, it has been determined that the amount of obtained water will be enough in 35 of 81 city centers in the long term (2034-2050) and in 17 of them in the medium term (2024-2033). It has been projected that drinking water should be supplied in 15 city centers in the short term (2019-2023) and in 14 city centers urgently (2015-2018), and the necessary studies for the relevant settlements are continuing.

In the Action Plan of the settlements with a population higher than 50.000, it has been determined that there will be drinking water shortage in 21 settlements urgently (2015-2018) and in 7 settlements in the short term, and that the amount of available drinking water in other settlements in the middle and long term will be sufficient.

In the Action Plan prepared for the settlements with a population of between 25.000 and 50.000, it has been determined that there will be drinking water shortage in 12 district centers urgently and in 2 of them in the short term, and that the needs of other district centers can be met with available resources in the middle and long term.

3.88 billion m^3/year of drinking water has been supplied for approximately 42 million people from 207 drinking water facilities which have been taken into operation by DSİ so far. When other plants under construction, planning and project stage are completed, 2.97 billion m^3/year more drinking water will be additionally supplied by DSİ. Thus, the amount of drinking, domestic and industrial water supplied will reach 6.85 m^3/year per capita along with the works which are in operation and under construction.

With the Turkish Republic of Northern Cyprus (TRNC) Water Supply Project carried out by the General Directorate of State Hydraulic WorksState Hydraulic Works, 75 million m3 of water per year was supplied to the TRNC. In Africa where, clean water is needed at most in the world, clean drinking-domestic water to be enough for 1.653.220 people has been provided with 458 wells drilled by DSİ in Africa in cooperation with TİKA (Turkish Cooperation and Coordination Agency). These studies in Africa will also continue in the next period.

Studies for Protection from Flood

As of the end of 2017, 8168 flood protection facilities and 68 dams for protection from flood were built for the purpose of improving the rivers with flood risk with a holistic basin approach protect settlements and agricultural lands from floods. A total of 1.890.136 hectares of the area were protected from floods with 8236 facilities.

The DSİ Flood Action Plan (2014-2018) has been prepared by DSİ to carry out studies within the scope of actions necessary for the minimization of flood damages in Turkey and the effective implementation of intervention and improvement activities. The Objectives of the DSİ Flood Action Plan are as follows;

- to create flood database in the GIS environment,
- to perform studies aimed at determining and removing the interventions on stream beds,
- to perform a preliminary assessment of all basins' flood risk,
- to prepare Flood Hazard Maps,
- to establish Flood Early Warning Systems,
- to improve the rivers with flood risk with a holistic basin approach.

The Geographic Information System (GIS) based TAMBIS (Flood Failure and Response Information System) Project has been prepared to collect and access the data related to the flood studies of DSİ. Furthermore, studies for the preparation of flood hazard maps are continuing, and studies have been started to establish a flood forecasting and early warning system using the prepared maps (Selek and Deniz, 2017).

The studies on preparing a flood management plan on the basis of basins have been initiated by the General Directorate of Water Management (GDWM for the purpose of evaluating not only a part of the river but also the entire basin as a whole by evaluating the floods in Turkey on the basis of basins. The flood management plans of the Susurluk, Yeşilırmak, Sakarya, Antalya and Ceyhan Basins have been prepared up to Now. The studies on preparing management plans are continuing in 15 basins, and it is aimed to prepare flood management plans for all 25 basins in Turkey until 2021.

The Capacity Improving for Applying the Flood Directive in Turkey Project, which constitutes the first step in the formation of Flood Risk Management Plans, was conducted by the General Directorate of Water Management between 2012 and 2015. Within the scope of the project, Flood Risk pre-assessment was performed in the West Black Sea River Basin, then flood hazard and flood risk maps were created in two pilot areas selected, and the Flood Risk Management Plan draft was prepared. Within the scope of the project, the National Application Plan draft and Guides for Applying Flood Directive were also prepared to be able to apply the Flood Directive in all of the river basins in Turkey.

Distribution of Water Among Sectors

The gradual increase in the need and demand for water resources and the fact that this resource is not available at the desired quantity and quality according to time and location require the most efficient use of available water resources within economic, environmental and social benefits. Sectoral water allocation planning studies on the basis of basins, which aim the sharing of water resources on the basin and sectoral sub-basin scale, planning for the future, and the fair supplying of water needed by every sector, have been initiated. With Sectoral Allocation Plans, the allocations to be made to sectors are determined by taking into account the protecting-using principle according to the present and future water potential. Furthermore, alternative solutions are developed for dry and restricted periods which are likely to be faced as a result of climatic impacts by determining the future status of the water potential in the basin.

The "Seyhan Basin Sectoral Water Allocation Plan" was prepared by the General Directorate of Water Management in 2016. The allocation plan in the Konya and Akarçay basins will be prepared in 2018, and Sectoral Water Allocation Plan studies for the Gediz and Küçük Menderes Basins will be completed in 2019. It is aimed to complete the studies on preparing water allocation plans in all other basins until 2023 within the scope of investment programs.

Studies on the Control of Nitrate Pollution Originating from Agriculture

The Nitrate Directive (No.91/676/EEC), designed for the protection of water against agricultural nitrate pollution, entered into force in the EU member states in 1991. In Turkey, the "By-Law on the Protection of Water against Nitrate Pollution from Agricultural Sources", which was prepared to transfer the requirements of the Nitrate Directive to the national legislation, was put into force in 2004; however, it was revised in 2016 and published in the Official Gazette dated 23.07.2016 and numbered 29779. In this context, the "Notification on Code of Good Agricultural Practices for the Prevention of Nitrate Pollution Caused by Agricultural Activities in Water" (Notification No: 2016/46) was published in the Official Gazette dated 11.02.2017 and numbered 29796 and entered into force.

The studies on monitoring nitrate pollution caused by agricultural sources in water are still conducted at a total of 4.751 stations consisting of 2.451 surface water and 2.300 groundwater. The analysis results obtained from monitoring studies are recorded in real time in the web-based Nitrate Information System and used to perform the relevant assessments for the control and management of agricultural pollution. The studies on determining nitrate sensitive areas depending on nitrate pollution monitoring results are still continuing. Consciousness-raising activities related to nitrate pollution caused by agricultural sources are performed.

As a result of the monitoring activities carried out by the Ministry of Agriculture and Forestry; Since a significant pollution trend was observed in our water resources, it was concluded that NVZs should be identified immediately and that Nitrate Action Plans should be prepared and implemented at the same time. The Ministry has signed a project with TÜBİTAK MAM to carry out the study of the preparation of the Nitrate Action Plans and preparation of the cost-benefit analysis of action plans. In 2019, the determination of NVZ in 9 basins, preparation of Nitrate Action Plans for these 9 basins and calculated cost benefit analyzes of the Nitrate Action Plans will be completed and completed at the end of 2021 with the costs of NVZs and related Nitrate Action Plans. Benefit analysis will be prepared in 25 basins.

Determination of Sensitive Areas and Quality Objectives in Turkey on the Basis of River Basins

Determining the Sensitive Areas and Water Quality Aims on the Basis of River Basins in Turkey Project about the determination and management of the sensitive areas was launched in 2012 and was completed at the end of 2016. With the project, sensitive water areas in terms of water pollution, nitrate-sensitive water areas and sensitive areas affecting these areas, water quality aims, and precautions to be taken in order to improve water quality were determined in surface waters in 25 water river basins in Turkey.

2,468 water bodies, 1,813 of which are river water bodies and 655 of which are lake water bodies, were determined in 25 river basins within the scope of the project. Pollution loads that come from urban, industrial, and agricultural activities are estimated by determining the pressures-effects affecting water bodies and the potential sensitive areas are determined. Biological and physicochemical monitoring studies are completed in potentially sensitive areas and the studies directed towards determining the final sensitive areas are ongoing.

Accordingly, 778 sensitive water bodies including 551 rivers and 227 lake water bodies have been determined. By taking into account the pressure elements affecting sensitive water bodies, drainage areas are classified as urban sensitive areas where urban wastewater formation is intense and/or nitrate sensitive areas containing agricultural and Non-agricultural lands where nitrate is formed. With the project in question, the number of urban sensitive areas were determined to be a total of 855 including 621 rivers and 234 lakes, and the number of nitrate sensitive areas was determined to be a total of 844 including 615 rivers and 229 lakes. Furthermore, the "By-Law on the Determination of Sensitive Water Bodies and the Areas Affecting These Bodies and the Water Quality Improvement" was published in the Official Gazette dated 23.12.2016 and numbered 29927 and entered into force with the aim of determining the sensitive water bodies in terms of nutrients in the context of the project and the urban and nitrate sensitive areas affecting these bodies, revealing the policies and procedures related to it, and determining the necessary measures to be taken for the improvement of water quality in sensitive water bodies.

Erosion and Sediment Control Studies

For the purposes of maintaining the sustainability of earth and water resources; studies about overflow and sediment control are being carried out in order to prevent the damages done by the sediment that is carried downstream from the upper river basins with erosion to the downstream sites of DSİ, dams and ponds and the sites of the other public institutes.

In this context, within the scope of the "Flood Action Plan (2014-2018)" made by DSİ, the studies on constructing permeable precipitation embankment that ensures that the woody material causing capacity losses in flood control facilities and transition structures by being carried from afforested lands in river precipitation basins to the downstream sites, and other rough sediment are kept at higher altitudes, and that provides the passage of water and sediment at the desired diameter are conducted by 14 Regional Directorates in Turkey. Planning and project studies in this regard have been projected to be completed in 2018. In order to address sedimentation problems, field surveys have been conducted in 337 reservoir basins. In 82 of these dams soil saving dams and check dams have been built in order to control sedimentation.

Project of Controlling and Improving Water That Returns from Irrigation for Reuse in GAP Region

Within the scope of the project completed in 2017, it was aimed to carry out an investigation for the protection and reuse of water resources by reducing the effect of water that returns from irrigation in GAP region, and for ensuring water saving. Accordingly, legal, technical and administrative gap analysis on water that returns from irrigation was performed, the present situation and environmental conditions of the project area were investigated, the quality and the pollutants of water that returns from irrigation were investigated, and appropriate methods were determined for improving the quality of this water and reusing it. The results that would be an example for the studies to be carried out across the country for the determination of the quality of drainage water and the options for reuse were achieved.

Evaluation of the Reuse Alternatives of Used Waters Project

Within the scope of the Evaluation of the Reuse Alternatives of Used Waters Project that started at the end of 2017, the potential and characterization of used water in Turkey will be revealed on the basis of river basins. The areas where water used on the basis of river basins can be reused will be regionally determined, and the project will be completed in 2019.

Evaluation of Hydro-meteorological Measurement and Monitoring

The General Directorate of State Hydraulic WorksState Hydraulic Works is the sole authorized organization for the measurement of water quantity and monitoring of water quality in Turkey. There are Flow Monitoring Systems (FMSs) where hydro-meteorological observation is performed in 25 hydrological basins by DSİ. DSİ has maintained monitoring studies in all river basins in Turkey since 1978. In general, there are a total of 2045 monitoring points in Turkey installed by DSİ. The number of wells operated by DSİ and used for monthly and instant level measurement is 1445, and the number of wells used for seasonal level measurement is 2003. An observation network consisting of 1674 stations is operated by the Turkish State Meteorological Service.

6.4.3.2 Agriculture and Food Security

Detailed information about the legal regulations and applications about adaptation to climate change in agriculture sector is given in Section 4. Studies done about adaptation to climate change are given below together with various applications like fighting agricultural drought, good agriculture applications, and organic agriculture.

The Strategy of Fighting Agricultural Drought and Action Plan (2018-2022)

The "Turkey's Strategy of Fighting Agricultural Drought and Action Plan (2018-2022)" has been put into practice by Ministry of Agriculture and Forestry (former Ministry of Food, Agriculture and Livestock and Ministry of Forestry and Water Affairs) with respect to drought, which is one of the most important indicators of climate change. The Agricultural Drought Action Plan aims to solve the problems that may arise due to drought in agriculture with the participation of all institutions, organizations and water users in exhibiting common attitudes and in taking precautions against the measures to be taken to mitigate the effects of possible drought in our country. The Action Plan includes the studies on Drought Risk Estimation and Crisis Management, Provision of Sustainable Water Supply, Effective Management of Agricultural Water Demand, Accelerating Supportive R&D Studies, and Increasing Educational/Publishing Services and Improving Institutional Capacity.

Agricultural Monitoring and Information (TARBIL) System

Agricultural Monitoring and Information (TARBIL) System Project aimed to evaluate the data obtained from satellite images and ground measurement networks, turn these into up to-date agricultural information and deliver these to stakeholders instantly. In the pilot step of the project, a monitoring system that can monitor the agricultural development is developed in South East Anatolia Region. Images that are downloaded directly to the satellite ground station are processed and transmitted to data collecting center. Besides, building of smart measurement stations that can find plant properties from camera images and send data through Türksat satellite is started. In the pilot application, the building of the first 100 stations is completed and pilot telecasting is started, especially in the GAP area.

In the pilot step of the project, studies of building TARBIL System is started with the purpose of providing service to stakeholders and generalizing it to Turkey starting from the end of 2011 after successfully completing infrastructure development activities. There are four main components of TARBIL system:

a) Satellite image downloading and processing center,

b) Ground monitoring network collecting image properties of soil and product (metrics such as size and color),

c) Data collecting and processing center,

d) Live reporting, agricultural warning, and decision support system according to the selected product and place.

24 different parameters are measured every 10 minutes in the ground stations that are developed. The center produces regional product development distributions by matching the satellite images that it collects from the same points and the data calculated from the ground measurements. It will be possible to predict the yield in the next term more accurately as the past measurement data are formed.

TARBIL also has service aims towards farmers, agricultural warnings and irrigation management being the first ones. Investments made in the pilot step of the project are met to an important extent with the usage of the provided satellite images by the Ministry of Agriculture and Forestryunits. In the generalization of the TARBIL system in Turkey, the number of ground measurement stations is being increased to 1200. SPOT7 satellite will be added to the capacity of monitoring from satellite that consists of SPOT4, SPOT5, SPOT6, and RADARSAT satellites. There is a wide utilization field for farmers such as determining ideal cultivation date according to the place where they are and the seed to be planted, agricultural warnings, and irrigation management.

An important strategy of TARBIL is forming a union of forces by bringing the national researcher potential, Ministry of Agriculture and Forestry experts being the first ones, live systems, and communication infrastructure together. In the variety base that TARBIL provides on the basis of phenological development, the data are important not only for agricultural yield management, but also the planned consumption of the natural resources.

The project has a critical importance in the systematic collecting and sharing of the information that will provide a basis for the precautions to be taken against greenhouse gas emissions and climate change (TARBIL, 2018).

Making the Use of Water Effective in Agriculture Program Action Plan

Effective Use of Water in Agriculture Program studies that take place in 10th Development Program (2014-2018) are continuing under the coordination of Ministry of Agriculture and Forestry. With this program, it is aimed to make the use of water effective in agriculture by solving the problems stem from or expected to stem from climate conditions and wrong and excessive irrigation in the country and on the basis of river basins. The aims of the program are determined as follows:

- Increasing the portion of the field, on which in-land irrigation methods that save water (drop and sprinkler) are applied in the total irrigating field from 20% to 25% in the Plan term in the irrigating sites developed by DSİ.
- Increasing the irrigation rate from 62% to 68%, irrigation efficiency from 42% to 50% in the Plan term in DSİ irrigations.
- Increasing the total number of modern irrigation systems every year by 10%.
- Decreasing the usage of underground water to 5% during the term of the Plan.
- Preparing Management Maps for effective irrigation management in CBS medium.
- Providing comprehensive and applied education to the farmers with the purpose of tap water economically.

11 performance indicators are determined in the program and there are indications such as the rehabilitation of the networks in the irrigation sites in the fields, 40 thousand hectares in 2016 and each of which are 50 thousand hectares in 2017 and 2018, formation of 30-thousand-hectare underground irrigation networks every year between 2014 and 2018, and opening 168-thousand-hectare field to irrigate every year (Ministry of Development-d, 2015).

Agriculture and Rural Development Support Institution (TKDK)

The general purpose of TKDK, which was founded with the Law numbered 5648 that came into effect in 2007, is to carry out the activities directed towards the application of rural development programs in a way that will also include resources obtained from European Union and international institutions in the framework of the essentials and aims presupposed in national development plans, programs, and strategies. In this framework, TKDK carries out accepting project and activity applications, doing their controls in their places, evaluation, determining the projects and activities to be supported, preparing application contracts, signing contracts, doing accrual, payment, and accounting processes and reporting proceedings and developments.

The Agriculture and Rural Development Support Institution contributes to agriculture and rural development in Turkey with the support it provides. The institution contributes to the sustainable development of rural areas by supporting the modernization of the agricultural sector, encouraging agricultural businesses' compliance with EU standards on food security, animal health, plant health and the environment, and making preparations to carry out the LEADER approach, implementation of agri-environment, climate and organic farming and LEADER (local rural development strategies) (Agriculture and Rural Development Support Institution, 2017).

Within the scope of the IPARD I program, meat farming including dairy farming and red and poultry meat in 42 provinces, the processing and marketing of meat, milk, fruit-vegetable and fisheries in the processing and marketing sector, and the investments in rural tourism and aquaculture along with bee culture, greenhouse cultivation, medical and aromatic plant breeding, local products and handicrafts within the context of the rural economic activities for small farmers have been supported.

According to the data for 2017, TKDK made 15 call announcements under the IPARD I Program, and contracts were signed with a total of 10.693 investors as a result of these calls. Within the scope of the investment amounting to approximately 6.7 billion TL, TKDK paid 3.15 billion TL to the investors. Within the scope of these investments, approximately 57 thousand people were employed. An indirect contribution of 1 billion 181 million TL was made to the beneficiaries due to the tax exemptions for IPARD investments. Furthermore, 37 businesses supported by IPARD funds realized exports worth 179 million TL to 48 different countries.

Following the successful completion of the IPARD I program, the second-period IPARD II program covering the years 2014-2020 is continuing.

Agricultural Insurance Law

The procedures and principles regarding the application of agricultural insurance are determined to ensure the reimbursement of the losses that producers will be subject to because of the risks that are pointed to in the Agricultural Insurance Law, which came into effect in 2005 with the number 5363. The Agricultural Insurance Pool (TARSİM) was formed in accordance with the law, and 50% of the insurance premium that the farmer will pay is met. Furthermore, 60% state premium support for district-based drought yield insurance and 66.7% state premium support for the risk of frost in fruits grown in the open field are provided. TARSİM is an important instrument for the protection of the agricultural sector, which has a strategic role and function in the economy and an increase is recorded in all of its basic data in years (Table 6.7).

Table 6. 7 TARSIM Basic Data (x1000 TRY)

	2007-2010 (Total)	2011	2012	2013	2014	2015	2016	2017
Total İnsurance Charge	10.721.751	6.986.308	9.497.470	11.252.737	13.894.744	18.377.979	23.080.720	30.303.348
Total Premium Production	472.780	440.879	499.348	526.835	683.536	965.772	1.299.986	1.628.554

Total Occured Damage Charge	285.610	209.819	260.666	386.093	501.501	692.195	800.807	762.591
Policy Number (Piece)	1.165	588	744	892	1.087	1.375	1.444	1.598

Developing Agricultural Publication Project (TAR-GEL)

Developing Agricultural Publication Project (TAR-GEL) is applied between 2007 and 2013 with the purpose of meeting the needs of agricultural plant owners in terms of knowledge, skills, and technical methods. In the scope of the project, contracted personnel are assigned to the determined working regions by 81 City Managements. 10,001 staff are allocated in Turkey in general, 6,129 of which being agriculture engineers, 3872 of which being veterinarians. All kinds of publication and education activities from food security to soil protection law are under the duties and responsibilities of the employed personnel. In this aspect, the related personnel have the potential to play a key role in the development of the application of the adaptation precautions by taking responsibility in the informing and education of the agricultural plants, which are the main appliers.

Studies of Fighting Erosion

One of the major issues for Turkey is erosion. 59% of cultivated agricultural lands and 64% of pastures are facing an erosion problem. Erosion in agricultural land is on the rise due to destruction of land cover that keeps the soil with their roots and stems (forest, heath land, pastures, etc.), not practicing preservative agricultural techniques in sloping agricultural lands, ploughing vertically along the slope, and cultivating on steppe and shallow lands not suitable for agriculture (class VI and VII).

In Turkey, the duty of fighting erosion is under the responsibility of the Ministry of Agriculture and Forestry (former Ministry of Food, Agriculture and Livestock and Ministry of Forestry and Water Affairs) in agricultural, forest and pasture lands and under the responsibility of DSİ in reservoir basins.

Besides, city private managements and municipalities carry out studies of fighting erosion in the framework of their duties and responsibilities. Non-Governmental Organizations such as Fighting Erosion, Planting Trees, and Protecting Natural Possessions Foundation (TEMA) also contribute to studies of fighting erosion.

The Combat Desertification National Strategy and Action Plan (ÇMUSEP 2015-2023) was approved in 2015 and entered into force. The action plan includes action and activities planned to be carried out in a period of 8 years in the prevention of desertification/land degradation in Turkey.

Climate Change National Action Plan-Agriculture Sector

Agriculture Sector and Food Security topic is under the Adaptation to Climate Change Chapter of NCCAP, which is prepared under the coordination of Ministry of Environment and Urbanization and started to be applied in 2011. Under this topic, the purposes are reported as integration of adaptation to the effects of climate change approach to food safety policies; determining the climate change effects in agriculture and developing and generalizing R&D studies and scientific studies in order to determine the effects of climate change in agriculture and adapt to climate change; planning agricultural water usage sustainably; protecting the soil and the agricultural biodiversity from the effects of climate change; and developing the institutional capacity and cooperation between institutions about adaptation choices in agriculture in Turkey. Besides, action plans are also put forward under every purpose.

Aquaculture

With respect to aquaculture activities carried out with the aim of protection and development of available aquatic products in water resources developed by DSİ, limnological studies have been completed in 287 dam lakes until today. 230 dam lakes have been provided with fishes with a total of 546 seed fishes that have been produced so far at the Fisheries Stations of DSİ. A total of 14.100 tons of various types of aquaculture are produced annually in the reservoirs with annual production control and renewed stock quantities from 177 dam lakes opened for commercial fishing. Furthermore, the aquaculture capacity of a total of 727 projects implemented with the opening of dams and ponds for

project-based aquaculture has been approximately 213 thousand tons per year. Within the scope of aquaculture activities in the reservoirs, R&D studies are continuing to develop commercial fishing, fish farming in net cages, farming in ponds, amateur fishing, and other farming models and to provide dam lakes with suitable fish species (General Directorate of State Hydraulic WorksState Hydraulic Works, 2018).

6.4.3.3 Extreme Weather Events and Disasters

The meteorological warnings prepared before powerful meteorological events are delivered to the institutions and organizations by the TSMS to minimize the problems to be caused by powerful meteorological events and to ensure that necessary measures are taken in time by the relevant and authorized institutions. 400 meteorological warnings and assessments related to strong and excessive precipitation, storm, strong snow, snowmelt, avalanche and landslide danger that may lead to flood and overflows, heater poisoning risk, dust transportation, agricultural frost and hot/cold air wave were published by the TSMS Analysis and Forecasting Center in 2017.

Flash Flood Early Warning System

The flash flood early warning system is developed to reduce the damage that may occur in the areas exposed to flash floods, to increase regional capacities, and to give real-time and high accuracy flash flood warnings. The Black Sea and Middle East Regional Flash Flood Early Warning System, in which Turkey is the regional center, was established within the body of the TSMS in 2013, and it provides services and products to the Meteorology and Hydrology Services of 8-member countries. The model is run with three different digital weather forecast models and is used operationally in the preparation of flash flood early warning 6 hours in advance (Turkish State Meteorological Service-d, 2018).

Flood Action Plans

The DSİ Flood Action Plan (2014-2018) was prepared by DSİ for the minimization of flood damage and the effective implementation of intervention and improvement activities. The studies for the preparation of flood management plans on the basis of basins have been started by the General Directorate of Water Management, and flood management plans of 5 basins have been prepared. The studies on preparing management plans are continuing in 15 basins, and it is aimed to prepare flood management plans for all 25 basins in Turkey until 2021.

Lightning Detection and Tracking System

Within the scope of the project carried out by the Turkish State Meteorological Service (TSMS), the installation of the Lightning Detection and Tracking System was completed in 2014. The Lightning Detection and Tracking System (LDTS) is a passive remote sensing system that provides real-time and high-resolution meteorological information for the detection, tracking and short-term weather forecasting (Nowcasting) of thunder and lightning events. The data on the location, type, polarity of lightning and thunderbolt, signal magnitude, and lightning height can be obtained with this system. The Lightning Detection and Tracking System is a network consisting of 35 passive sensors, not a single sensor.

Forest Fires and Meteorology Early Warning System (MEUS)

The risk of forest fires is very high in weather conditions where the air temperature is above 40°C and the relative humidity is below 20%. These conditions are occasionally experienced in some forested areas in Turkey.

Various meteorological data are used in the Forest Fire Early Warning System (MEUS) prepared by the Turkish State Meteorological Service. The meteorological forecast data obtained from the global forecasting model of the ECMWF (European Centre for Medium-Range Weather Forecasts) are used, and the risk maps are created. With the analyses performed continuously, the maps showing a three-day Forest Fire Risk Potential for Turkey are obtained and shared with the General Directorate of Forestry.

Disaster and Emergency Management Presidency (AFAD) Studies

The Turkey Disaster Response Plan (TAMP) was prepared in 2014 by the Disaster and Emergency Management Presidency (AFAD) to ensure that the response studies to be carried out after any kind of disaster that may occur in Turkey are performed effectively and quickly. In this context, the duties, authorities, and responsibilities among all ministries and institutions and organizations related to the studies to be carried out after a disaster have been determined. Within the scope of the TAMP, 28 National Level Service Group Plans were completed in 2015. In 2016, 81 Provincial Disaster Response Plans and 26 Service Group Operation Plans, the addition of these plans, were prepared.

The studies on developing Turkey's Disaster Management Strategy Paper and Action Plan (TAYSB), the framework document of the disaster management system that will ensure that studies on risk mitigation, preparation and intervention in disasters, and post-disaster rehabilitation are performed in an integrated manner, are continuing.

The preparations for the Turkey Disaster Risk Mitigation Plan (TARAP), which is a plan that describes what, when, by whom and how a work will be performed for the determination of disaster risks, taking all kinds of precautions together, and the prevention and reduction of these risks, have also been initiated. All stakeholders ranging from all public institutions and organizations, universities, private sector, Non-governmental organizations, media, families, and individuals come together in a governance perspective while discussing disaster risks in TARAP.

Annual Climate Assessment and Meteorological Characteristic Natural Disaster Reports

A report evaluating the previous year in terms of climate change and providing data has been published by the Turkish State Meteorological Service (TSMS) since 2009. In the report, detailed analyses of temperature and precipitation, as well as global climate assessment, are performed. In the important events section, data on extreme weather events and related flood, hail, storm, snow, hose, lightning and frost events are provided. Furthermore, the "Natural Disasters with Meteorological Character 2016 Evaluation Report" was published in 2016 (Turkish State Meteorological Service, 2016; Turkish State Meteorological Service-b, 2018; Turkish State Meteorological Service-c, 2018).

Impact of Climate Change on Water Resources Project

With the project, how water resources were affected on the basis of basins was determined between 2013 and 2016, and sectoral adaptation planning was done in the basins.

Studies at the Local Administration Level

The Establishment of Disaster Information and Meteorological Early Warning System Project in Rize province and the Agricultural Forecasting and Early Warning System Project in Izmir province were launched at the local administration level.

6.4.3.4 Ecosystems and Biodiversity

Following Turkey's taking part in United Nations-Convention on Biological Diversity 1996, "National Biological Diversity Strategy and Action Plan" is prepared as Turkey's responsibility according to the 6. Article of this Convention. This strategical plan has been updated by also considering the requirement that the activities of Turkey in this area must be in accordance with the regulations of European Union in the scope of nature protection sector and in this framework, six thematic working areas have been generated in order to adapt to the effects of climate change. These areas are agricultural biological diversity, forest biological diversity, steppe biological diversity, mountain biological diversity, inner waters biological diversity, and shore-sea biological diversity thematic areas. Climate change is added to the Action Plan as an article and it is decided that it will be considered in the scope of determining and monitoring the effects of climate change on biological diversity.

Based on National Biological Diversity Action Plan and according to the Directives number 92/43/AET and 79/409/AET in Turkey National Program About Undertaking the Acquired Rights of European Union, it is guaranteed that a frame law towards protecting biological diversity will be made starting from "after 2011" and "Nature and Biological Diversity Protection Law" design is prepared.

"Protected Areas and Climate Change National Strategy of Turkey", which was prepared by Ministry of Forestry and Water Affairs (now Ministry of Agriculture and Forestry) in 2011, is prepared in order to develop the effective management of the protected areas in Turkey, make the role of the protected areas understandable for all of the parts, and carrying out activities in this direction for decreasing climate change in the process of global climate change and adapting to its effects. In this strategy, generating a "protected areas system" in Turkey, planning protected areas, and generating a policy about their management, increasing the number of research, raising awareness, and information sharing are subjects with priority in the context of protected areas and climate change. The strategy is considered in three basic groups and these groups are forest, wetland, steppe, and coastal ecosystems.

The aims, goals, and strategies of General Directorate of Forestry Strategic Plan (2017-2021) are prepared in accordance with the Ninth Development Plan (2007-2013), Tenth Development Plan (2014-2018), Forestry Special Expertise Commission

Report, National Forestry Program, Medium-Term Program, Medium-Term Financial Plan, and the other forestry sector plans and programs. In also GDF Strategic Plan, seven basic goals with priority are determined for sustainable forest management and all of these are directly or indirectly related to the aims of adapting to climate change.

Studies/projects that are being carried out

There are a lot of projects that are carried out with the coordination of Ministry of Environment and Urbanization and Ministry of Agriculture and Forestry with the purpose of protecting ecosystems, nature, and biological diversity in Turkey and maintaining their sustainability. Especially the studies done on protected areas, which are an important part of the global campaign against climate change, are important in maintaining the sustainability of natural ecosystems of terrestrial/naval scale and ecosystem services.

In Decreasing the Effects of Climate Change and Sustainable Usage of Biological Diversity and the Wetlands in Turkey in Order to Protect them (2009-2011) project, it is aimed to develop national and local wetland management systems with the purpose of decreasing the effects of climate change on wetland ecosystems. In the studies done by GIZ (German Technical Cooperation Institution) and General Directorate of Nature Conservation and National Parks, a management model that covers protection of wetlands for their adaptation to climate change, their rehabilitation, and sustaining their ecological functions is generated.

Determining the Climate Change Decreasing Potentials of Yeniçağa Lake (Bolu) and Akgöl (Konya) Wetlands (2012) project is a part of the project above and in the framework of this project, activities towards protecting the wetlands and restoring them are carried out in Yeniçağa Lake and Akgöl, which include two important peat beds of Turkey. Peat beds are the most important terrestrial ecosystems for carbon holding on the World. Carbon and the other greenhouse gases that are held in two pilot areas are estimated by taking the global indexes and the other studies of the project into consideration. It is revealed how much the protection studies and restoration applications that were done by using this information have prevented gas release to the atmosphere and how valuable this is economically. In the project study that was done in 2012, an effective tool is generated for protection by revealing the effect of protecting and restoring the wetlands in Turkey on the campaign against climate change.

Reinforcement of Protected Areas System in Turkey: Generalizing the Sustainability of Sea Shore Protection Areas Project (2009-2014) - In the project, which is supported by GEF 4 - Global Environment Fund, it is aimed to reinforce the national sea and shore protection system of Turkey and maintaining its effective management. The project named Reinforcement of Forest Protection Areas Management Project - Küre Mountains National Park (Kastamonu-Bartın) (2008-2012) is carried out under the coordination of General Directorate of Nature Conservation and National Parks and it is aimed to develop the position of our forests in the national protected areas and their administrative effectivity by generating and effective and integrated management model, which is based on participation principle with the purpose of nature protection and sustainable resource management.

In the project named Developing Forest General Management Capacity for Sustainable Forest Management Applications in the Context of the Water Usage of the Forests -1. Step (2012-2013), it is aimed to check the present policies and strategies for sustainable forest management by bringing a deeper understanding to the potential results of climate changes including desertification and loss of biological diversity on forest and water interactions and integrating water function to forest management plans in order to adapt to climate change and contribute to reducing it.

In the scope of Wetland Management Plans Preparation (2011-2017), it is aimed to prepare management plans for all of the wetlands with international importance based on "Ramsar Convention – Guidelines on Wetland Management Planning" in the framework of the decisions in Protection of Wetlands By-Law (Official Gazette with the date 17 May 2005 and number 25818), (especially 26. article). The project is being managed by Ministry Species Protection Action Plans launched by the former Ministry of Forestry and Water Affairs, General Directorate of Nature Conservation and National Parks in 2013 are continued to be developed and implemented. The aim of the Ministry is to add 10 new species to the plan every year until 2023 and to protect these species. In the project in which it was aimed to prepare 100 species action plans until 2019, the action plans of 60 species were completed by the end of 2017.

The "Lakes and Wetlands Action Plan 2017-2023" was prepared under the coordination of the General Directorate of Water Management to ensure that the lakes and wetlands are preserved in an integrated manner by considering the protection-use balance. The "Circular on Lakes and Wetlands Action Plan" numbered 2017/1 entered into force to ensure that the Action Plan would be implemented sensitively and in a disciplined manner by the responsible Ministries, institutions and organizations. The action steps within the Action Plan are as follows:

- Taking Inventory of Natural Lakes,
- Determination of Bathymetry of Natural Lakes,
- Determination of the Water Budget of Natural Lakes,
- Determination of Pressure and Impact Components and the Assimilation Capacity for Pollutant Parameters,
- Monitoring of Natural Lakes and Determination of Water Quality,
- Improvement of Water Quality and Quantity of Natural Lakes.

Within the scope of the Action Plan, it is aimed to study 303 lakes and wetlands in 25 basins.

The "Agricultural Practices for Ecosystem-Based Adaptation to Climate Change in Steppe Ecosystems (ETU) Project," which is conducted in cooperation with the Ministry of Agriculture and Forestry and FAO, is continuing. The project is funded by the European Union and Turkey; it has a total budget of 3 million euros. The overall project GCP/TUR/063/EC aims to increase the resilience of societies and steppe ecosystems to the impacts of climate change. The first objective is to increase national capacity and awareness in preparation for the adoption of medium and long-term climate change ecosystem based adaptation plans. The plans, focusing primarily on Anatolian steppe ecosystems will be gradually aligned with EU climate policy and legislation.

6.4.3.5 Coastal Areas

Studies of adaptation to climate change that were carried out on the coastal regions are given below.

Determination and Classification of Sea and Coastal Waters Project (2011-2014)

In the scope of the project, it is aimed to generate the necessary information and application tools that will support "management with ecosystem approach" principle applications for the applications of EU Water Framework Directive (2000/60/EC) and EU Marine Strategy Framework Directive (2008/56/EC), which have come into effect in 2008. Besides, it is also a strategic aim of the Project to prepare the proposals that are directed towards the sustainable usage of our shore and sea resources and are based on good environmental level aims and present them to the decision makers and appliers that need to do mutual planning. The studies done in the scope of the Project can be summarized as the definition of coastal and transition waters, determining coastal water typologies and water management units, classifying coastal waters according to their ecological qualities, determination of the gaps, local evaluation of the "good environmental situation" of the seas, determination of the aims and their indicators, and formation of the application structure.

Management of Urban Sewage on the Coasts of Turkey Project

In the scope of SINHA project, the coasts of Turkey are evaluated in terms of eutrophication risk according to Urban Sewage Purification By-Law and classified as sensitive and a little sensitive. Sensitive coastal areas that were determined in 2009 were updated in 2011. Loads with urban and industrial source are estimated on the shores in order to be able to do pressure-effect analysis. Loads that will come to urban sewage purification sites in 2020, 2030, and 2040 in the present situation and related to the population productions are determined. Sewage purification conditions of municipalities on the coastal areas of Turkey are investigated and their improvement needs are determined. Settlement areas, in which there is not urban sewage purification sites, are evaluated according to specific principles (sensitivity of the coast to eutrophication, population, etc.) and sewage purification site processes are proposed.

Integrated Coastal Zone Plans

Integrated Coastal Zone Plans are being prepared under the coordination of Ministry of Environment and Urbanization. Aims of the study can be summarized as;

- Bringing a new approach to coastal planning and application studies in Turkey,
- Determining the precautions about protection and inspection on the coasts,
- Directing local expectations and requests in coastal areas,
- Regulating the authorization areas that intersect on the coasts, and
- Maintaining integrated policies and decision-making processes that take all of the sectors into consideration for encouraging the usage of coastal areas by protecting them in a coherent and balanced way and producing instructive strategies and aims for applications about the coastal structures that will be built on coastal areas. By June 2018, Integrated Coastal Zone Plans have been completed for 82 % of coastal zones.

With the Legislative Decree about the Governances and Duties of Ministry of Environment and Urbanization with date 4 July 2011 and number 644, it is stated that management and planning works of the integrated coastal areas are among the duties of Ministry of Environment and Urbanization.

In the scope of "Making Spatial Planning Legislation", which has come into effect by being published in the Official Gazette with the date 14.06.2014 and number 29030, the definition of "Integrated Coastal Areas Zone Plan (ICZP)" is made and these plans are defined as plans that do not take place in spatial planning hierarchy are prepared with the strategical approach special to the coastal zone and its interaction area, and guide development plans. Besides, with the legislation, essentials about Integrated Coastal Zone Plans, which are planned to be prepared as a guide document for the planning, project designing, and applications of institutions and corporations authorized on the coastal areas, legal managements and enterprisers, are determined. ICZP is shortly defined as a plan that considers coasts, all sectoral activity and plans together with their interaction areas in a way that it will also include social and economic aspects and includes the protection of the coastal ecosystem in the direction of sustainable development principle, and spatial aim, strategy, and action proposals in which the usage of natural resources is primary.

6.4.3.6 Health

All countries (even if they are not at the same ratio) are at risk against adverse health effects of climate change. The "National Program and Action Plan for Mitigating the Negative Impacts of Climate Change on Health" have been prepared for the determination and solution of potential effects and precautions to be taken before these problems affect Turkey for a long time (Ministry of Health, 2015).

The aim of the program is to protect our people from the adverse health effects to be caused by climate change in Turkey and to take necessary health precautions for disaster situations. The objectives of the program are summarized below:

- to reduce the effects of extreme weather events (excessive precipitation, extremely hot and cold weather, air pollution) and resulting natural disasters (flood, fire, etc.) on human health,
- to strengthen the corporate infrastructure for the follow-up of the diseases seen and/or increasing in Turkey as a result of climate change, to increase cooperation within and between the institutions,
- to ensure water and food security, to fight against water and foodborne diseases,
- to carry out necessary studies to ensure that vulnerable groups are not affected by the adverse effects of climate change,
- to reduce the negative contributions of health institutions to climate change,
- to raise public awareness for more effective protection against adverse health effects of climate change,
- to carry out monitoring and evaluation activities.

6.4.3.7 Settlement Areas and Tourism

6.4.3.7.1 Settlement Areas

Studies of adaptation to climate change that were carried out on the settlement areas are given below.

In the scope of "National Climate Change Action Plan-NCCAP", there are the aims of

- Determine the amount of carbon held in the settlement areas in land use and forestry sector in 2012 and increase this value by 3% with green space until 2020,
- Effectively applying 'By-Law Regarding Energy Performance in Buildings' and other energy efficiency legislations in all of the buildings in buildings sector until 2017, obtaining at least 20% of the yearly energy need of the new buildings from renewable energy resources starting from 2017, decreasing greenhouse gas emissions at least by 10% in the new settlements compared to the present settlements until 2023,

- Restricting the emission increase rate originating from personal vehicle usage in transportation sector in local transportation, doing the necessary legal legislation and administration for sustainable transportation in the settlements until the end of 2023, taking the local precautions in order to encourage alternative fuel and clean vehicle usage in urban transportation until 2023,
- decreasing the amount of biodegradable waste that will be accepted to the regular storage sites to its 75% until 2015, 50% until 2018, and 35% until 2025 by weight, by taking 2005 as the basis in the waste sector, building solid waste disposal sites in the country in general until the end of 2023 and disposing 100% of the municipality wastes of in these sites, completing Package Waste Management Plans, closing 100% of the wild storage areas until 2023,
- Considering the water management of the settlements with the adaptation to climate change point of view, in water resources management.

Attempts were started by Ministry of Environment and Urbanization, Infrastructure and Urban Transformation Services Directorate General in order to prepare an Ecological Settlement Unit Standard, in which all of the precautions described above can be included (Yalazı, 2014). "Ecological Settlement Unit" standard study and pilot project application aim the formation of a new application language in the framework of the urban regeneration studies to be carried out in the scope of the Law No. 6306. It is aimed to add the sustainability level to the aim of forming brand settlements that are resistant to disasters of the Ministry, together with the financial supports and planning precautions that will be separately defined based on the law. Ministry and related directorates continue their studies especially in the scope of increasing carbon sink potential originating from improving the urban area use.

In the case that the application of Ecological Settlement Unit standard during urban regeneration activities is ensured with new projects, which is aimed by Ministry of Environment and Urbanization, Infrastructure and Urban Transformation Services Directorate General to be completed in 2015, it is aimed to decrease the greenhouse gases by bringing down 6.5 million independent units and rebuilding them.

With Heat Insulation Legislation in Buildings of June 2000 (TS 825), insulation standards are developed in the new buildings and the present buildings, 15% of which are renewed. The standards helping the development of the policy of Turkey towards increasing the energy efficiency in the building stock and the relevant legal framework of the national energy policy started to be formed with the preparation of Energy Efficiency Strategy Draft in 2004 and making of Energy Efficiency Law in 2007 (Law No. 5627) by Ministry of Environment and Urbanization. It is aimed to restrict the greenhouse gas emission of the buildings in terms of primary energy and carbon dioxide (CO_2) emission and regulate the protection of environment with "Building Energy Performance (BEP) By-Law", which was prepared in accordance with "Energy Performance of Buildings Directive (EPBD)" of EU with number 2002/91/EC in 2008 and revised in 2011. As per this By-Law, Energy Identity Certificate (EKB) system of buildings has been brought into effect in 2011 and an obligation is made in order to have EKB as a part of the new buildings residential usage license. According to this, the buildings are classified from A to G according to their energy consumption level and greenhouse gas emission amounts and it is predicted that all of the present buildings take EKB until 2017. Buildings are separated into categories from A to G according to their energy consumption levels and CO_2 releases. This system ensures that the building sector, property owners, and local managements put importance into the subjects of energy consumption and CO_2 release. It is thought that investing in energy efficiency will be encouraged by giving information about how energy efficiency can be increased and energy bills can be decreased. "Legislation about the Certification Methods and Essentials of Sustainable Green Buildings and Sustainable City" is published in 2014.

In the areas and buildings, in which the standards of Leadership in Energy and Environmental Design (LEED) are applied in the scope of the urban regeneration activities carried out by Ministry of Environment and Urbanization, a decrease of 24-50% energy efficiency (electric, natural gas, etc.) and a decrease of 33-39% carbon dioxide emission related to this are maintained. In a similar way, it is kNown that water consumption decreases by 40% and solid waste production decreases by 70% in the buildings in which these standards are used. For this reason, it is proposed to decrease the greenhouse gas emissions, especially carbon dioxide, that originate from the buildings and studies carried out with this purpose are these:

• As per the decision of Council of Ministers with the number 2014/5813, it is decreed that the interest support ratio related to the provided credits will be applied by increasing by 50 base points for buildings with B class energy efficiency certificate and by increasing by 100 base points for buildings with A class energy efficiency certificate in the framework of Energy Performance Legislation in the Buildings.

- Studies of designing ecological settlements and determining standards.
- Studies in the scope of increasing carbon sink capacity originating from the improvement of urban land use are ongoing.

Spatial planning studies that were carried out by Ministry of Environment and Urbanization are given below:

- With the change made in the Development Planning Law in 2013(Law No. 3194), it is ensured that the minimum urban standards can be determined with territorial development plan and the duties of preparing climate-sensitive and ecological plans and projects, building buildings with these properties, and providing long term credits with this purpose are imposed to the Ministry.
- With the By-Law for Preparation of Spatial Plans that has come in force in 2014, it is stated that it is necessary to do the research, investigations, and studies about the disasters and the other urban risks and to take the risk reducing precautions should be taken in the plans according to the research and essentials are determined in order to maintain the protection and usage balance while making the plans.

A chapter of the Plan Research Report which was prepared by a group of experts from different disciplines in the first step of Territorial Development Plans which were described in the By-Law for Preparation of Spatial Plans that was published in 2014 is reserved for "Climate" data and data such as temperature, raining, relative humidity, evaporation, overcast and insolation, wind, and pressure are collected in this chapter. In another chapter of the report, environmental problems such as air, water, and soil pollution are mentioned. And later, natural structure analysis is made in the direction of all of the data about the natural structure, including climate data. In this scope, areas that are sensitive, under risk, and not under risk are determined in terms of nature. In the synthesis chapter in the results part of the report, settle ability synthesis is done by bringing all of the analysis done about the area together. Areas suitable for settlement, areas not suitable for settlement, and risky areas are determined in the planning area with the synthesis in question. In this scope, areas that have the possibility to be affected by climate change are also determined and the plan decisions (protection and improvement) are made in this direction.

GEF, Increasing Energy Efficiency in Buildings in Turkey Project (2011-2015), which is supported by an investment company that consists of the government of Turkey and TOKI and which is applied by UNDP, is a 5-year project with a budget of 17.6 US dollars. In the scope of the project, it is aimed to increase the building energy performance standards, increasing the sanctions of the related legislations as application tools, increasing the efficiency of the energy management of the building, and development and application of the integrated building design approach in the national scale in order to decrease the energy consumption and CO_2 release in public buildings.

In the scope of Sustainable City Planning for Urban Resilience and Ecosystem Services (Tezer et al., 2014), studies of research about the negative effects of Land Use/Land Cover (LULC) change on climate change are ongoing.

In the scope of İstanbul Seismic Risk Mitigation and Emergency Preparedness (ISMEP), which was started after signing credit contract with International Bank for Reconstruction and Development (IBRD), it is aimed to take supportive precautions in order to develop the institutional and technical capacity, raising the consciousness of the public about preparation and intervention to emergency situations, investigating the situations of the public buildings with priority against seismic risk and reinforcing them according to the results of these investigations or bringing them down and reconstruction them, supporting national disaster studies, drawing inventories of the buildings in the scope of cultural and historical inheritance, doing seismic risk evaluations and their projects designs, and the more effective application of public improvements and building legislation with the purpose of making Istanbul ready for a possible earthquake.

In Sustainable Development Report of Turkey (2012), in the scope of regional development, it is stated that especially the improvements to be maintained in the regions with low income will provide important contributions in terms of environmental sustainability. Development Agencies, which are the main elements of management at the regional level together with the settlements, are developing projects for sustainable aims. Regional Development Strategies (2014-2023) are determined by Ministry of Development in 2013 (Ministry of Development-b, 2013).

It is aimed to decrease possible life and property loss and rehabilitate the deteriorated land to protect the land, including decreasing the possible life and property loss and damage decreasing studies in sites such as land/settlement/road etc. by Ministry of Forest and Water Affairs in different urban scales in the scope of flood, landslide, and snow slide control projects (2012-2014). KOYDES (Village Infrastructure Support) Project, which is developed for rural settlements, has been turned into an integrated rural infrastructure program by including agricultural irrigation on a small scale in 2012

and sewage components in 2011. In 2005-2013 term, approximately 8.8 billion TL resource is allocated to the Project with current numbers. Besides, 2600 km of locked parquet was furnished and 32 thousand km of road was repaired. In the scope of drinking water component, 47,461 units, 4,116 units of which (village and village-related) without water and 43,345 units of which with inadequate water were supplied with adequate and healthy drinking water.

Applications of protecting and improving the land by preventing its loss and loss of its properties by natural or artificial ways and maintaining planned land use in accordance with the sustainable development principle with environmental priority are being carried out by Ministry of Agriculture and Forestry (former Ministry of Food, Agriculture and Livestock and Ministry of Forestry and Water Affairs) by making CATAK, Land Consolidation, Supporting Modern İrrigation and Processing Methods that will Provide Water Saving Program, Soil Protection and Land use Law (5403) with the purpose of decreasing the greenhouse gas emissions that cause climate change, especially for rural-urban settlements and land use.

In the national level, as a strategy document carrying reference framework document, Integrated Urban Development Strategy and Action Plan (KENTGES 2010-2023) determines works and studies at central and local level mainly in transport, infrastructure, housing and land construction, preparation for disasters, conservation, climate change, housing quality, social policies and participation issues.

Integrated Urban Development Strategy and Action Plan (KENTGES 2010-2023), which puts forward the principles, strategies, and actions towards maintaining balanced and habitable urban development, determines the application principles of these, relates these to an action program, and which is a strategy document with the property of reference framework document on the national level, considers the sectors related to spatial planning in the framework of sustainability principle.

In order to promote healthy, balanced and livable urban development, Integrated Urban Development Strategy and Action Plan KENTGES (2010-2023) defines principles, strategies and actions, determines principles of implementation and connects these with action plan, carries the property to be a national reference framework document and with regarding sustainability principle deals with the sectors of spatial planning related with the space with an integrated approach. The municipality actions in the Action Plan are monitored with "Municipality Questionnaire" done by the municipalities whereas the actions that are under the responsibility of central authorities are monitored with the reports of the central authorities.

With the "Municipalities Questionnaire", besides the technical and financial capacities of the municipalities; their practices on issues such as spatial planning, urban development, urban design and space quality, sustainable transport (public transport, bicycle and pedestrian roads), infrastructure practices, livable environment and protection of natural assets, social integration, etc. are monitored. Year 2016 Municipality Questionnaire covering 1397 municipalities have been completed in year 2017. The detailed information can be obtained from KENTGES official internet address.

In the scope of Increasing the Institutional and Technical Capacity for Developing Climate Adaptation Strategies Project, which is supported by Ministry of Environment and Urbanization, Adaptation to Climate Change Support Package is prepared special to Bursa Metropolitan Municipality. While making this package, the adaptation support tool, which was developed by Europe Environment Agency consisting of 6 steps is taken as example. Adaptation to Climate Change Support Package for the Cities is an example for the process of adaptation plan preparation process of municipalities in Turkey (Cindoruk, 2014). A lot of municipalities from Turkey took part in the Presidents Contract, which was generated in the scope of Europe Commission and signed by about 5 thousand local management presidents. Among these municipalities, Bornova Municipality and Antalya Metropolitan Municipality, which have prepared Sustainable Energy Action Plan, are prominent. Besides, Local managements have various authorizations and duties about setting goals in sectors related to climate (waste, building, energy, etc.), making legal regulations about these subjects in their local bodies, generating various application tools, and doing applications themselves. Local managements do applications about subjects such as urban planning related to adaptation to climate change besides the precautions to decrease the greenhouse gases. There are the precautions that the municipalities will apply about climate change in NCCAP.

The "Development of Planning Principles and Criteria in Urban Transformation Project", which was prepared to be able to create healthy and livable cities and to determine the planning procedures and principles for the studies conducted within the "Law No. 6306 on the Transformation of Areas Under Disaster Risk", was launched by the Ministry of Environment and Urbanization in 2017. With the project, within the scope of the By-Law on Preparation of Spatial Plans and the "Law No. 6306 on the Transformation of Areas Under Disaster Risk", it is aimed to determine the procedures and principles for the redetermination of the livability standards of urban space and the establishment of the planning principles and

criteria by addressing green spaces, social and cultural facilities, technical infrastructure and transportation systems of cities together in the development plans for the renewal of unhealthy and insecure building stock. The protection of domestic architecture and the reintegration of neighborhood scale are also among the priority objectives of the project.

The second axis of the strategic objectives of the "Ministry of Environment and Urbanization 2018-2022 Strategic Plan" is related to urbanization. The strategic objectives within this axis are summarized as follows within the framework of three strategic objectives.

- Spatial Planning and Urban Transformation for the Cities Resistant to Disaster: in Turkey of 2023, to obtain earthquake and disaster resistant, human-focused, environmentally friendly cities that preserve their original identity by performing infrastructure, spatial planning, design and urban transformation studies, especially in the settlements under disaster risk.
- Smart Cities and National Geographic Information Services: to perform infrastructure studies for the creation of smart cities, to improve space management in cities with technology, to provide data sharing to improve public services, and to become the focal point of national geographical information.
- Energy Efficient and Environmentally Friendly Settlement: for environmentally sensitive, energy efficient and safe construction, to develop new construction techniques and domestic materials, to ensure that building supervision studies are performed effectively, and to determine the procedures and principles related to professional services.

6.4.3.7.2 Tourism

Turkey's Tourism Strategy (2023) and Turkey's Tourism Strategy and Action Plan 2007-2013

In Turkey, tourism is mainly based on the sea and coastal resources. It is performed in the form of mass tourism, and tourism is concentrated on the Mediterranean and Aegean coasts and has a periodic structure. This structure of Turkey's tourism, resulting from partial approaches to tourism planning, has led to the emergence of environmental problems such as Non-planned urbanization/settlement in the areas behind and around the coasts, and inadequate infrastructure. This constantly increases the pressure on environmental resources depending on the development of tourism.

"Turkey's Tourism Strategy 2023" and "Turkey's Tourism Strategy Action Plan 2007-2013" were prepared in 2007 by the Ministry of Culture and Tourism to change this negative structuring positively. The Strategy and Action Plan was approved by the High Planning Council Decision dated 28.2.2007 and numbered 2007/4 and entered into force by being published in the Official Gazette dated 02.03.2007 and numbered 26450 (Ministry of Culture and Tourism, 2007).

Turkey's Tourism Strategy includes approaches to holistic policy, strategy, and implementation. Turkey has unique opportunities in terms of types of tourism, such as alternative tourism (health and thermal tourism, winter sports, mountain and nature tourism, highland tourism, rural and ecotourism, congress and fair tourism, cruise and yacht tourism, golf tourism, etc.) as well as coastal tourism. However, this potential cannot be used in the rational sense. Turkey's Tourism Strategy 2023 and Action Plan 2013 aim to use the natural, cultural, historical and geographical values of our country within the protection-use balance and to increase Turkey's share in tourism by developing tourism alternatives.

The fact that the relevant tourism resources are addressed in a way to form tourism corridors, tourism regions, tourism cities and ecotourism regions along the development axes instead of planning on a point scale is considered as a more accurate approach in terms of the introduction of these values and determining the usage criteria. Thus, the attraction of the regions with potential tourism will be increased with other types of alternative tourism. This will allow for the development of tourism at the national level by reducing regional accumulation, as well as reducing periodicity in tourism and spreading tourism over the whole year. Moreover, wider masses will be allowed to take a share from tourism, and the development and the removal of regional imbalances will be supported. Above all, it is projected that the pressure and destruction on the natural and cultural resources on the Mediterranean and Aegean coasts will decrease since the development of tourism will be holistic and based on planning. An important point related to the objectives of the Strategy and Action Plan is that the risks that arise due to climate change especially on the Mediterranean coastline will be reduced by the emergence of new types of tourism and new destinations.

Eco-Labels and Environmentally Sensitive Certificate Systems

In Turkey, within the scope of sustainable tourism, various applications have been implemented for the protection of the environment, the development of environmental awareness, and encouraging and promoting the positive contribution of tourist facilities to the environment. In this context, Notification No 2008/3 on Giving Environmentally Responsible Accommodation Facilities Certificate to Tourism Facilities Certified Accommodation Facilities, which classifies environmentally-friendly accommodation businesses, entered into force in 2008.

According to the notification, of the facilities exceeding the minimum score determined for the type and class, the stars showing the classes in the plaques of accommodation facilities with a star symbol will be arranged in green color, and the "Environmentally Responsible Facility" will be present on the plaque. The number of facilities with the Green Star document and the tourism establishment certificate of the Ministry of Culture and Tourism was 126 in 2014 and increased to 40 in 2018, and the bed capacity of these facilities increased to 293.625. These figures clearly show the interest of accommodation facilities in the Green Star. It is also observed that cogeneration and trigeneration energy systems have become widespread especially in accommodation facilities with the Green Star Certificate in recent years.

One of the eco-labels used for accommodation facilities and tourist attractions in Turkey is the Green Key Award. The Green Key Award has 7 main objectives. The first dimension is the protection of the environment. Accordingly, it is based on the protection of the environment with the measures such as energy and water saving, the use of environmentally friendly cleaning materials and waste management by reducing the negative effects of tourism establishment on the environment. "Economic management," which is an economic objective, projects a reduction in costs as a result of decreases in consumption on the issues such as electricity, water, fuel, cleaning materials and wastes. This is also considered as an important factor in the protection of the environment and especially in adaptation to climate change with energy saving. Indeed, the share of accommodation facilities in the tourism sector, which accounts for 5% of the greenhouse gas emissions in the atmosphere, is 21% (Somuncu, 2016). As of 2018, the number of Accommodation Facilities with the Tourism Establishment Certificate in Turkey is 3847, and the bed capacity of these facilities is 959.055. The number of facilities with a Municipality certificate is 7596, and the bed capacity of these facilities is 506.127. Therefore, the importance of the issue will be understood better when the presence of 11.443 facilities and a bed capacity of approximately 1.5 million in Turkey, energy, water, and fuel uses of all these facilities, and the wastes resulting from the use of them are taken into account.

The Green Key Award is given for a year by the Green Key National Jury, and applications are renewed every year. In Turkey, the facilities receiving the Green Key Award are primarily inspected, and flags, plaques, and certificates are given to the facilities that meet the criteria. Then, they are inspected at least one time in a year. The award of the facilities that do not meet the criteria is taken back without waiting for the end of the year. As of 2018, 94 facilities have the Green Key Award in Turkey. Internationally, there are a total of over 2900 facilities with the Green Key Award within the scope of this program implemented in 57 countries. Turkey ranks 9th among 57 countries. The Green Key Award organization is held by the Turkey Environment Education Foundation (TÜRÇEV), a member of the Foundation for Environmental Education (FEE).

6.5 MONITORING, REPORTING AND EVALUATION

A network-based monitoring and evaluation system has been established to monitor the issues included in the Climate Change Action Plan (IDEP). It was decided to monitor the plan 8 months after it was shared with the public. In the Climate Change Coordination Board meeting held on February 22, 2012, it was decided to establish a Monitoring and Guidance Committee consisting of the representatives of institutions and organizations and to create a Working Group affiliated to this committee. Following the decision, data were started to be entered into the network-based monitoring system created since 2013 for monitoring 541 actions defined in the IDEP. The developments regarding the realization of the actions are followed in the system where 330 users from responsible institutions/organizations enter data (Ministry of Environment and Urbanization-b, 2016).

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7 FINANCIAL, TECHNOLOGICAL AND CAPACITY-BUILDING SUPPORT

As mentioned in the First, Fifth and Sixth National Communications, Turkey is not an Annex -II country, therefore doesn't have an obligation of providing support to developing countries within the scope of Articles 4.3, 4.4 and 4.5 of the Convention and Article 11 of the Kyoto Protocol.

Turkey is a developing country according to the categorization of the World Bank, the International Monetary Fund as well as the United Nations Development Programme despite being an Annex-I country within the scope of the Convention. "World Economic Situation and Prospects" Report from 2018 places Turkey in developing economies' list together with non-Annex countries while Annex-1 countries are listed as developed economies . In addition, Turkey is an OECD member while being listed among the countries which could benefit from Official Development Assistance (ODA) by the Development Assistance Committee of the OECD. Furthermore, Turkey is acknowledged as upper-middle income economy rather than developed country by Climate Technology Center and Network (CTCN)

Turkey has been a developing country in the forefront of the global outlook with an average annual GDP growth of 5% during the last decade. In order to meet the increasing need for infrastructure in a sustainable manner due to the need for development, external financing has been provided through mostly loans from bilateral agencies, multilateral development banks and climate funds for primarily renewable energy, energy efficiency and low carbon transport projects.

The Conference of Parties Decision No. 1/CP.16 recognizes special circumstances of Turkey while Decision No. 1/CP.18 confirms the importance of financial, technological and capacity building support in order to ensure effective implementation of the Convention and strongly encourages Annex-II countries to provide Turkey with financial, technological and capacity building support through multilateral organizations including the Global Environment Facility, (GEF), one of the two UNFCCC financial mechanisms and has benefitted from the Climate Investment Funds managed by the World Bank.

However, the fact that the Paris Agreement, adopted in 2015, is based on a distinction of developed/developing countries without considering any categorization, and that the special circumstances of Turkey already recognized by the Conference of Parties Decisions, are not reflected to the Agreement creates an uncertainty as far as Turkey is concerned. As a result of this uncertainty, Turkey is not able to benefit from the Green Climate Fund, which was created in 2010 as one of the funding mechanisms of the UNFCCC, and which started to support projects as of 2015, becoming the largest climate fund. Turkey has concerns that especially the increasing co-financed projects with the Multilateral Development Banks would limit its climate financing.

In this context, given its high growth potential, it is of critical importance to ensure Turkey's access to financial mechanisms under the UNFCCC, so that in addition to the funds for which it already has access, so that Turkey is able to maintain its efforts to combat climate change, realize nationally determined contribution and fulfill its high mitigation potential within the framework of common but differentiated responsibilities.

35 https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/publication/WESP2018_Full_Web-1.pdf
36 https://www.ctc-n.org/countries/asia/turkey

8

RESEARCH AND SYSTEMATIC OBSERVATION

8.1 INTRODUCTION

The activities related to the investigation of issues such as modeling, paleoclimate, compatibility, adaptation, and mitigation regarding the climate change, and the systematic observations of climate elements are discussed in this chapter. Both State institutions and academic institutions and Non-governmental organizations have been involved in intensive studies on different issues of climate change. State institutions and academic institutions are performing studies on climate change at the international and national levels. Non-governmental organizations have focused on the studies on awareness and adaptation. In this chapter, the programs which are in accordance with the national policy framework and especially with the climate conditions are discussed for the study. This chapter also includes the basic national achievements and projects in the field of climate change research and systematic observations.

Turkey is continuing to conduct research and scientific studies that will contribute to the AR6 IPCC report. On the other hand, it is intensively maintaining its efforts to determine the impact rates of natural and human systems against climate change by running climate models with different scenarios and to determine the necessary measures and adaptation strategies.

8.2 GENERAL POLICY ON RESEARCH AND SYSTEMATIC OBSERVATION

8.2.1 Research

The Supreme Council for Science and Technology, founded in 1983, plays the most important role in the formation of the science and technology policies of Turkey. The duties of this council are to assist the government in determining long-term science and technology policies, to identify targets, to determine priority areas, to prepare plans and programs, to appoint public institutions, to cooperate with private institutions, to prepare required law drafts and legislation, to educate and provide researcher human resources, to take measures to establish private sector research centers and to ensure coordination between sectors and organizations. The 29th meeting of the Supreme Council for Science and Technology was held on 17 February 2016 (TÜBİTAK 2016).

Supporting efficient and renewable energy technologies as well as environmental technologies through research and development (R&D) is upheld as one of the priorities within the mission-oriented support programmes of The Scientific and Technological Research Council of Turkey (TÜBİTAK). In this respect, priorities as put forth in the Climate Change Strategy of the Republic of Turkey, the National Energy Efficiency Action Plan, and other related national strategy documents have the opportunity to be supported through calls that are opened through TÜBİTAK. The call-based support programmes in which priorities for sustainable energy and the environment are addressed are the Support Program for Research, Technological Development and Innovation Projects in Priority Areas (TUBITAK 1003) and The Support Program for Research, Technological Development and Innovation Projects in Priority Areas (TUBITAK 1511). In addition, researchers have the opportunity to submit projects of their interest in a bottom-up approach to other support programmes. Overall, over 330 projects with keywords on technologies that contribute to mitigating climate change have been supported by TÜBİTAK in the past 5 years.

Policy direction for the call-based support programmes are mainly determined based on technology roadmaps that are coordinated by TÜBİTAK based on the Delphi method. The technology areas of the technology roadmaps have covered energy efficiency, mobile communication technologies, LED/OLED and screen technologies, embedded systems in the automotive and machinery sectors and light-weight materials in the automotive sector. Most recently, technology roadmaps are developed based on the technology groups of factories of the future, digitalization and interaction within the scope of smart manufacturing systems. Moreover, studies to prioritize research topics in the social sciences and humanities are necessary to increase the capacity to address societal and global challenges as well as enable the findings from social sciences to support the process of technological development by suggesting means to overcome societal barriers. For this reason, TÜBİTAK dedicated one of the technology roadmaps to the social sciences and humanities, including aspects of urbanisation.

Other policy initiatives that are well-suited to supporting energy and environmental priorities are based on a new call under the 1004 Excellence Centres Program. This call enables the establishment of "High Technology Platforms" to realize technology transfer between leading research results and private sector firms. Accordingly, the High Technology Platforms will be formed by research universities, research laboratories that have received approval for research and managerial competence (according to Law 6550), and private sector firms that contain an R&D and product design centre. After evaluation, the platforms will be supported to realize the milestones that are claimed for the development of high technology products in technology acquisition roadmaps. It is expected that the roadmaps will address the gap between technology-based ideas and technology-based products. The performance of the High Technology Platforms will be monitored based on milestones in the technology roadmaps.

Another flagship program of TÜBİTAK has been the Public Procurement of R&D Program in which public institutions, including ministries, are allowed to submit a problem or issue that can be resolved through means of R&D and innovation. Based on an evaluation procedure, TÜBİTAK then opens a call and receives applications from consortiums to address the particular topic. It is mandatory that a private sector firm that is capable of scaling-up a prototype into mass production takes place in the project consortium. For the closure of the supported R&D and innovation project, it is necessary that the initial public institution applies or directly procures the project output according to the "Project Outcomes Application Plan." National flagship projects have been supported under this programme, specially projects on Development of Hydroelectric Energy Technologies (MILHES), Development of Wind Energy Power Plant Technologies (MILRES), Development of Solar Energy Technologies (MILGES), Development of National Design and Manufacturing Capability for Thermal Power Plant Flue Gas Treatment Technologies (MILKAS) and others for thermal power plants (MILTES) and coal gasification.

Especially in the aspect of climate mitigation, it is essential that interactions between R&D and innovation actors are strengthened to effectively facilitate the process of technology development and diffusion. In this respect, the Industrial Innovation Networks Mechanism (SAYEM) is directed to private sector firms, especially those that contain an R&D and product design centre. These firms will form a network with other firms that take place in the value chain of the targeted technology-based product together with end-users, technology development zones and universities. As a whole, the network will have the opportunity to take centre stage in the innovation system for co-creating high value-added products and technologies, including technologies that are expected to contribute to effective measures to reduce CO_2 emissions.

Another means of supporting the R&D and innovation system for sustainable technology development is through strengthening the knowledge base of universities in accordance with their competences. In this respect, 143 universities in Turkey have been benchmarked according to their competences in 120 research areas with 12,000 thousand different keywords. The indicators that have been used per research area include total publications of the university in comparison to total publications and the relative citation index total citations among multiple other indicators. According to these analyses, the competence map of universities across 100 research domains is obtained, including those for bioenergy, power conversion, transmission and distribution, energy storage, energy efficiency, solar energy, hydropower, geothermal energy, hydrogen and fuel cells, and wind energy. The results have been used to provide guidance to a support program, namely TÜBİTAK 1000, in which universities are called upon to develop their research and deinnovelopment capabilities through university-oriented R&D Strategy Plans.

At the international level, Turkish researchers have been actively engaged in the EU Framework Programmes. In the context of the Seventh Framework Programme and Horizon 2020, Turkish researchers were active in over 100 projects with relevance to energy and climate challenges.

For this purpose, the 100/2000 Program has been designed by the Council of Higher Education with a long and participative approach considering the needs and development areas of Turkey in this regard, and it is an effective project for the future. Within the scope of this program, 2,000 human resources with a doctorate's degree in 100 fields will be educated for the priority areas of Turkey. Employment of these human resources is not only for the academy but also for the development-oriented processes regarding the public and private sectors. For this purpose, doctorate studies on the subjects directly and indirectly related to the climate change should be supported. Some of these priority areas are as follows:

- Urban Transformation Studies
- Renewable Energy Resources / Technologies (Solar Energy, Wind Energy, Geothermal Energy, Hydropower)
- Food Safety and Food Assurance
- Hydrogen and Fuel Cells

- Climate Change
- Polar Studies
- Forest Products and Technology
- Sustainable Forestry
- Sustainable Agriculture
- Sustainable and Intelligent Transportation
- Remote Sensing and Geographic Information Systems
- Renewable Energy and Energy Storage (YÖK 2018)

According to the calculations made within the scope of the R&D activities as a result of these intensive studies, while the Gross Domestic Product (GDP) ratio in 2006 was 0.56%, it increased to 0.94% in 2016 (Figure 8:1). This increase shows that the financing support allocated for R&D is increasing. As a result of expenditures on R&D studies, the number of publications in the internationally indexed journals increased from 5,442 in 2000 to 31,555 in 2016 (Figure 8:2) (TÜBİTAK 2017a).

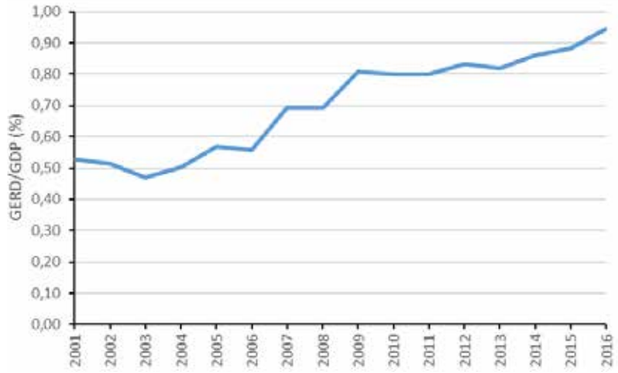

Figure 8. 1Share of R&D Expenditures in GDP (Reference TUİK [Turkish Statistical Institute])

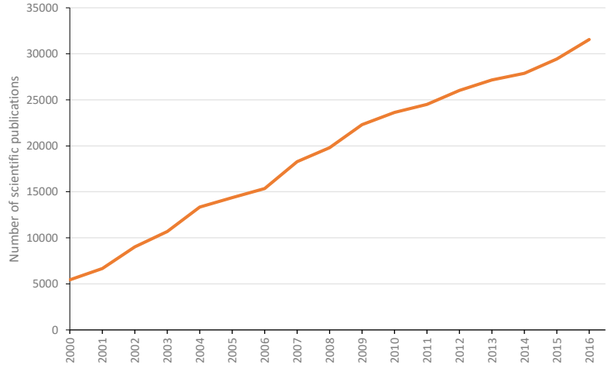

Figure 8. 2 Number of Scientific Publications Originated from Turkey (Reference: WoS-InCites TUBİTAK ULAKBİM)

8.2.2 Observation

Meteorological observations and forecasts provide data and services to be used in many areas, such as monitoring climate and climate changes, prevention and extinguishing of forest fires, wind and solar energy studies, planning of cities and facilities, especially agriculture, transportation, national defense, health, and tourism in every moment of life. To make meteorological observation systems widespread across Turkey and to increase consistency rates in forecasts with the development of weather forecasting and early warning systems are among the priority targets. The development of information infrastructure for the quality control of meteorological data and instant presentation to users, increasing R&D studies in the field of meteorology and meteorological visibility in the international arena, and the studies on providing correct and reliable information to the public constitute the strategic objectives.

8.2.3 Major Turkish research institutions and organizations working in the field of Climate and Climate Change

A quite large number of national universities, public and private institutes and other organizations are involved in climate research and climate-related research and systematic observation. The major Turkish universities consortium, research institutions and organizations conducting climate and climate change research are the following ones:

- Boğaziçi University, Climate Change and Applications Research and Application Center,
- Boğaziçi University Kandilli Observatory and Earthquake Research Institute
- Istanbul Technical University, Department of Meteorological Engineering,
- Istanbul Technical University, Polar Research Application and Research Center
- Istanbul Technical University, Eurasian Institute of Earth Sciences
- Istanbul University, Institute of Marine Sciences and Management,
- Ankara University, Department of Geography,
- Ankara University, Institute of Water Management
- Middle East University, Institute of Marine Sciences
- Middle East University, Marine Ecosystem and Climate Research Center
- Çukurova University, Dokuz Eylül University, Institute of Marine Sciences and Technology
- Samsun University, Department of Meteorological Engineering
- TUBİTAK, Marmara Research Center,
- Turkish State Meteorological Service
- Ministry of Environment and Urbanization, Department of Climate Change
- Ministry of Environment and Urbanization, Department of Greenhouses Management
- General Directorate of Environmental Management
- Ministry of Agriculture and Forestry,
- General Directorate of Agricultural Research and Policy
- General Directorate of Forestry
- Directorate of Forestry Research Institute
- General Directorate of Combating Desertification and Erosion
- General Directorate of Nature Conservation and National Parks,
- General Directorate of Natural Heritage Conservation,
- General Directorate of Water Management,

- Turkish Naval Forces, Office of Navigation, Hydrography and Oceanography,
- General Directorate of Mapping

8.2.4 Major funding bodies in the field of Climate Change

- The major Turkish funding bodies for climate change research are reported below:
- Presidency, Directorate of Strategy and Budget,
- Ministry of Industryand Technology,
- Ministry of Agriculture and Forestry,
- Ministry of Environment and Urbanization
- Ministry of Foreign Affairs
- The Scientific and Technological Research Council of Turkey
- Naval Forces Command,
- General Command of Mapping,
- Coordinator-ship of Scientific Research Projects of Universities
- Istanbul Metropolitan Municipality, Disaster Coordination Center (AKOM)

8.3 RESEARCH

The Turkish State Meteorological Service (TSMS) produced scenarios based on RCP4.5 and RCP8.5 projections for Turkey and its immediate neighborhood. The 1971-2000 period was selected as the reference period for the projections produced at 20X20 km resolution, and the years 2016-2099 were selected for the projections. The 2016-2099 projection range was studied in periods of 2016-2040, 2041-2070, 2071-2099. Three models were used as global climate models. These models are HadGEM, GFDL and MPI global models (Akçakaya et al., 2015).

The project entitled the "Impact of Climate Change on Water Resources" was launched by the Ministry of Agriculture and Forestry (former Ministry of Forestry and Water Affairs) General Directorate of Water Management, as well as the TSMS, in 2013, and the project was completed in June 2016 (OSİB, 2016). In this project, the RegCM4.3 regional climate model was run with the outcomes of three global models and RCP4.5 and RCP8.5 release scenarios. The differences of the parameters, which were determined for the whole country and river basins through model simulation, until 2010 were calculated as seasonal and annual averages for 10 and 30-year periods with 10x10 km resolution based on the reference period accepted as the simulations of 1971-2000.

The climate scenarios until the year 2100 in Turkey were determined within the scope of the above projects. Therefore, the projects in Turkey mainly focused on the effects of climate change on natural systems, socio-economic effects, and mitigation and adaptation studies.

8.3.1 Climate Systems And Climatic Processes

Table 8. 1 Relevant International Projects on climate process and climate system studies, including paleoclimate studies

Code	Title	Sponsor/Recipient	Start Date -End Date	Coordinator	Involved Turkish Partner(s)
101Y00	Magnitude of Quaternary glaciers and glaciations from low to high latitudes: Global or local dominant controlling factors?	The Scientific and Technological Research Council of Turkey (TUBİTAK)-NSF (National Science Foundation–USA)	N/A	TUBİTAK	Hacettepe University

Table 8. 2 Relevant National Projects on climate process and climate system studies, including paleoclimate studies

Project No	Project Name	Sponsor/Recipient	Start Date-End Date
112Y139	Geyik Mountain (Middle Taurus) Late Quaternary Glaciation and Paleoclimate Interpretation	The Scientific and Technological Research Council of Turkey (TUBİTAK)	1.10.2012-1.4.2015
113Y408	Quaternary Paleoclimate of Southwestern Anatolia and its neighborhood: Comparison of Climate Records and Global Records in Acıgöl (Denizli-Afyonkarahisar) and Lake Salda (Burdur)	The Scientific and Technological Research Council of Turkey (TUBİTAK)	15.5.2014-15.2.2017
114Y218	Evaluation of Late Quaternary Glaciation and Paleoclimate Conditions of the Kavuşşahap Mountains (Eastern Anatolia)	The Scientific and Technological Research Council of Turkey (TUBİTAK)	15.11.2014-15.5.2017
115Y493	Investigation of the origin of Sarıkavak tufa deposits and significance of paleoclimatic aspect, SW-Turkey	The Scientific and Technological Research Council of Turkey (TUBİTAK)	15.11.2015-15.11.2017
114Y835	Investigation of the Bottom Deposits of Lake Aktaş in terms of the Late Holocene Climate of Northeastern Anatolia	The Scientific and Technological Research Council of Turkey (TUBİTAK)	15.5.2015-15.11.2016
112Y222	Evaluation of Quaternary River Terrace Deposits Records along the Mudurnu Valley in Terms of Climate Change and Seismicity	The Scientific and Technological Research Council of Turkey (TUBİTAK)	15.8.2012-15.8.2013
115Y033	Late Pleistocene-Holocene Sea Level and Paleo-Climate Changes in the Gemlik Gulf.	The Scientific and Technological Research Council of Turkey (TUBİTAK)	15.5.2015-15.5.2016
112Y217	A Comparative Analysis of the Origin of Beachrocks in the Black Sea (Kıyıköy, NW Thrace) and Marmara Sea (Parion, Çanakkale), AMS Radiocarbon Dating, and the Connections with Holocene Level Changes	The Scientific and Technological Research Council of Turkey (TUBİTAK)	1.8.2012-1.8.2013
112Y153	Response of the Kızılırmak River to Climate Change During the Late Quaternary in the Cappadocia Region	The Scientific and Technological Research Council of Turkey (TUBİTAK)	2012-2015

Table 8. 3 Relevant Thesis on climate process and climate system studies, including paleoclimate studies

End Date	Name of Thesis
2015	High-resolution sediment records of Lake Salda (SW Anatolia) for the last millennium: Past climate changes driven by solar forcing
2015	Late Holocene high resolution multi-proxy climate and environmental records from Lake Van, Eastern Turkey
2017	Climatic changes in the Lake district during Chalcolithic and Bronze ages and its effects on archaeological settlement systems
2016	Late Pleistocene to Holocene palaeoceanographic and paleo-climatic changes in the Gulf of Gemlik, Sea of Marmara, Turkey
2016	Paleoclimatic modelling of borehole temperature-depth data and identification of recent climatic variations in Western Anatolia
2015	The effect of the late quaternary climate changes on the geographic distribution of Quercus robur L. (Pedunculate oak)

8.3.2 GLOBAL AND REGIONAL CLIMATE MODELS

Table 8. 4 Relevant International Projects on Global and Regional Climate Models

Code	Title	Sponsor/Recipient	Start Date -End Date	Coordinator	Involved Turkish Partner(s)
SPICES - 2015	Space-borne observations for detecting and forecasting sea ice cover extremes	H2020-EO-2014	2015 / 2018	Ilmatieteen Laitos	Istanbul Technical University (İTÜ)
SESAME	Southern European Seas Assessing and Modeling Ecosystems Changes Sustainable Development	European Union	2006 / 2011	Hellenic Centre For Marine Research	METU, Institute of Marine Sciences
ECOOP	European Coastal-shelf sea operational observing and forecasting system	European Union	2007 / 2010	Denmark's Meteorology Institute	METU, Institute of Marine Sciences
MEECE	Marine Ecosystem Evolution in a Changing Environment	European Union	2008 / 2013	N/A	METU, Institute of Marine Sciences
PERSEUS	Policy-oriented Marine Environmental Research in The Southern European Seas	European Union	2012 / 2015	Hellenic Centre For Marine Research	METU, Institute of Marine Sciences
COCONET	Towards Coast to Coast Networks of Marine Protected Areas from The Shore to The High and Deep Sea Coupled with Sea-based Wind Energy Potential	European Union	2012 / 2016	Consiglio Nazionale Delle Ricerche	METU, Institute of Marine Sciences
OPEC	Operational Ecology Ecosystem Forecast Products to Enhance Marine GMES Applications	European Union	2012-2014	Plymouth Marine Laboratory	METU, Institute of Marine Sciences
MyOcean	Ocean Monitoring and Forecasting	European Union	2009 / 2014	Alessandro Crise	METU, Institute of Marine Sciences
UASİS	National Land Cover Classification and Monitoring System	Presidency, Directorate of Strategy and Budget	2018-2021	European Environment Agency	General Directorate of Combating Desertification and Erosion

Table 8. 5 Relevant National Projects on Global and Regional Climate Models

Project No	Project Name	Sponsor/Recipient	Start Date-End Date
113Y108	Investigation of the Effect of the Mediterranean and Black Sea on Turkey's Climate System with a Combined Atmosphere-Ocean Model	The Scientific and Technological Research Council of Turkey (TUBİTAK)	15.9.2013-15.9.2015
	Turkey Desertification Model and Risk Map Project	General Directorate of Combating Desertification and Erosion	2015-2019

Table 8. 6 Relevant Thesis on Global and Regional Climate Models

End Date	Name of Thesis
2016	Determination of local wind energy potentials using climate modeling
2015	Trend analysis of climate extreme indices for Turkey
2015	Computational dam safety analysis based on predicted probable maximum flood discharge from statistical downscaling taking into consideration different general circulation models
2017	Modeling of probable effects of climate change on dam basin hydrology: AR5-RCP scenarios and case of Demirkopru dam reservoir
2017	Modelling forest cover change within the context of climate change mitigation strategy, in Bozdağlar
2017	Modelling ecosystem services based on carbon considering of Eastern Mediterranean Region the global climate change
2017	Statistical downscaling for precipitation and temperature predictions of global circulation models
2017	Monitoring and modeling of climate change dependent seawater surface temperature using geographical information systems (GIS) and remote sensing methods
2017	Modelling the effects of land use changes on climate
2016	Modelling of the sea level effect of geographical information systems using climate change
2015	Modelling the effect of climate change on surface water resources, soil water profile and plant yield in the Thrace region
2015	Projections of climate indices during the 2013-2040 period of the Kızılırmak Basin
2017	Modelling flooding risk under urbanization and climate change in Istanbul, Turkey

8.3.3 RESEARCH ON THE EFFECTS OF CLIMATE CHANGE

Table 8. 7 Relevant International Projects on Research on the Effects of Climate Change

Code	Title	Sponsor/Recipient	Start Date -End Date	Coordinator	Involved Turkish Partner(s)
112R005	Determination of the Effects of Biosolids (Biochar) on Corn Plant Growth and the Emissions of Greenhouse Gases (CO_2, N_2O, and CH_4) as an Organic Soil Improver	TUBİTAK COST project,	2012-2015	TUBİTAK	Uludağ University
TR 2013 / 0327.05.01-03 / 001	Technical Assistance Project for Establishing Advanced Analytical Basis for Land Use, Land Use Change and Forestry (LULUCF) Sector	European Union	2017-2019	AESA	Ministry of Environment and Urbanization

Table 8. 8 Relevant National Projects on Research on the Effects of Climate Change

Project No	Project Name	Sponsor/Recipient	Start Date-End Date
112Y204	Flood Risk Estimation of Water Basins in Rize Provincial Boundaries: Present and Future Situation According to Climate and Hydrological Models	The Scientific and Technological Research Council of Turkey (TUBİTAK)	2012-2015
113Y071	Possible Physiological Effects of Climate Change on Green Seaweeds in the Mediterranean	The Scientific and Technological Research Council of Turkey (TUBİTAK)	2013-2015
112M942	Injection of Greenhouse Gases Emerging During Production in Geothermal Fields into the Reservoir.	The Scientific and Technological Research Council of Turkey (TUBİTAK)	15.5.2013-15.5.2015
113Y079	Determination of the Seasonal Cycle of Aurelia Aurita (Linnaeus, 1758) Polyps and Efiras in the Bosphorus and the Sea of Marmara and the Possible Effect of Climate Change on Population Dynamics	The Scientific and Technological Research Council of Turkey (TUBİTAK)	1.4.2014-1.6.2016
112Y038	Spatial Modeling of Urban Heat Islands (UHI) with Satellite Images	The Scientific and Technological Research Council of Turkey (TUBİTAK)	2012-2016
N/A	Impacts of Climate Change on the Future of Istanbul and Turkey's Water Resources Project	İstanbul Metropolitan Municipality	2017-
N/A	Basin Monitoring and Evaluation System Installation Project	General Directorate of Combating Desertification and Erosion ,The Scientific and Technological Research Council of Turkey (TUBİTAK)	2016-2018
N/A	Turkey of Soil Organic Carbon (TOC) Modeling and Mapping Project	General Directorate of Combating Desertification and Erosion	2016-2030
N/A	National Land Cover Classification and Monitoring System	General Directorate of Combating Desertification and Erosion	2018-2021
N/A	Project on Balancing Land Degradation in Upper Sakarya Basin	General Directorate of Combating Desertification and Erosion	2018-2021
	Datça-Bozburun Special Protected Area Strategy and Action Plan for the Adaptation to Climate Change	Ministry of Environment and Urbanization	2017

Table 8. 9 Relevant Thesis on Research on the Effects of Climate Change

End Date	Name of Thesis
2017	Effects of major global climate change components on nutritional physiology and biofortification of wheat
2017	A tool to automate the process of flood risk areas detection due to climate change
2016	Climate change impacts on catchment-scale extreme rainfall variability
2016	Modeling the impact of climate variability on anchovy overwintering migration in the Black Sea
2016	Impacts of eutrophication and climate change on phytoplankton community structure, size diversity, and phytoplankton based ecological status
2015	Modeling impacts of eutrophication and climate change in Lake Eymi r using pclake model
2015	The impact of climate change on agricultural production in Mediterranean countries
2018	Effects of anthropogenic geomorphology on climate change
2017	Impact of climatic change on water resources of Izmir
2017	Climate change impact on precipitation-temperature in Turkey and drought analysis: Akarcay case study
2017	Climate Change Impacts in the Hindu-Kush Karakoram Himalaya
2016	Trend analysis of hydrometeorological data for evidence of climate change in Istanbul
2016	Vegetation geography and climate change of the Bolkar Mountains
2015	Possible effects of climate change on evaporation
2015	Examination the climate change in the East-Blacksea Region
2015	Effects of climate change on fruit trees and wheat phenological periods in Turkey
2015	Investigation of forest areas in subalpine zone towards alpine zone by effect of climate change
2015	Impact of climate changes in Turkey on wheat prices
2017	COSMO-CLM (CCLM) climate simulations over Turkey: Performance evaluation and climate projections for the 21st century
2017	State of the global climate change in the Canakkale some climate parameters process
2015	The effect of climatic factors and climate change on the yield of opium poppy (Papaver somniferum L.) in Turkey
2015	Examination of possible effects of climate change on wheat growth and yield by a crop-climate simulation model
2015	The effect of climatic factors and climate change on the yield of sunflower (Helianthus annuus L.) in Turkey
2017	Investigation of the impact of climate change on the financial analysis of a real hydroelectric power plant project
2017	Statistically downscaling maximum precipitation under CGCM climate change scenarios
2017	The impacts of climate change and land use on the ecosystem structure and services of Lake Beysehir

8.3.4 SOCIO-ECONOMIC ANALYSIS OF CLIMATE CHANGE AND INTERVENTION

Table 8. 10 Relevant International Projects on the Socio-Economic Analysis of Climate Change and Intervention

Code	Title	Sponsor/Recipient	Start Date -End Date	Coordinator	Involved Turkish Partner(s)
N/A	Enhancing the Capacity of Turkey to Adapt to Climate Change	European Union	2018-2012	UNEP, UNDP, FAO, UNIDO	Ministry of Environment and Urbanization
TR2013 / 0327.05.01-02 / 110	Yüreğir District is preparing for climate change	European Union	2013-2014	Ministry of Environment and Urbanization	Yüreğir Municipality
TR2013 / 0327.05.01-02 / 132	Greening the Climate, Greening the Local	European Union	2013-2014	Ministry of Environment and Urbanization	Green Thought Association, Bornova Municipality
TR2013 / 0327.05.01-02 / 039	Consumer Responsibility and Awareness on Energy Use, Aimed at Reduction of CO_2 Emission in Cities	European Union	2013-2015	Ministry of Environment and Urbanization	Consumer Rights Association, Mayor-ship of Edremit
TR2013 / 0327.05.01-02 / 095	Trabzon is Combating against Climate Change	European Union	2013-2015	Ministry of Environment and Urbanization	Trabzon Metropolitan Municipality
TR2013 / 0327.05.01-02 / 024	Increasing Climate Change Awareness at TOBB ETU	European Union	2013-2014	Ministry of Environment and Urbanization	TOBB University of Economics and Technology
TR2013 / 0327.05.01-02 / 038	Climate Change and Erosion Awareness Project	European Union	2013-2014	Ministry of Environment and Urbanization	Tuzlukçu Municipality, Nature and Wildlife Conservation Society
TR2013 / 0327.05.01-02 / 111	Raising Awareness on Extending Precision Agriculture Techniques for the Effects of Climatic Changes on Agricultural Production	European Union	2013-2015	Ministry of Environment and Urbanization	Selcuk University
TR2013 / 0327.05.01-02 / 120	Change Yourself, Not Climate	European Union	2013-2015	Ministry of Environment and Urbanization	T.R. Governorate of Manisa, CEIPES Centro Internazionale Per La Promozione Dell'educazione E Lo Sviluppo
TR2013 / 0327.05.01-02 / 031	Action of 'We Struggle With Climate Change With Our Bicycles'	European Union	2013-2014	Ministry of Environment and Urbanization	Lüleburgaz Municipality
TR2013 / 0327.05.01-02 / 093	Kocaeli Green House Gas Inventory and Climate Change Initiative	European Union	2013-2014	Ministry of Environment and Urbanization	Kocaeli Metropolitan Municipality
TR2013 / 0327.05.01-02 / 094	Eco Towns of Kayseri	European Union	2013-2014	Ministry of Environment and Urbanization	Kayseri Directorate of Provincial Food Agriculture and Livestock, Cappadocia Organic Farming Producer Union Association
TR2013 / 0327.05.01-02 / 124	Development of a common protocol to assess the impact of forest management practices on climate change	European Union	2013-2014	Ministry of Environment and Urbanization	Karadeniz Technical University, Dimokriteio Panepistimio Thrakis / Democritus University of Thrace (DUTH)
TR2013 / 0327.05.01-02 / 080	Increase of Awareness of Public Understanding through Building Stakeholder Capacity on National Climate Action	European Union	2013-2014	Ministry of Environment and Urbanization	Kadir Has University
TR2013 / 0327.05.01-02 / 112	Integrated and Participatory Climate Action for Kadıköy Municipality	European Union	2013-2014	Ministry of Environment and Urbanization	Municipality of Kadıköy, Turkey Europe Foundation
TR2013 / 0327.05.01-02 / 099	Green Re-vision: A framework for the Resilient Cities	European Union	2013-2015	Ministry of Environment and Urbanization	Izmir Metropolitan Municipality, Landscape Research Society
TR2013 / 0327.05.01-02 / 007	Improving climate change awareness and engagement in Istanbul	European Union	2013-2015	Ministry of Environment and Urbanization	Istanbul Metropolitan Municipality
TR2013 / 0327.05.01-02 / 130	A Better Environment Starts With You!	European Union	2013-2014	Ministry of Environment and Urbanization	Governorate of Hatay, Antakya Environment Protection Association
TR2013 / 0327.05.01-02 / 055	Community Capacity Building in Higher Education Against Climate Change: Managing Perceptions, Raising Awareness and Strengthening the Resilience	European Union	2013-2015	Ministry of Environment and Urbanization	Dokuz Eylul University
TR2013 / 0327.05.01-02 / 002	Power the Revolution for Climate Action	European Union	2013-2015	Ministry of Environment and Urbanization	Denizli Metropolitan Municipality
TR2013 / 0327.05.01-02/ 043	Enhancing Awareness of Female Labor Force for Agricultural System in a Changing Climate	European Union	2013-2015	Ministry of Environment and Urbanization	Boğaziçi University, Rize Municipality

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TR2013 / 0327.05.01-02 / 113	Better Futures with Enhanced Capacity and Awareness on Climate Change	European Union	2013-2015	Ministry of Environment and Urbanization	The Governorship of Bilecik, Bilecik Provincial Directorate of Environment and Urbanization Bilecik Provincial Directorate of Public Health Bilecik Provincial Directorate of National Education Edebali Culture and Research Association Bilecik Şeyh Edebali University The Municipality of Osmaneli
TR2013 / 0327.05.01-02 / 022	Project of Using Green Energy in Sports Facilities and Creating Awareness	European Union	2013-2015	Ministry of Environment and Urbanization	Metropolitan Municipality of Ankara
TR2013 / 0327.05.01-02 / 115	The Project Against Greenhouse Gas Emission in Akcadag	European Union	2013-2014	Ministry of Environment and Urbanization	Akçadag Municipality
MP / TUR / 08 / 003	Hydrochlorofluorocarbon Termination Management Plan (HPMP) Project (Phase 1)	Multilateral Fund for the Implementation of the Montreal Protocol (MLF)	2013-2018	United Nations Industrial Development Organization (UNIDO)	Ministry of Environment and Urbanization
N/A	National Ozone Unit Institutional Strengthening Project (IS) Phase 8	Multilateral Fund for the Implementation of the Montreal Protocol (MLF)	2017-2019	United Nations Industrial Development Organization (UNIDO)	Ministry of Environment and Urbanization
MP / TUR / 08 / 003	Activation Activities Project within the framework of the Montreal Protocol, the Kigali Amendment	Multilateral Fund for the Implementation of the Montreal Protocol (MLF)	2018-2020	United Nations Industrial Development Organization (UNIDO)	Ministry of Environment and Urbanization
N/A	Support Project for Economic Analysis for Combating Climate Change and Low Development in Turkey	European Union	2016-2017	N/A	WWF-Turkey, Yeryüzü Derneği (Earth Society), E3G

Table 8. 11 Relevant National Projects on the Socio-Economic Analysis of Climate Change and Intervention

Project No	Project Name	Sponsor/Recipient	Start Date-End Date
113Y040	Development of Ecosystem-Based Fisheries Management Options in Turkey's Seas	The Scientific and Technological Research Council of Turkey (TUBİTAK)	1.4.2014-1.4.2016
114K934	Global Climate Change and Emission Trading: Recommendations for Green Economy Design	The Scientific and Technological Research Council of Turkey (TUBİTAK)	15.4.2015-15.1.2017
114Y716	Investigation of Future Irrigation and Drinking Water Sufficiency Under Climate Change Scenarios: The Case of the Gediz Basin	The Scientific and Technological Research Council of Turkey (TUBİTAK)	1.1.2015-1.9.2016
114K934	Global Climate Change and Emission Trading: Recommendations for Green Economy Design	The Scientific and Technological Research Council of Turkey (TUBİTAK)	2014-2016

Table 8. 12 Relevant Thesis on the Socio-Economic Analysis of Climate Change and Intervention

End Date	Name of Thesis
2017	Securitization of climate change
2016	The impact of transnational municipal networks on climate policy-making: The case study of Gaziantep, Nilufer and Seferihisar municipalities
2016	Modeling temperature and pricing weather derivatives based on temperature
2016	A proposed model for understanding the impacts of climate change on tangible cultural heritage
2016	Future of Arctic maritime activities in the light of climate change
2015	Evaluation of the technical and economic aspects of solar photovoltaic plants which were built under different climate conditions and feed-in tariff zones
2015	The European Union as a distinctive actor in global climate change policy
2018	State responsibility for climate change
2018	Analysing of the effects of climate change on dairy farming in terms of economy and agricultural policy; Thrace region
2015	The importance of hegemony in global climate change regime
2015	Climate change action plans in Turkey and in the world
2017	Private sector responsibilities for climate change impacts on human rights
2017	Climate change: From a development problem to a security problem

8.3.5 RESEARCH AND DEVELOPMENT ON MITIGATION AND ADAPTATION

Table 8. 13 Relevant International Projects for Research and Development on Mitigation and Adaptation.

Code	Title	Sponsor/Recipient	Start Date -End Date	Coordinator	Involved Turkish Partner(s)
113M522	New Approaches and Methodologies to Reduce Energy Consumption and Greenhouse Gas Emissions on Transportation Networks	TUBİTAK/COAST	2013 / 2015	TUBİTAK	Sabanci University
CARMOF	CARMOF: New process for efficient CO2 capture by innovative adsorbents based on modified carbon nanotubes and MOF materials	H2020-NMBP-2017	2018-2021	AIMPLAS - Asociacion De Investigacion De Materiales Plasticos Y Conexas	Petkim Petrokimya Holding Incorporated Company
TR2013 / 0327.05.01-02 / 119	Decreasing of Carbon Emission Trough Forestation in Gaziantep	European Union	2013-2015	Ministry of Environment and Urbanisation	Gaziantep Metropolitan Municipality
TR2013 / 0327.05.01-02 / 042	Capacity Building for Climate Change Mitigation and Adaptation in Thrace Region	European Union	2013-2015	Ministry of Environment and Urbanization	Tekirdağ Metropolitan Municipality, Namık Kemal University
TR2013 / 0327.05.01-02 / 083	Water management modelling of Kızılırmak Delta Project within the scope of Samsun's Adaptation Process to Climate Change	European Union	2013-2014	Ministry of Environment and Urbanization	Samsun Metropolitan Municipality
TR2013 / 0327.05.01-02 / 114	Capacity Development for Future Builders	European Union	2013-2014	Ministry of Environment and Urbanization	Özyeğin University
TR2013 / 0327.05.01-02 / 006	Enhancement of High School Students' Knowledge Capacity and Awareness for Climate Change Mitigation by Sustainable Training in Niğde	European Union	2013-2014	Ministry of Environment and Urbanization	Niğde Ömer Halisdemir University
TR2013 / 0327.05.01-02 / 003	Climate Change Mitigation (CCM)-Muğla	European Union	2013-2014	Ministry of Environment and Urbanization	Muğla Metropolitan Municipality
TR2013 / 0327.05.01-02 / 028	Stand up to Climate Change	European Union	2013 - 2015	Ministry of Environment and Urbanization	Mersin Metropolitan Municipality, Mersin University
TR2013 / 0327.05.01-02 / 126	Mitigating climate change through the sustainable management of agricultural biodiversity (AgroCLIMA)	European Union	2013 - 2015	Ministry of Environment and Urbanization	Mersin Akdeniz Chamber of Agriculture, Organic Products Cluster Municipality of Toroslar
TR2013 / 0327.05.01-02 / 009	Climate Change and Mitigation Game for a Metropolis (CAMAPOLI)	European Union	2013-2014	Ministry of Environment and Urbanization	Istanbul Technical University, World Resources Institute Turkey- Sustainable Cities
TR2013 / 0327.05.01-02 / 025	Roof-top in Coastal Cities	European Union	2013-2014	Ministry of Environment and Urbanization	International Solar Energy Society Turkey Section, Municipality of Bodrum
TR2013 / 0327.05.01-02 / 057	Capacity Building in Climate Change Adaptation of Agriculture, Forestry, and Fisheries	European Union	2013-2014	Ministry of Environment and Urbanization	Fırat University
TR2013 / 0327 / 05.01-02 / 072	Climate Change Adaptation for the Sea and Coasts of Antalya	European Union	2013-2015	Ministry of Environment and Urbanization	Metropolitan Municipality of Antalya, Turkish Marine Research Foundation
TR2013 / 0327.05.01-02 / 059	Building Capacity on Vulnerabilities of Agricultural Sector to Climate Change in Turkey	European Union	2017-2019	Ministry of Environment and Urbanization	Ankara University Water Management Institute
N/A	Promoting Energy-Efficient Motors in Small and Medium Sized Enterprises in Turkey	Global Environment Facility (GEF).	2017-2021	Ministry of Industry and Technology)	United Nations Development Programme - Turkey
N/A	Developing a National Green OIZ Framework: Green Zones Turkey Project	World Bank Group	2017	Ministry of Industry and Technology	The Ministry of Industry and Technology Directorate General for Industry and Productivity
N/A	Adaptation of Mediterranean Forests to Climate Change	MAVA	2014-2015	Nature Conservation Center	WWF-Turkey, General Directorate of Forestry
N/A	Development of Turkey's Forest Carbon Standards for Combating Climate Change	British Embassy Welfare Fund	2014-2015	Nature Conservation Center	General Directorate of Forestry
N/A	Creating Carbon Certification System for Afforestation Areas in Turkey	British Embassy Welfare Fund	2013-2014	Nature Conservation Center	General Directorate of Forestry

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N/A	Preparation of Infrastructure for Turkey's Entry into Forest Carbon Markets	British Embassy Welfare Fund	2012-2013	Nature Conservation Center	General Directorate of Forestry
N/A	Determination of Climate Change Mitigation Potentials of Wetlands in Lake Yeniçağa (Bolu) and Akgöl (Konya)	GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit)	2012-2013	Nature Conservation Center	General Directorate of Forestry
N/A	Adaptation of Forest Ecosystems and Forestry to Climate Change in the Seyhan Basin	United Nations Development Program (UNDP)	2009-2010	Nature Conservation Center	General Directorate of Forestry
N/A	Agricultural Applications for the Adaptation of Steppe Ecosystems to Climate Change Project	FAO/ European Union	2018	N/A	General Directorate Agricultural Reform
N/A	Sustainable Land Management and Climate-Friendly Agriculture Project	GEF	2015-2018	N/A	General Directorate of Combating Desertification and Erosion and FAO
	Integrated Natural Resources Management Project in Drought-Prone and Salt-Affected Agricultural Landscapes in Central Asia and Turkey (CACILM II)	GEF	2017-2020	General Directorate of Combating Desertification and Erosion	Ministry of Agriculture and Forestry
	Decision Support for Mainstreaming and Scaling up of Sustainable Land Management Project (DS-SLM)	UNCCD-FAO	2018-2021	General Directorate of Combating Desertification and Erosion	Ministry of Agriculture and Forestry
	Contributing to Land Degradation Neutrality (LDN) Target Setting by Demonstrating the LDN Approach in the Upper Sakarya Basin for Scaling up at National Level	GEF			

Table 8. 14 Relevant International Projects for Research and Development on Mitigation and Adaptation.

Project No	Project Name	Sponsor/Recipient	Start Date-End Date
112Y096	Development of Climate Change-Ecosystem Services Software to Support Sustainable Land Planning Studies	The Scientific and Technological Research Council of Turkey (TUBİTAK)	2014-2018
111Y205	Removal of Broth Integrated with the Use of Microalgal and Anaerobic Microbial Cultures, Greenhouse Gas Mitigation, and Bio-Fuel and Bio-Product Output	The Scientific and Technological Research Council of Turkey (TUBİTAK)	15.5.2012-15.8.2015
115Y455	Investigation of the Biotechnological Evaluation of Gas Emissions in Petrochemical Industry	The Scientific and Technological Research Council of Turkey (TUBİTAK)	15.11.2015-15.11.2016
114M142	Investigation of Renewable Energy Potentials and Development of Sustainable Models with the Zero Waste Approach Within the Scope of Thermodynamics, Thermoeconomic Analysis and Optimizations of the Biodegradable Solid Waste Facilities	The Scientific and Technological Research Council of Turkey (TUBİTAK)	1.11.2014-1.11.2016
N/A	Preparation of the Drought Management Plan of the Eastern Mediterranean Basin Project -	General Directorate of Water Management	2016-2018
N/A	Preparation of the Drought Management Plan of the Little Menderes Basin Project -	General Directorate of Water Management	2016-2018
N/A	Preparation of the Drought Management Plan of the North Aegean Basin Project -	General Directorate of Water Management	2016-2018
N/A	Preparation of the Drought Management Plan of Lake Van Project -	General Directorate of Water Management	2016-2018
N/A	Preparation of the Drought Management Plan of the Antalya and Burdur Basins Project -	General Directorate of Water Management	2016-2018
N/A	Preparation of the Drought Management Plan of the West Mediterranean Basin Project -	General Directorate of Water Management	2016-2018
N/A	Preparation of the Drought Management Plan of the Euphrates-Tigris Basin Project -	General Directorate of Water Management	2017-2019
N/A	Preparation of the Drought Management Plan of the Seyhan Ceyhan Asi Basins Project -	General Directorate of Water Management	2017-2019
N/A	Preparation of the Flood Management Plans of the Ceyhan Basin Project -	General Directorate of Water Management	2015-2018
N/A	Preparation of the Flood Management Plans of the Susurluk Basin Project -	General Directorate of Water Management	2015-2018
N/A	Preparation of the Flood Management Plans of the Sakarya Basin Project -	General Directorate of Water Management	2015-2018
N/A	Preparation of the Flood Management Plans of the Kızılırmak Basin Project -	General Directorate of Water Management	2016-2019
N/A	Preparation of the Flood Management Plans of the Büyük Menderes and Akarçay Basin Project -	General Directorate of Water Management	2016-2019
N/A	Preparation of the Flood Management Plans of the Burdur and West Mediterranean Basin Project -	General Directorate of Water Management	2016-2019
N/A	Preparation of the Flood Management Plans of the Aras Basin Project -	General Directorate of Water Management	2016-2019
N/A	Preparation of the Flood Management Plans of the Western Black Sea Basin Project -	General Directorate of Water Management	2017-2019

N/A	Preparation of the Flood Management Plans of the Euphrates-Tigris Basin Project -	General Directorate of Water Management	2017-2020
N/A	Preparation of the Flood Management Plans of the North Aegean, Gediz, and Küçük Menderes Basin Project -	General Directorate of Water Management	2017-2019
N/A	Preparation of the Flood Management Plans of the Eastern Mediterranean Basin Project -	General Directorate of Water Management	2017-2019
N/A	Determination of the Impact of Climate Change on Snow Melt and Flow Project -	General Directorate of Water Management	2017-2019
N/A	National Water Information System Project -	General Directorate of Water Management	2012-2018
N/A	National Water Plan -	General Directorate of Water Management	2017-2018
N/A	Preparation of the Gediz River Basin Management Plan Project -	General Directorate of Water Management	2016-2018
N/A	Preparation of the Küçük Menderes River Basin Management Plan Project -	General Directorate of Water Management	2017-2019
N/A	Preparation of the North Aegean River Basin Management Plan Project -	General Directorate of Water Management	2017-2019
N/A	Preparation of the Burdur River Basin Management Plan Project -	General Directorate of Water Management	2017-2019
N/A	Development of Turkey's Groundwater Management Capacity Project -	General Directorate of Water Management	2016-2018
N/A	Impact of Climate Change on Water Resources Project	General Directorate of Water Management	2013-2016
N/A	Application of the Daily Maximum Total Load Approach in the Gediz Basin Project	General Directorate of Water Management	2015-2017
N/A	Project on Possibe Measures to Sustain Drinking Water in City Centers in Case of Drought	DSİ	2018-2019
N/A	Water Flux Projection and Basin Optimization Project (ATHOM)	DSİ-TÜBİTAK	2016-2019

Table 8. 15 Relevant International Projects Research and Development on Mitigation and Adaptation.

End Date	Name of Thesis
2016	Pre-service teachers' plausibility perceptions of global climate change: The role of cognitive, behavioral and personal variables
2016	Vulnerability of global primary food production against extreme climatic events in the context of food governance
2015	Climate change and urban resilience: Vulnerability and risk assessment for Istanbul
2016	An assessment of energy efficient and climate sensitive urban design principles: Design proposals for residential city blocks in temperate arid and hot humid regions
2016	Combating climate change: Critical evaluation of climate change action plans on urban scale

8.4 SYSTEMATIC OBSERVATION

8.4.1 ATMOSPHERIC CLIMATE MONITORING SYSTEMS

Nowadays, meteorological warnings have reached an important position to be able to take measures before and after the strong meteorological events and natural disasters with the meteorological character, the frequency of which is increasing, to minimize social and economic losses, to achieve maximum benefit from energy and water resources, and to facilitate the human life. Nowadays, it has become a necessity to use current monitoring systems more effectively and to increase the frequency of the observation network for the increase in the accuracy of these warnings and the earlier estimation of them.

TSMS is one of the leading institutions of Turkey regarding the use of common and up-to-date technology. Meteorological radars, automatic meteorology observation stations, upper atmosphere observation systems, lightning detection and tracking systems, meteorological satellites, satellite communication and ground receiving systems, high-performance supercomputer constitute the basic technological resources of the TSMS.

Meteorological studies require a strong communication infrastructure both on the national and global scale. Countries share their observation and measurement data with other countries. The TSMS collects, produces and distributes meteorological observation and measurement data in accordance with its national usage and international responsibilities through its strong communication infrastructure.

Along with the state-of-the-art observation systems that have become widespread across the country and allow observations to be made automatically with electronic devices, faster, more accurate, continuous and timely observation data are obtained and presented to users (TSMS, 2018e).a).

8.4.1.1 Atmospheric Climate Observing System, including those measuring atmospheric constituents

The only competent authority to make atmospheric measurements in Turkey is the TSMS. The TSMS's observation network consists of meteorological radars, automatic meteorology observation stations, upper atmosphere observation systems, lightning detection and tracking systems, meteorological satellites, satellite communication and ground receiving systems. The TSMS has been organized across the country with 15 regional directorates (Figure 8.3). The observation network connected to these regional directorates is presented in Table 8.16.

Figure 8. 3 Distribution of the TSMS's regional directorates

Table 8. 16 Types of stations connected to the regional directorates

Directorate	AWOS	A-AWOS	Mobil AWOS	M-AWOS	RADAR	Mobil RADAR	Marine RADAR	Rawinsonde	Mobil Rawinsonde	Lightning Detection and Tracking System	Total
Region 1 Istanbul	111	5		12	2	1	2	1		2	136
Region 2 Izmir	102	7	1	23	2			1		3	139
Region 3 Eskişehir	49	5	1							2	57
Region 4 Antalya	75	4		12	2			1		5	99
Region 5 Afyonkarahisar	45	3			1					2	51
Region 6 Adana	73	3	1	5	2			1		4	89
Region 7 Kayseri	63	3			1			1		2	70
Region 8 Konya	50	1			1					2	54
Region 9 Ankara	89	5		3	2			1	1	3	104
Region 10 Samsun	98	4	1	6	1			1		3	114
Region 11 Trabzon	66	1		7	1					1	76
Region 12 Erzurum	61	4	1		1			1		4	72
Region 13 Elazığ	58	3	2							1	64
Region 14 Van	28	1		3						3	35
Region 15 Diyarbakır	62	4	1		1			1		4	73
Total	1.030	53	8	71	17	1	2	9	1	41	1233

Meteorological studies require a strong communication infrastructure both on the national and global scale. Countries share their observation and measurement data with other countries. The TSMS collects, produces and distributes meteorological observation and measurement data in accordance with its national usage and international responsibilities through its strong communication infrastructure.

The TSMS in Turkey cooperates with the WMO (World Meteorological Organization), of which it is a member. Through this international partnership, the TSMS is actively involved in all WMO programs. Some of these programs can be listed as the Global Observation System (GOS), the Global Climate Observation System (GCOS), Surface Radiation Network (SRN) and Global Atmospheric Watch (GAW). The Global Observation System consists of the combination of surface

observations, marine observations, high-level observations, and observations made by air vehicles, satellites, and radars. Essentially, the GOS has been designed to combine international data collection systems developed internationally and separately (such as Global Upper Atmosphere Observation Systems, Global Climate Observation Systems, Global Synoptic Observation Systems, etc.). The TSMS shares internationally the airport observations (73 stations), upper atmosphere observations (6 stations), climatic observations (GCOS 7 stations and Regional Basic Climate Network 61 stations), synoptic observations (Regional Basic Synoptic Network 74 stations) and ozone observations (GAW 1 station) on behalf of Turkey. In total, the number of stations sharing data internationally (some stations share more than one data) is 148 (WMO WIGOS OSCAR). The GCOS consists of surface network and upper atmosphere network. The stations in GCOS are similar to the stations in GOS. 7 stations from Turkey (Rize, Istanbul, Kastamonu, Sivas, Van, Isparta, Finike) are GCOS stations (Figure 8.4).

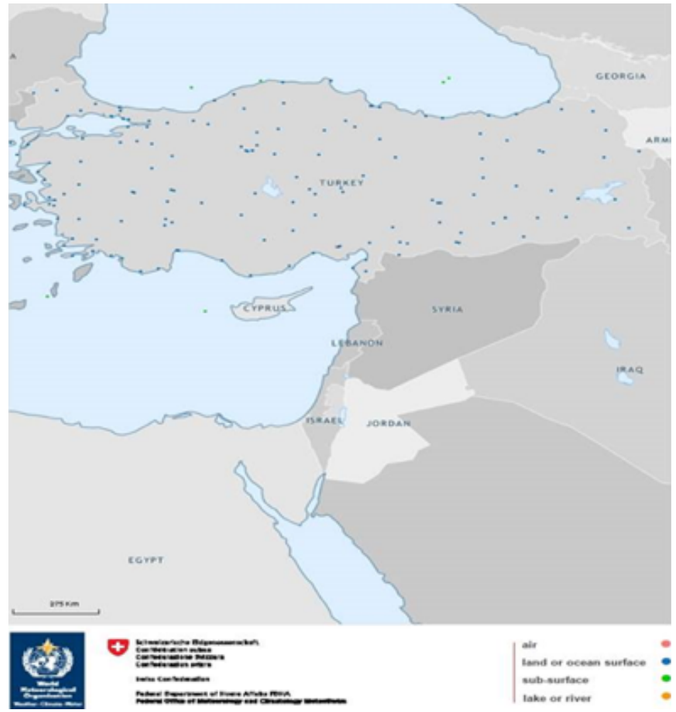

Figure 8. 4 TSMS's international roaming data sharing stations (WMO WIGOS OSCAR)

The World Meteorological Organization Global Climate Observation System has regarded precipitable water vapour (PWV) values obtained by the Global Navigation Satellite Systems (GNSS) as one of the Basic Climate Variables and indicated that pilot balloons and ground-based profile creators provide auxiliary wind information and that the calculation of net water vapor content without delay in receiving GNSS signals, with ground-based receivers and other ground-based remote sensing forms plays an important and growing role (WMO, GCOS, 2016).

In G26 action, the World Meteorological Organization Combined Global Observing System has projected to obtain more benefits from existing GNSS receiver stations by establishing collaborative arrangements with station owners and operators to access and share real-time data for obtaining meteorological or ionospheric data (Zenith Total Delay (ZTD) or Integrated Water Vapour (IWV), Total Electron Content (TEC) (WMO WIGOS, 2013). The Turkish. National Permanent GPS Network (TNPGN) Project conducted a project entitled the "Turkish National Permanent

GPS Network" (TNPGN-ACTIVE (CORS-TR)) for the General Directorate of Land Registry and Cadastre and the General Command of Mapping by Istanbul Kültür University between May 2006 and May 2010. Since 2009, it has spread throughout Turkey, and Turkish Republic of Northern Cyprus (TRNC) (4 points in the TRNC) Turkish National GNSS Network-Active (TNPGN-Active) started to work with 146 permanent stations. The system is developing and growing in parallel with the developing technology with each passing day. It provides an opportunity and contributes to many scientific studies, especially modeling the atmosphere and ionosphere in the region where Turkey is located, more reliable meteorological forecasts and signals, communication. Precipitable water vapor products are produced as a by-product of measurements.

8.4.1.1.1 Automatic Weather Observation Station (AWOS)

Turkey has been continuously improving the observation network since 1929 when planned observations began to be made. The number of systems in the observation network reached 1.030 along with the new systems put into service in 2017 for the purpose of presenting instant weather information to the user, preparing the forecasts, increasing consistency in forecasts and verifying the forecasts made, carrying out many research activities, including climate and climate change, and preparing the meteorological products and services needed by various sectors (Figure 8.5) (TSMS 2018b).

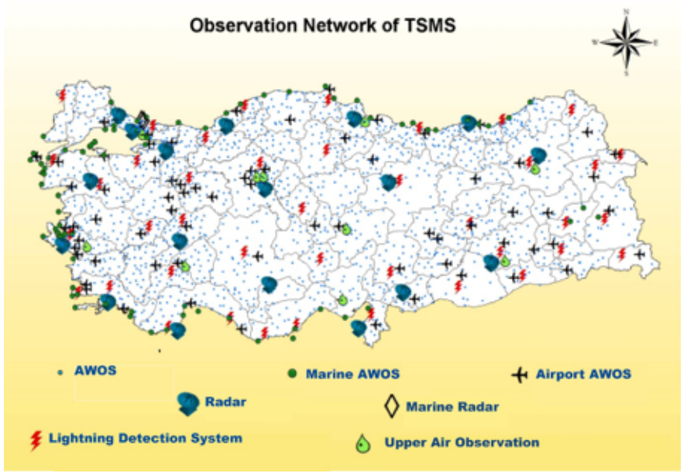

Figure 8. 5 2017 TSMS Observation Systems

8.4.1.1.2 Airport Automatic Weather Observation Station (A-AWOS)

It is used to prepare meteorological products and services needed for aviation at airports and indispensable for flight safety. As of the end of 2017, observation data are obtained from the A-AWOSs (53) and Mobil AWOS (8) installed at 61 airports (Figure 8.5).

8.4.1.1.3 Marine Automatic Weather Observation Station (M-AWOS)

Temperature, humidity, wind direction and speed, precipitation, and seawater temperature measurements are performed in 71 M-AWOS systems that are located in the places where lighthouses are located and on buoys for the purpose of obtaining meteorological data in the seas to support maritime activities and preparing meteorological products and services for the maritime industry. Furthermore, there are wave-meter, flow meter, salinity and conductivity detectors, as well as meteorological parameters, on 5 meteorological observation buoys (Figure 8.5, Table 8.16).

8.4.1.1.4 Upper Atmosphere Observation Systems (Rawinsonde)

Upper atmosphere observation systems are used for obtaining height data of temperature, humidity, wind and pressure levels in the atmosphere up to 35 km above ground level for the purpose of ensuring the acquisition of upper atmosphere data required for presenting meteorological products and services, which are of vital importance for the preparation of weather forecasts and flight safety. As of the end of 2017, upper atmosphere observations are performed at 9 stations (Adana, Ankara, Diyarbakır, Erzurum, Isparta, Istanbul, Izmir, Samsun and Kayseri). In addition, one mobile system can be used to perform upper atmosphere observations in any area required (TSMS, 2018f)

8.4.1.1.5 Lightning Detection and Tracking System

The Lightning Detection and Tracking System (LDTS) is used for detection, tracking of lightning and thunderbolt phenomena and short-term weather forecasts (Nowcasting). The location, type, polarity and signal size of lightning and thunderbolt, and lightning height data can be obtained with this system. The TSMS can currently observe lightning with LDTS installed at 41 points (Figure 8.5)

8.4.1.1.6 Meteorology Radars

A meteorology radar is an active remote sensing system which can determine the density, position, direction and speed of movement of air masses and enables to obtain data that will contribute to making estimates about them. It is possible to obtain data for many meteorological studies, especially short-term weather forecasts, from radars, which are the most important meteorological observation systems, in terms of making high resolution meteorological observations on a large scale and obtaining data needed by weather forecasting models. The TSMS currently operates a radar network consisting of 17 C-Band (Ankara, Istanbul, Balıkesir, Zonguldak, Izmir, Muğla, Antalya, Hatay, Samsun, Trabzon, Afyonkarahisar, Bursa, Karaman, Gaziantep, Şanlıurfa Erzurum and Sivas) and 1 X-Band (Istanbul Atatürk Airport) meteorology radars (TSMS, 2018f) (Figure 8.5)

8.4.1.1.7 Marine Radars

It is used to measure the information about the waves, winds, and currents in our seas in a wide area by the remote sensing method. The TSMS currently operates 2 Marine Radars. As of October 2015, Marine Radar products were made available to all users on the web page of the institution. From these systems, data on current velocity and direction, wave height and direction, wind speed and direction are obtained every half hour.

8.4.1.1.8 Meteorological Satellite Ground Receiver Systems

In 1984, the TSMS joined the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT) as a founding member. The TSMS receives real-time and near real-time data from 4 geostationary orbit satellites and 2 polar orbit satellites belonging to the EUMETSAT.

8.4.1.1.9 Ozone Measurement

Total ozone measurements are made with the Brewer Spectrophotometer device installed in the TSMS. The results are sent to the World Ozone and Ultraviolet Radiation Data Centre (WOUDC) and published.

8.4.1.1.10 Acid Rains and Air Pollution

The samples coming from the Automatic Precipitation Collecting Systems located in 10 different regions of Turkey are analyzed in the Acid Rain Laboratory in terms of acidity (pH), electrical conductivity, and metal analyses, anion and cation analyses are conducted, and transboundary pollution transportation is detected.

Air pollution became a phenomenon that started to constitute a problem for the world along with the beginning of the industrial revolution. The industrial revolution also increased urbanization and the rate of fuel usage which causes an increase in carbon emissions. Increased emissions have caused some harmful consequences for people and the environment. Air quality monitoring networks have been established in Turkey and in many countries to reduce these harmful consequences and to monitor emission rates. For this purpose, 220 air quality measuring stations have been established in Turkey by the institutions such the Ministry of Environment and Urbanization, municipalities, and

Organized Industrial Zones. Sulphur dioxide (SO_2) and Particulate Matter (PM10) parameters, and in addition to these, Nitrous oxides (NO, NO_2, NOx), Carbon monoxides (CO) and Ozone (O3) are also measured at stations. All data are sent to and collected by the Data Operation Center of Environmental Reference Laboratory affiliated to the Ministry. This data are available to users at "http:// .havaizleme.gov.tr/Default.ltr.aspx.

8.4.1.1.11 Hydrometeorological Observation System

State Hydraulic Works (DSİ), which performs terrestrial observations and is also the largest organization responsible for supervision, performs the observations carried out in rivers and lakes.

State Hydraulic Works (DSİ) observation stations have been built and installed in 25 basins, which conduct hydrometrical and hydrometeorological observations and observe sedimentatation, snow, water quality and quantity. The number of active stations are given in the table below:

Table 8. 17 Types and number of observation stations installed by State Hydraulic Works[39]

Type of Station	Number of Station	Number of On-line Station
Flow Monitoring Station	1353	855
Lake Monitoring Stations	120	59
Meteorological Monitoring Station	156	
Snow Observation Station	261	35
Sediment Intake Point	155	
Flowmeter		7
Water Quality	1147	
TOTAL	2045	956

Approximately 25% of Turkey's power generation is obtained from hydraulic sources. In this context, accurate water flow estimates for hydraulic sources and the efficient operation of cascade hydroelectric power plants are extremely important.

The fact that water is disposed without getting its energy as a result of failure to accurately predict the water that will come to the basins and failure to operate the plants optimally for various reasons or electricity generation with imported resources although there is water lead to significant financial losses. Furthermore, problems, such as forcing dams due to instant floods, and the occurrence of floods due to the forced opening of the dam shutters, are also encountered.

With the Flow Estimation and Basin Optimization Model Project to be conducted between DSİ and TÜBİTAK Marmara Research Center, it is aimed to estimate the current to single and sequential water structures and accordingly to prepare the water budgets of storage facilities, and to develop a model that will enable the operation of the facilities on a daily, monthly and annual basis (DSİ 2017).

Thus, it will be ensured that water resources for irrigation and drinking water will be checked optimally and water will not be wasted, the dams will be operated in a way to maximize the hydraulic electric power generation, and the risks that may occur during the flood season can be estimated by means of an automatic system to be developed.

8.4.1.1.12 Calibration Center (KALMER)

The Calibration Center consists of precipitation, global radiation, wind direction and electrical calibration laboratories, which are monitored by the temperature, humidity, pressure and wind speed calibration laboratories accredited by the Turkish Accreditation Agency (TÜRKAK). KALMER also performs calibration requests from all public and private sectors, as well as the calibrations of AWOS sensors included in the meteorological observation network (TSMS, 2018f).

39 State Hydraulic Works, 2018

8.4.1.2 Forecasts and Meteorological Warning Models

The TSMS is a member of organizations that support studies on global climate change. These organizations are as follows:

- World Meteorological Organization - WMO,
- European Centre for Medium-Range Weather Forecasts - ECMWF,
- European Organization for the Exploitation of Meteorological Satellites - EUMETSAT,
- Aire Limite Adaptation Dynamique Développement InterNational - ALADIN

It uses the ECMWF's Global ECMWF-IFS and ECMWF-EPS models (regional scale reduction is performed with WRF, MM5, LAEF, METU-3, WW3 models), and the global ARPEGE model of the ALADIN consortium (regional scale reduction is performed with ALARO and AROME models) for weather and marine forecasts.

High-performance computer systems with 512+256 cores are used in order to run forecast models required for increasing consistency rates in weather forecasts and early warnings, and high-performance computers with 80 cores are used for climate studies. The high-performance computer system with 512 cores has a capacity of approximately 3.4 trillion operations per second.

8.4.1.2.1 Flood Forecast (Flash Flood Guidance System (FFGS) Model

The TSMS provides its flood forecasts nationally and internationally within the scope of the "Flash Flood Guidance System." The Flash Flood Guidance Model is used to determine basins that will be exposed to flood 6 hours in advance on the sub-basin scale, and flood warnings are made. Using the Flash Flood Guidance Model, it is ensured that basins which will be exposed to flood are determined 6 hours in advance on the sub-basin scale, and necessary warnings are communicated to those concerned.

8.4.1.2.2 Road Forecasting System

It is a web-based information presentation service which has been developed within the TSMS to help plan travels and contribute to safe travel. The Road Forecasting System delivers interprovincial weather forecasts up to 72 hours to users on the basis of the ALADIN modeling system. With the Road Weather Forecasting System covering all of the important main lines of our highway network, pointwise meteorological forecast information on the route can be accessed via the internet.

8.4.1.2.3 Agricultural Frost Warning System (AFWS) and Frost Risk Forecast Maps

Using the latest data every day, the TSMS's website provides frost risk forecast maps and Agricultural Frost Warning System (AFWS) to its users. Agricultural frost risk forecast maps are published on the TSMS website every day of the week, using meteorological forecasts and showing the areas with mild, moderate, strong and very strong frost risks for the next 4 days in different colors on the map.

Another study of the TSMS, the AFWS provides information on the basis of the province/district where users are located, using the daily values by means of the program. After selecting the province and district information, and then the plant and the stage of growth in the program, the program automatically displays the critical temperature, the frost risk and the expected minimum temperatures in the next 4 days for the desired region and plant, based on the results of the studies conducted in the UN Food and Agriculture Organization (FAO) and in Turkey. In this way, in order to predetermine the frosts, which cause large losses in agriculture, producers who receive frost forecasts during the critical seasons of the year and especially for certain regions where frost sensitive species are cultivated can take the necessary precautions in time (TSMS, 2018f).

8.4.1.2.4 Drought Analyses

The TSMS conducts drought analysis using the Standardized Precipitation Index (SPI) and Percent of Normal Index (PNI) method, and the severity of dry and wet periods is determined. The Drought Monitoring System (DMS) software enables meteorological drought pheNomena to be analyzed and monitored on a monthly or yearly basis over long or different periods.

8.4.1.2.5 Distribution of Solar Radiation in Turkey

The Solar Radiation Distribution maps of Turkey have been obtained with the "Solar Radiation Model" developed within the TSMS. In the study, data are produced with a satellite-based semi-dynamic model. For the 3610 grid points of Turkey, a data archive with 20-km resolution has been created for the years 2004-2017 with the model outputs produced daily. For Turkey, the areal average of the solar radiation intensity has been calculated as 1635 kWh/m2/year. The accuracies of the calculated solar radiation data were tested using the measurements obtained from the 54 ground observation stations. As a result of the statistical evaluation, it has been determined that the model outputs are 98% reliable on average. The Solar Radiation Distribution Maps of Turkey are published in the Analysis section on the website of the TSMS in the form of Global Solar Radiation Distributions throughout the country and on the basis of geographical regions, seasons and provinces.

8.4.1.2.6 Inversion Forecast Model

With the "Inversion Intensity Forecast for Urban Air Pollution Risk" study conducted by the TSMS, in the provincial and district centers, it is aimed to make the Inversion Intensity Forecasts for the risk of air pollution especially in the winter season by announcing it to the public on the TSMS's website, and to ensure necessary precautions by the related institutions and organizations.

8.4.1.2.7 Dust Transport Forecast

The "Sand and Dust Storm Forecasting Model (BSC-DREAM8b)" developed by the Barcelona Supercomputing Center has been operationally run on the computers of the TSMS since July 2010 within the scope of the EU Technical Assistance and Information Exchange Program (TAIEX). With this model, 72-hour forecasts are produced operationally and published daily on the internet. Furthermore, pointwise forecasts are produced on the basis of provinces with the "Dust Transport Warning System," and they have been presented to users on the internet since 2012. In accordance with the "Action Plan for Cooperation in the Field of Environment and Meteorology" signed between Turkey, Iran, Iraq, Syria, and Qatar in 2010, the "Sand and Dust Storms Virtual Forecasting Center" was established within the TSMS. By means of the Virtual Forecasting Center, which was put into operation in 2012, 72-hour dust transport forecasts are produced operationally for the countries in the Middle East and North Africa.

8.4.1.2.8 UV Index and Ozone Forecast Global Model (GME-Global Model)

Within the framework of Total Ozone and UV Index forecast studies, the results of the German Meteorological Organization (DWD) Global Model (GME-Global Model) are published as daily forecasts on the TSMS's internet page. The TSMS-Statistical Model "Three-Day Total Ozone and UV Index Forecast" results developed for Ankara within the scope of the TÜBİTAK Project are published as daily forecasts on our organization's internet page.

8.4.1.2.9 Avalanche Forecast and Early Warning Model

Using the ECMWF forecast model outputs, models have been developed, and experimental studies have been initiated to predetermine the areas where avalanches can be observed and to warn the relevant sectors. They are published as daily forecasts on the TSMS's internet page.

8.4.1.2.10 Meteorological Early Warning System for Forest Fires (MEWS)

The Meteorological Early Warning System for Forest Fires (MEWS) has been developed for meteorological purposes in order to initiate the establishment of a sensitive system suitable for the conditions of Turkey in preventing forest fires. As a result of evaluating the data obtained from the European Center for Medium-Range Weather Forecasts (ECMWF) with the MEWS and Angstrom index, risky places are displayed on the map, and three-day risk maps are prepared. The three-day forest fire risk maps prepared with the MEWS and ANGSTROM index model outputs for forest fires within the scope of duties, authorities, and responsibilities of the TSMS and the desired meteorological observation data and forecasts are shared on the TSMS's internet page and with the General Directorate of Forestry (GDF).

8.4.1.2.11 Sea Route Forecasting System

This system, developed by the TSMS, is an interactive application in which the METU-3 wave model and the WRF weather forecast model are used together. Users can easily reach the expected weather and marine conditions during their travel by selecting the desired route of travel in the Black Sea, Mediterranean, Aegean, Marmara and Caspian seas. In addition, it is possible to reach the expected weather and marine forecasts for any desired point for 5 days. In this system, it is possible to reach 5-day weather and marine forecasts for more than 200 domestic and foreign marinas/ports in all seas in the system.

8.4.1.2.12 Marina Forecasting System

This application has been developed considering the increasing yacht tourism in recent years. The purpose of establishing the Marina Forecasting System is to support the yacht and coastal tourism in the coastal regions and to present all the meteorological forecasts needed in these regions together.

8.4.1.2.13 Preparation and Presentation of Meteorological Warnings

They are communicated by the TSMS through the adversities (life and economic losses, transportation, tourism, health, construction, environment, training, etc. sectoral activities and participation in the connections and broadcasts of radio institutions, etc.) caused by strong meteorological phenomena. In order to minimize the adversities in daily life and to ensure necessary measures by the relevant and competent institutions in a timely manner, the meteorological warnings prepared before strong meteorological phenomena are communicated to the AFAD units, media organizations, local and administrative units, relevant public institutions and organizations, and citizens through the available means of communication (such as SMS, telephone, fax, e-mail, TSMS Website, Voice of Meteorology Radio (Meteorolojinin Sesi Radyosu) and participation in the connections and broadcasts of national television and radio organizations, etc.).

The short and medium-term weather forecasts prepared by the TSMS are presented to the public daily (in 3-hour periods) and in 5-day and 7-day periods, and long-term weather forecasts are presented monthly (weekly periods) and seasonally (3 months). While the consistency average of long-year precipitation forecasting was 85%, the consistency of 2016 and 2017 was 92.3%. While the consistency average of long-year precipitation forecasting was 82.4%, it was 86% in 2016 and 85.4% in 2017 (TSMS, 2018g).

8.4.1.2.14 Obtaining, Archiving and Presentation of Meteorological Observation and Measurement Data

The observation and measurement studies constitute the basis of meteorological activities. The data obtained from the observations and measurements are collected very quickly and automatically in the center of the TSMS, and they are instantly sent from there to the country and abroad. Similarly, all observations, measurements, and forecasting data are also obtained instantly from abroad. The collection and global distribution of all data and the redistribution of the data by obtaining it from the global distribution to the country are conducted in such a short period of time which can be expressed in minutes.

Meteorological measurement and observation data sources consist of Automatic Meteorology Observation Stations, Upper Atmosphere Observation Systems, Meteorology Radars, Marine Radars, Lightning Detection and Tracking System and Meteorological Satellites. Some observation data (cloud cover, type and severity of precipitation, ground condition, etc.) that cannot be obtained through automatic systems are added to the information received from these sources by providing it from the observations made by the experts working in meteorological units. The measurement and observation data are then transmitted to the domestic observation and forecasting units through the servers located at the center of the TSMS, and the data obtained from the domestic observation points are also distributed to the whole world through the same server.

All meteorological measurements and observation data obtained from the observation network are archived in the electronic media (databases) at the center of the TSMS.

The access to the archived data and the presentation and sale of the archive data in electronic format in the desired file format are performed with a user-based MEVBİS (Meteorological Data Information Presentation and Sales System) interface. With this interface, ground observations involving archive data (Temperature, Humidity, Air Pressure,

Precipitation, Wind, Meteorological Incident, Sun, Snow Parameters), upper atmosphere observations, Marine observations, Lightning Detection system records, Upper observations, precipitation intensity analysis data, climate bulletin including all parameters for long years, and data on climate projection are presented online within the framework of user authority (TSMS, 2018e).

8.4.2 OCEAN CLIMATE MONITORING SYSTEMS;

Middle East Technical University-Institute of Marine Sciences (METU-IMS) has been carrying out oceanographic and climatologic research for 40 years in the Mediterranean, Marmara and Black Seas. METU-IMS is the coordinator of Marine Ecosystem and Climate Research Center (DEKOSIM), established in 2012 by the support of the Ministry of Development.

DEKOSIM aims to increase the long-term and continuous observation capacity in the Turkish seas and to use the data obtained from these in deriving climate and ecosystem-relevant data products for the use of public and private end users and stakeholders in marine, maritime and climate change sectors (ODTÜ 2012).

METU-IMS research covers a variety of topics; marine ecosystems, descriptive physical oceanography, biogeochemical dynamics, modelling of ocean physics and ecosystem dynamics and biogeochemical cycles. Recent projects have focused more on climate change and anthropogenic induced dramatic changes in marine ecosystems and the feedback of these changes to the regional climate. Moreover, capacity development for direct measurements of climate-relevant greenhouse gases such as carbon dioxide has been complete, and first air-sea carbon dioxide fluxes will be measured for the Eastern Mediterranean as a part of DEKOSIM.

8.4.3 SEA LEVEL OBSERVATION SYSTEMS

Oceanographic observations are being done mainly by marine sciences institutes and the General Command of Mapping in Turkey.

Many coastal countries on a local scale establish and operate their own national sea level observation networks and provide support to global/regional networks under various programs and projects. In Turkey, sea level observations are made by the General Command of Mapping (http://www.hgk.msb.gov.tr/) within the scope of the Turkish National Sea Level Monitoring Network (TUDES) project. The Monitoring Network consists of a total of 20 digital and automatic mareograph stations that are distributed over Turkey and TRNC coasts and meet the GLOSS standards (Figure 8.6).

Besides the measurements of sea level, meteorological parameters such as temperature, humidity, and pressure is also stored at those sites. The data are then transmitted as 15-minute mean values to the data/processing center in Ankara.

Also, via TUDES Web portal, accessing sea level data at the local datum of each station has been made freely available to users (tudes.hgk.msb.gov.tr/tudesportal). Users can also reach the sea level data at the national height datum after paying a standard annual subscription fee.

There are 20 automatic tide gauge (mareograph) stations in the National Sea Level Measurement Network in Turkey (Simav et al., 2011). Stations are being upgraded and changed from acoustic sensors that have sounding tubes to radar.

Besides the measurements of sea level, meteorological parameters such as temperature, humidity, and pressure are also stored at those sites. The data are then transmitted in 15-minute intervals to the data/processing center in Ankara.

Figure 8. 6 Turkish National Sea Level Monitoring Network (TUDES) stations

Sea level observations are carried out by the General Command of Mapping. Sea level data from seven tide gauge stations operated by the General Command of Mapping are instantaneously transmitted to Boğaziçi University Kandilli Observatory and Earthquake Research Institute via satellite connection. Kandilli Regional Earthquake and Tsunami Monitoring Center is the 24/7 operational National Tsunami Warning Centre for Turkey under the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-eastern Atlantic, the Mediterranean and connected seas (ICG/NEAMTWS) initiative.

METU-IMS has established long-term marine observation systems in the Mediterranean and Black Seas within the scope of the DEKOSIM project. The long-term monitoring systems consist of the deployment of 4 Argo floats in the Black Sea and 2 Argo floats in the Eastern Mediterranean, one coastal mooring system in the Eastern Mediterranean with both surface and underwater sensors to obtain continuous oceanographic, meteorological and atmospheric measurements in the Eastern Mediterranean, as well as an oceanographic time series program (Erdemli Time Series - ETS) that has been operating since 1997. Within the ETS, the physical and biochemical parameters of the water column are measured monthly at 3 stations. The obtained data are analyzed to understand the long-term variability in the region, including the climatic variability. METU-IMS is a member of many international Global Ocean Observation System (GOOS) organizations such as EuroGOOS, MonGOOS, and Euro-Argo Program.

8.4.4 CRYOSPHERE OBSERVATION

Although the Republic of Turkey made the first formal attempts in relation to Antarctica by becoming a party to the Antarctic Treaty in 1995, which froze the claims of states, it is known that Turkish scientists have been conducting scientific studies in the region since 1967 and even the Piri Reis Map of 1513 shows the territories closest to Antarctica by drawing the southernmost regions of South America. The Republic of Turkey did not participate in the Antarctic Treaty Consultative Meeting until 2013, but in 2013 it participated with individual initiatives. The Antarctic Treaty has 53 parties, of which 29 have the right to vote in decisions taken in the status of the Consultative Countries. The first institutional initiative in polar sciences was started by Istanbul Technical University (ITU) in 2014, and the ITU Polar Research Center (PolReC) was established with the By-Law published in the Official Gazette on January 17, 2015. There are 97 facilities that belong to 30 countries in Antarctica. By 2017, the number of our scientists involved in individual initiatives and studies at foreign scientific bases is about 40. Within the framework of the Turkish Antarctic Research Expedition 2016 organized in cooperation with the National Antarctic Science Center of Ukraine in 2016 under the leadership of ITU PolReC, 13 Turkish scientists carried out the first interdisciplinary international (with the collaboration of Ukraine and Turkey) Antarctic scientific expedition. Participants from the Presidency, Ministry of Foreign Affairs, Ministry of Environment and Urbanization, TÜBİTAK, ITU PolReC, and participants from various universities represented the Republic of Turkey at the 2016 Antarctic Treaty Consultative Meeting (ATCM). In the same year, the application package prepared by ITU PolReC and TÜBİTAK was presented together with the Presidential Representative at the biennial of the Scientific Committee on Antarctic Research in Kuala Lumpur, and the Republic

of Turkey became a member of the Scientific Committee on Antarctic Research (SCAR). The studies taken under the Republic of Turkey presidency in 2017 are carried out under the responsibility of the Ministry of Industry and Technology (former Ministry of Science, Industry and Technology) and under the coordination of ITU PolReC. All necessary studies have been planned by the Ministry of Industry and Technology in order to carry out polar studies with systematic integrity and involvement and sense of ownership at the national level, and they have been started under the name of "Antarctica Project." It is kNown that scientific studies on the Arctic zone were started by Turkish scientists in the 2000s. As the Republic of Turkey, the first initiative related to the Arctic zone was made by applying to the Arctic Council in 2015 under the leadership of the Ministry of Foreign Affairs and with the support of ITU PolReC. As of December 2017, the result of the application was not announced.

The studies and the activities carried out to date within the scope of the Antarctica Project are summarized below:

• The approval process of the Madrid Protocol in the Turkish Grand National Assembly was coordinated and entered into force with the publication in the Official Gazette dated May 24, 2017 and numbered 30075.

• During the period of February-April 2017, necessary coordination and financing were provided at the national and international levels for the realization of the National Antarctic Science Expedition-I, and the first expedition was successfully completed.

• The participation at the national level was provided in the ATCM 40th meeting hosted by the People's Republic of China between May 22 and June 1, 2017 and the CEP 20th meeting with a delegation under the presidency of the Ministry of Science and Technology. The information notes for the national expedition of the Republic of Turkey and scientific initiatives it made were presented for the first time by Turkey at this meeting.

• The planning studies of the National Antarctic Science Expedition-II and the preparation studies of the National Polar Science Program have been carried out in coordination with Istanbul Technical University.

• Within the scope of the bilateral cooperation, preparations for the memorandum of understanding with Ukraine and Chile have been brought to a conclusion stage, and the necessary procedures for the participation of 8 Turkish scientists in international projects in the 2017-2018 Antarctic season have been completed.

• Following the National Antarctic Science Expedition-I, the National Polar Science Workshop and workshops with Chile and Bulgaria were organized with the contributions of the persons and institutions.

The main heading of Physical Sciences, which cover a variety of study fields such as the atmosphere and sea ice that are directly linked to the "Global Climate Change," also includes sky studies. Within the scope of Physical Sciences, it is aimed to carry out scientific studies in the following fields:

• Applied Physical Sciences and Innovative Technologies

• Atmosphere and Climate Research

• Modeling Studies

• Pointwise and Moving Observation Systems

• Sea Ice Processes

• Astronomy and Astrophysics (TÜBİTAK 2017b)

8.5 OTHER ACTIONS TAKEN TO SUPPORT RELATED CAPACITY-BUILDING IN DEVELOPING COUNTRIES

8.5.1 Meteorological Communication and Applications Package (METCAPPLUS)

It is a software package developed by the TSMS experts to provide communication between different forecasting centers and to facilitate the preparation of various meteorological cards, maps, and graphs. It consists of various modules such as communication, data management, meteorological maps, satellite and radar products, preparation of flight path documents developed for meteorological applications. METCAPPLUS is also used in Azerbaijan, Yemen, Georgia and the Turkish Republic of Northern Cyprus (TSMS, 2018f).

8.5.2 Flash Flood Guidance System (FFGS) Model

At the 15th Congress of the World Meteorological Organization in 2007, it was decided to establish Flash Flood Guidance Systems worldwide. The project is being implemented in cooperation with the WMO Commissions for Hydrology and Basic Systems, the United States National Oceanic and Atmospheric Administration (NOAA) and the United States Hydrologic Research Center (HRC). Bosnia and Herzegovina, Romania, Serbia, Croatia, Montenegro, Moldova, Slovenia, Macedonia, and Albania were determined as the countries that would participate in the initial phase of the Southeast European Countries Guidance Project. At the meeting, Turkey was selected as the regional center. The TSMS provides service internationally within the scope of the Flash Flood Guidance System.

8.5.3 Eastern Mediterranean Climate Center Studies

The TSMS serves as the Eastern Mediterranean Climate Center (EMCC) in the 6th Region (Europe) Regional Climate Centers (RCC) network of the World Meteorological Organization (WMO). In this center, the TSMS provides monthly climate monitoring, seasonal forecasting and data products for Greece, Turkey, Syria, Lebanon, Jordan, Israel, Palestine, Egypt, Southern Cyprus and the Turkish Republic of Northern Cyprus that are located in the Eastern Mediterranean from its address http://emcc.mgm.gov.tr (Figure 8.7). According to a survey conducted by the WMO with this variety of the TSMS climate services, it has become one of the countries providing full climate services.

In order to strengthen its services and products on climate change internationally, the Turkish State Meteorological Service (TSMS) serves as the Eastern Mediterranean Climate Center under the Regional Climate Center (RCC), which is run by the World Meteorological Organization internationally for the 6th Region Organization (TSMS, 2018f).

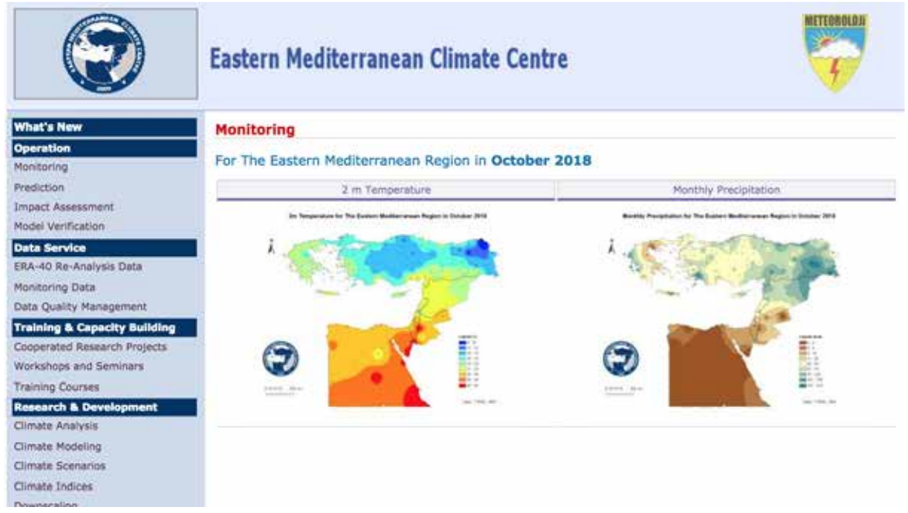

Figure 8. 7 Eastern Mediterranean Climate Center Products

8.5.4 World Meteorological Organization (WMO) Regional Training Center (RTC)

Turkey was recognized as the Regional Training Center (RTC) of the WMO in 2001. Main fuctions of the RTC includes organization of training, seminars, and conferences regarding the meteorology and related fields at the national and international levels.

The TSMS currently has three Regional Training Centers in Ankara, Istanbul, and Alanya. Since 2001, the TSMS has organized more than 100 certified training programs and trained more than 1000 international participants.

At the RTC, meteorological training is conducted on the subjects of AWOS, Upper Atmosphere Observation Systems, Calibration, Radar and Satellite Meteorology, Aviation and Satellite Meteorology, Agricultural Meteorology and Climate Change, Weather Forecasting, and Digital Weather Forecasting.

8.5.5 Support Activities conducted by the General Directorate of Combating Desertification and Erosion (CDE)

8.5.5.1 Ankara Initiative

United Nations Convention to Combat Desertification 12th Conference of Parties (COP12) was hosted by Turkey on 12-23 October 2015 in Ankara. Turkey launched an initiative, named after the host city of the conference Ankara, in order to provide support to the implementation of the Convention and COP Decisions. The Ankara Initiative, adopted as Decision no. 29 of COP12, covers the period between 2016 - 2019 and Turkey provides 5 million US Dollars in this period. Having left almost 2 year-period behind, the Ankara Initiative includes several activities among which the contribution provided to countries in terms of offsetting land degradation is particularly important.

8.5.5.2 FAO-Turkey Forestry Partnership Program

FAO and the Government of Turkey - Ministry of Agriculture and Forestry signed the FAO-Turkey Forestry Partnership Programme Agreement (FTFP) with a total funding of USD 10 million.

Support shall be;

- 7 M$ for projects to be implemented in Central Asia,
- 3 M$ for projects to be implemented in Africa

Projects will be performed for the African and Central Asian countries within the scope of the program. The activities to be carried out within the scope of the project are damaged area restoration, forest management, conservation of forest biodiversity, and mountainous watershed management.

8.5.5.2.1 Building Bridges Between Turkey and Africa's Great Green Wall

Under the FAO-Turkish Forestry Partnership programme, the Turkish Ministry of Forests and Water Affairs is entrusting FAO with the development and implementation of a project called BRIDGES - Boosting Restoration, Income, Development, Generating Ecosystem Services. BRIDGES contributes to the Great Green Wall initiative, Africa's flagship programme to bring prosperity and boost resilience in the drylands of over 20 countries around the Sahara by responding to the challenges of deforestation, desertification, biodiversity loss, climate change, food insecurity. The Great Green Wall aims to increase the resilience of agrosylvopastoral systems and to transform the lives of millions of people by creating a great mosaic of productive landscapes across North Africa, the Sahel and the Horn of Africa. BRIDGES will work in synergy with the project "Action Against Desertification", supporting the expansion of the Great Green Wall in six countries - Burkina, Niger, Nigeria, Gambia, Ethiopia and Senegal - by FAO in collaboration with the African Union Commission and with the financial support of the European Union and the ACP Secretariat. Globally, BRIDGES contributes to the FAO's working group on "Dryland Forests and Agrosilvopastoral systems" established as a statutory body under the Committee on Forestry (COFO) (ÇEM 2016)

8.5.5.2.2 Activities to be Implemented in Central Asia

A budget of 7 M USD have been allocated for projects to be implemented in Central Asia. The projects will include Azerbaijan, Kazakhistan, Kirghizistan, Tajikistan, Türkmenistan and Uzbekistan. The areas of activities that are planned include rehabilitation of degraded land, forest management, conservation of forest biodiversity and watershed management in mountainous areas.

8.5.5.3 Pan-African Great Green Wall Agency Memorandum of Understanding

The Great Green Wall is an initiative which aims to create "a great green wall from Djibouti to Senegal on a line that cuts Africa from east to west," and thus, to combat desertification and land destruction. One of the pioneering executives of the initiative is the «Pan African Great Green Wall Agency.»

11 African Countries consisting of Burkina Faso, Djibouti, Eritrea, Ethiopia, Mali, Mauritania, Niger, Nigeria, Senegal, Sudan, and Chad are the members of the agency, which was founded in 2007. The Agency is aimed at capacity building and mobilization of resources for combating land degradation in member countries. In this context, it provides expertise support to the projects such as afforestation, water harvesting, and the support for local seed-seedling production, and encourages collaboration with global stakeholders.

During the opening ceremony of the International Combating Desertification Training held between May 30 and June 5, 2016, in Konya province, the Memorandum of Understanding on combating desertification was signed between the Ministry of Agriculture and Forestry (former Ministry of Food, Agriculture and Livestock and Ministry of Forestry and Water Affairs) and Pan-African Great Green Wall Agency, within the framework of the Ankara Initiative declared during Turkey's United Nations Convention to Combat Desertification (UNCCD) COP Presidency.

With this Memorandum of Understanding signed, Turkey's experiences on combating desertification are aimed to be shared with the member countries of the Agency. Under the Memorandum of Understanding signed between the Ministry and the Agency, the equalization of land destruction, combating desertification, water, wind and sand dune erosion studies, fighting drought, the formation and use of systems for the monitoring of desertification, integrated watershed management, production of forest tree seedlings is among the issues to collaborate (ÇEM 2017).

8.6 NATIONAL AND INTERNATIONAL DATA SHARING

In a world where globalization is rapidly advancing and economic boundaries have been removed, the rapid developments in information and communication technologies increase the gap between Turkey and the other developed countries. The state needs to use advanced technology and to get into a new structuring for Turkey to be able to close this gap and to reach the Information Society. This structuring model is stated as e-Government. As Fountain has stated, the importance and depth of the effects of internet technology on administration result not only from the speed it provides but also from its potential to affect coordination, communication, and control mechanisms, which means that the nature of organizations changes radically (Fountain 2005). In this context, with e-Government, it is aimed to ensure the transparency of the state, to ensure that the state functions quickly and effectively, to ensure the participation of citizens at all levels in management, to prevent duplication of work and data by providing information exchange between institutions, and to facilitate the lives of the citizens served by the public (Prime Ministry, 2002).

The e-Government Portal is a great website that provides access to all public services from a single point. The aim of the Portal is to provide public services to citizens, businesses and public institutions through information and communication techNologies in an effective and efficient way.

For this purpose, institutions and organizations have taken many measures to remove obstacles to data access and usage.

8.6.1 Preparation and Presentation of Meteorological Forecasts

The short and medium-term weather forecasts prepared by the TSMS are prepared and presented hourly for all provincial centers, daily (in 6-hour periods) and in the form of 5-day weather forecasts for all provincial and district centers, and weekly by the regions across Turkey. The weather condition, temperature, humidity rate, apparent temperature, and

wind direction and speed forecasts are also provided in hourly forecasts at 3-hour intervals in a period of 36 hours. In addition to domestic forecasts, 3-day weather forecast data are also prepared and published for some foreign centers.

Within meteorological forecasts, the following services are offered over the internet:

- Hourly forecast,
- Daily forecast,
- 5-day forecast,
- Long-term forecasts (monthly and seasonal),
- Forecasts of provincial and district centers,
- Highest and lowest temperatures,
- Highway Forecasting System,
- Marina Forecasting System,
- Seaway Forecasting System,
- Wave Forecast (daily, three-day, five-day),
- 24-hour wind forecast,
- Numerical forecast model products,
- Inversion forecast,
- Dust forecast,
- Dust warning system for provinces,
- Stadium forecasts,
- Istanbul Park Forecast.

8.6.2 Meteorological Communication and Distribution System (MSS)

The Meteorological Communication and Distribution System (Message Switching System) is a system that collects and controls all domestic and foreign-sourced meteorological data, redistributes them to the relevant places and temporarily stores these data. With the MSS software used, automatic and semi-automatic observations that are made simultaneously in every corner of Turkey within a few minutes are collected and classified in the Meteorological Communication and Distribution System in the center, and they are delivered to the relevant domestic and foreign centers. The forecasts and other information prepared by powerful computer systems and specialists in the center, and the bulletins collected through foreign links are also included in the distribution. For this data flow, very strong telecommunication networks and computers are needed both at the national level and at the international level. Around 215.000 bulletins (approximately 11.5 GB) come to the Meteorological Communication and Distribution System of the TSMS on a daily basis, and around 9.000.000 (approximately 50 GB) bulletins are distributed to many centers. The observation data collected from the domestic area and abroad, the forecasts made immediately after it, and many other information and products produced for aviation, maritime, agricultural and similar purposes are delivered to those concerned and to the public through various communication channels and web pages. The Meteorological Communication and Distribution System with 250 channel groups established in 2006 and updated in 2012 and a capacity of 250 communication channels in each group has a capacity to respond to domestic needs and the needs of the countries in the region. In 2013, the Meteorological Communication and Distribution Systems were updated in terms of hardware. Furthermore, WIS - DCPC (WMO Information System- Data Collection and Production Center) hardware and software were added to the MSS System and provided to work in parallel.

Under the management of General Directorate of Geographic Information System, national spatial information infrastructure establishment works continue. In this context, technical infrastructure has been prepared for geographic data sharing. Legislation preparation and data sharing standards have been being studied. Besides, within the scope of national geographic information infrastructure works, the aim is to make the data sharing to be carried out with the

determined standards via national spatial data portal. It is possible to perform data sharing transactions with network services infrastructure by querying metadata through national spatial data portal.

8.6.3 Voice of Meteorology Radio

It serves through Turksat-4A satellite and the internet with broadcasts from 27 centers throughout the country. The Voice of Meteorology Radio broadcasts information on forest, water, and meteorology and instantly announces the weather forecast and early warnings. Broadcasts are delivered to the whole world through Türksat-4A 11958 Mhz, Symbol 27500, Vertical, Fec 5/6 and the internet. The broadcasts of the Voice of Meteorology Radio can be listened live at http//www.radyo.mgm.gov.tr.

8.6.4 Meteorological Support for the Sectors

The TSMS provides service to almost all sectors, especially aviation, maritime and agricultural sectors. Special products have been developed for some sectors due to their activities, and new products continue to be developed for the sectors in line with the requirements. The main ones among these services are listed below:

Meteorological products prepared for the aviation sector;

- Observations for Aviation (METAR – SPECI),
- Forecasts for Aviation (TREND – TAF-GAMET),
- Warnings for Aviation (SIGMET – AIRMET),
- Hezarfen, Helimet Cappadocia aviation web pages,

Meteorological products prepared for the maritime sector;

- METU-3 wave forecast model products,
- SWAN METU-3 wave forecast model products,
- HF Marine Radar Products,
- Marine forecast reports,
- Display of Automatic Marine Observation Stations,
- Seaway forecasting system,
- Marina forecasting system,
- Display of sea water temperatures,
- Display of Buoy Observations.

Meteorological products prepared for the highway sector;

- Highway weather forecasting system,

Agricultural meteorological services;

- Agricultural Forecast Report,
- Agricultural Frost Warning System (ZDUS),
- Agricultural Frost Risk Estimation Maps,
- Harvest Time Estimation Program,
- Monthly Bulletin of Agricultural Meteorology,
- Reference Total Evaporation Maps (ET0),
- Phenology Maps,
- Maps of Plants' Resistance to Hot and Cold,

- Appropriate sowing time map according to soil temperature values (TSMS, 2018g)

9

EDUCATION, TRAINING AND PUBLIC AWARENESS

Observed impacts of climate change in Turkey such as landslides, droughts and increased frequency of extreme weather events and the consequences on the ecologic and ecoNomic systems the have pulled attention to climate change. Also, the efforts of state, sub-state and Non-state institutions have significantly contributed to the increase of public awareness regarding climate change the last decade. Several public awareness activities are conducted nationwide and locally regarding the fight against the climate change for various sectors and target groups.

9.1 GENERAL POLICY ON EDUCATION, TRAINING AND PUBLIC AWARENESS

"Everyone has the right to live in a healthy and balanced environment. It is the duty of the Government and the citizens to improve the environment, protect the environmental health, and prevent environmental pollution" as expressed in the Article 56 of the Constitution, the importance of protecting the environment is highlighted. Environment Law with the number 2872 has come into force with the purpose of protecting the environment, which is the common property of all of the living creatures, in accordance with sustainable environment and sustainable development principles on 11/08/1983 and the notion of environment has become the subject of a law for the first time.

The educational system in Turkey is administered by the Ministry of National Education (MNE). The Ministry prepares educational policy, oversees its implementation, and is responsible for educational matters at all educational levels.

Turkey's national vision within the scope of climate change is to become a country fully integrated to climate change related objectives into its development policies, disseminating energy efficiency, increasing the use of clean and renewable energy resources, actively participating in the efforts for tackling climate change within its special circumstances and providing its citizens with a high quality of life and welfare with low carbon intensity. The primary objective of Turkey within the scope of global fight against climate change is to take part in the global efforts for preventing climate change (MoEU, 2010).

9.1.1 Current Climate Change Awareness in Turkey

İklim Haber (Climate News) and KONDA have carried out a joint work titled "Perception of Climate Change and Energy Preference Survey in Turkey" in March 2018 to understand what is thought about climate change in Turkey and the preferences of the energy issue, which is an increasingly controversial area (CN and Konda, 2018).

The sample was prepared by stratifying the neighborhood and village results of the 2015 General Elections with data on population sizes and education levels of neighborhoods and villages. The settlements were first divided into rural / urban / metropolitan areas and a sample was taken based on 12 regions. Within the scope of the survey, seven questions asked at face-to-face interviews to 2595 people in 30 cities; and questions about other political and social preferences and trends were compared with these results. A hand in the preparation of questions related to climate and energy issues while overseeing Turkey's current conditions, the studies also at the global level on the other hand was examined. During the survey, the European Social Survey's work in 18 European countries in 2017 and the questions asked by Yale University on "KNowledge of Climate Change Across Global Warming's Six Americas" were also used (CN and Konda, 2018).

The first question addressed to participants in the survey was "Do you think global warming is happening?". While 86.8% of respondents answered yes to this question, 10% answered No, and 3.2% of the respondents preferred not to answer the question. It is seen that here, there is an important consensus on climate change in Turkey. In a society where there is separation and No consensus of many issues; regardless of political preferences, ecoNomic situation and social status, at least 8 people from every 10 people agree on climate change.

Participants were asked, "Are you worried about climate change?" and "How concerned are you?" questions, which were asked by the European Social Survey in 18 countries in 2017. 25% of the interviewees gave "I am very worried" and 50% answered "I am worried". When data from this question are compared with other European countries, the rate of respondents who answered "I am worried" is quite high in Turkey. Three out of every four people in Turkey implied that they were concerned about climate change.

Power plants are the subject of one of the hottest topics on the agenda in recent years in Turkey. In the framework of the survey, questions were asked to find out what the public thinks about this issue. The answers to the question revealed that Turkey's choice is solar and wind power. In answer to the question "Suppose that you have a power plant next to where you live, which power plants do you prefer?", the solar power ranked first with 70.5% while wind power ranked second with 52.8%. The same question, when asked what kind of power plants they were most likely to oppose, nuclear plant ranked first with 68.2%, while coal power plants ranked second with 53.1%. The answers to the question "Which do you agree on coal to be produced in Turkey?" were in support with the given answers of previous question. According to the answers given to this question, 83% of the participants emphasized that instead of coal, less harmful sources should be preferred (CN and Konda, 2018).

9.2 PRIMARY, SECONDARY AND HIGHER EDUCATION

The National Education System, determined by National Education Basic Act No. 1739, consists of two main parts, namely "formal education" and "Non-formal education". Formal education is the regular education conducted within a school for individuals in a certain age group and at the same level, under programs developed in accordance with the purpose. Formal education includes pre-school, primary school, lower secondary school, upper secondary and higher education institutions. In accordance with the general objectives and basic principles of national education, the objectives of Non-formal education, which covers citizens who have never entered the formal education system or are at any level of it or have left at that level, and which may accompany formal education. Compulsory education was expanded to uninterrupted 8 years with law No. 4306 dated 18.08.1997 as of 1997/'98 educational year, but to 12 gradual years with law No. 6287 dated 30.03.2012 as of 2012/'13 educational year. NET schooling ratio by 2016/2017 educational year and age groups are as follows: 53.01% for 4-5 years, 98.13% for 6-9 years, 99.23% for 10-13 years and 87.43% for 14-17 years (MNE, 2017).

9.2.1 Pre-school Education

The aims and duties of pre-school education consist of ensuring the physical, mental, and emotional development and acquiring good habits of children, preparation for primary education, creating a common environment of upbringing for children coming from environment and families with disadvantaged conditions, and ensuring the correct and proper speaking of the language (MNE, 2013a). According to 2016-2017 National Education Statistics, the number of pre-schools is 28,450 and the number of students receiving pre-school education is 1,326,123 (MNE, 2017). There are many activities related to climate change and environmental issues in pre-school education program, in which the importance of recycling is taught, and the negative results of climate change are explained (MNE, 2013b).

Every organism in the nature is a part of sensorial, cognitive and physical education. Children love picking up the flowers, leaves and different peels. Behaviors of the animals around them arouse their attentions. So, the children start to gain their first experience about science and nature activities through this period. Ecoliteracy (ecological literacy) provides individuals, to have an idea about the natural processes and factors making the life possible, communicate with natural environment, interiorize being a part of nature, act for the sustainability. Individual who has ecoliteracy is the one who is sensitive to the relationship s/he has established with nature dealing with environmental issues and prone to seeking for practical solutions. Pre-schools based on ecoliteracy are getting widespread throughout the country.

9.2.2 Primary School Education

The compulsory primary school age covers the age group of 5 to 13. The objective of primary education is to ensure that every Turkish child acquires the necessary kNowledge, skills, behavior and habits to become a good citizen and is raised in accordance with the concept of national morals and that he/she is prepared for life and for the next level of education in accordance with his/her interests, talents and capabilities.

Primary education institutions are consisting of, 4-year of primary schools and 4-year of compulsory lower secondary schools, total of 8 years. Compulsory lower secondary schools which give opportunity to allow between different programmes. Examples to the courses in which climate change and environment subjects were included and the educational attainments and explanations of these courses in the primary education curriculum were given in previous national communication (MoEU, 2016). This curriculum is perpetuated with the emphasize of recycling and climate change.

The 4-year primary school and the 4-year lower-secondary school programs of the 12-year compulsory education that is given after pre-school education constitute primary education. According to 2016-2017 National Education Statistics, there are 25,479 primary schools and 4,972,430 primary school students, and 17,879 lower-secondary

schools and 5,554,415 lower-secondary school students (MNE, 2017). The topics of climate change, energy efficiency, water and natural resources, and environmental awareness are mentioned in the course books and the teaching materials prepared in accordance with the curriculum of Turkish, Life Science, Science, Social Studies, Environmental Education, Technology and Design, Visual Arts and Science Applications subjects and supported by the lectures and visuals.

9.2.3 Secondary School Education

Upper secondary education includes all the teaching institutions, general vocational and technical education institutions with at least 4-year compulsory formal or Non-formal education, based on primary and lower secondary education. The aims and duties of secondary education, in accordance with the general purposes and basic principles of National Education, are as follows; (1) Enabling all students to have the awareness and power to get to kNow the problems provided that giving culture on minimum common general level look for ways of solution and acquire the conscious of contributing to country's economic, social and cultural development and power, (2) Preparing students for higher education or for life and job fields in accordance with their interests, aptitude and abilities with various programs and schools. While these missions are accomplished, a balance is set between students' expectations and abilities and the needs of the society.

Examples to the courses in secondary education in which climate change and environment subjects were included and the educational attainments and explanations of these courses in the secondary education curriculum were given in previous national communication (MoEU, 2016). This curriculum is perpetuated with the emphasize of climate change.

According to 2016-2017 National Education Statistics, there are 11,076 high schools and 5,849,970 students (MNE, 2017).

9.2.4 Higher Education

Higher education includes all the educational institutions which are based on secondary education, and which provide at least two years of higher education. The aims and duties of secondary education, in accordance with the general purposes and basic principles of National Education, are as follows; (1) Train students according to country's science policies and the need for labor in higher and various levels of the society in accordance with their interests, aptitude and abilities, (2) Providing scientific training at various levels, (3) Doing research exploring sciences in further detail in order to finding solutions to scientific, technical and cultural problems especially to ones related to country, (4) Providing the society with the results on research focusing on country's problems regarding its progress and development with the coordination of the government and institutions and giving opinion on the research the government demands, (5) Publishing everything that shows the results of research and that enables science and technology to develop, (6) Providing educational services such as spreading scientific data that can improve the level of Turkish society and that can enlighten the public in written or oral form. Higher education institutions are; universities, faculties, institutes, colleges, conservatories, vocational colleges, centers for practice and research.

Many studies about climate change are being conducted in various departments of higher education institutions. There are also master and doctorate programs including courses such as "climate change and modeling", "sustainable development", environmental economy", "energy policies and finance", "ground system sciences", and "plant-climate models" with the purposes of raising awareness about the adaptation and campaign processes related to global climate change, which is one of the most important problems of today, and meeting the need of the country for educated employee/academician.

A new fellowship project titled "YÖK 100/2000 - Powerful Generation Training Project for Future of Turkey" was announced in 2016-2017 academic year as first time. The project has completed four call periods up to Now. The project aims to give fellowships to 2000 PhD students in 100 priority areas in which are going to build capacity and awareness for coming decade for reinforcement of Turkey's global competition. Priority areas identified in the project calls include many topics such as "Climate Change", "Sustainable and Intelligent Transportation", "Sustainable Campus", "Renewable Energy" (CHE, 2018a).

According to the 2017-2018 statistics that Council of Higher Education (CHE) has published, the total number of students enrolled in associate programs (2,768,757 students), undergraduate programs (4,241,841 students), master's degrees (454,673 students), and PhD degrees (95,100 students) is 7,560,371 in 206 various institutions (state universities + colleges) (CHE, 2018b).

9.3 PUBLIC INFORMATION CAMPAIGNS

Turkey has carried out several nationwide public information and awareness raising campaigns that are of direct or indirect relevance to climate change. Here, activities that are more directly related to climate change are included.

Raising Awareness Project for Climate Change

Under the coordination of Ministry of Environment and Urbanization, the Awareness Raising Project on Climate Change, which was carried out in cooperation with Yıldırım Beyazıt University, was initiated with the protocol signed on 12 October 2015 and was completed by the end of 2017. The general aim of the project, which has a total budget of 4 Million TL and which has been going on for two years, is to raise the awareness of the students and teachers and local authorities on climate change.

The project has two main components. Seminars and training programs were organized in 18 provinces (Eskişehir, Denizli, Manisa, Antalya, Mersin, Niğde, Kastamonu, Çorum, Rize, Erzurum, Erzincan, Gaziantep, Kahramanmaraş, Malatya ve Şanlıurfa, Sivas, Kayseri, Van) within the context of the awareness raising component for students, teachers and teacher candidates as the first component of the project. These activities are to increase the level of kNowledge and awareness of climate change among students and teachers and prospective teachers at all levels of education starting from kindergarden.

Seminars, trainings, meetings and various activities were held in 14 cities (Ankara, Konya, Kayseri, Bursa, Kocaeli, Sakarya, İstanbul, Antalya, Hatay, Adana, Trabzon, Samsun, Çanakkale ve Lefkoşa) within the context of the development of capacities of local authorities as the second component of the project. These activities were carried out to improve the capacity of municipalities and public institutions, private sector and Non-governmental organizations to combat climate change and raise awareness.

Information on the activities carried out under the campaign can be found on the project website (http://www.iklimicindegisin.org).

İklimIN Project

"Enhancing Required Joint Efforts on Climate Action Project" (İklimIN) is co-financed by the European Union and the Republic of Turkey and beneficiary institution is the Ministry of Environment and Urbanization. Within the scope of the project, technical assistance is provided on capacity building through an extensive training program. Effective communication with climate-related stakeholders, and awareness raising activities are conducted and local climate change actions are realized through a grant scheme of 38 projects.

The goal of the project is, by means of increasing public understanding and enhancing stakeholder capacity, to foster the joint efforts in mitigating climate change in Turkey, gradually aligning with the EU climate policy and legislation. The focus to reach this goal is increasing national and local technical capacity in the field of climate change, raising the awareness of the target group on the climate change and the immediacy of joint climate action and providing project implementation support to the Grant Beneficiaries of "Capacity Building in the Field of Climate Change in Turkey Grant Scheme" for generating solutions at local level.

IklimIN is extensive public awareness project in which governmental, Non-governmental, academic, municipality organizations and societies involved. (www.iklimin.org)

The following projects have been awarded grants within the framework of the project:

Table 9. 1: Iklimin Grant Projects

Project Name	Beneficiary	Co-Applicants	Duration (months)	Budget (Euro)
Yüreğir District is being prepared for climate change	Yüreğir Municipality	ITU Graduated Students' Association	12	50.000,00
Greening the Climate, Greening the Local	Green Thought Association	Bornova Municipality	12	49.979,70
Consumer Responsibility and Awareness on Energy Use, Aimed at Reduction of CO_2 Emission in Cities	Consumer Rights Association	Mayorship of Edremit	15	48.665,46
Climate Change and Erosion Awareness Project	Tuzlukçu Municipality	Nature and Wildlife Conservation Society	12	48.365,63
Trabzon is Combating against Climate Change	Trabzon Metropolitan Municipality	-	24	193.187,43
Increasing Climate Change Awareness at TOBB ETU	TOBB University of Economics and Technology	-	8	49.903,50
Raising Awareness on Extending Precision Agriculture Techniques for the Effects of Climatic Changes on Agricultural Production	Selcuk University	-	18	45.863,84
Water management modelling of Kızılırmak Delta Project within the scope of Samsun's Adaptation Process to Climate Change	Samsun Metropolitan Municipality	-	12	197.997,61
Enhancement of High School Students' KNowledge Capacity and Awareness for Climate Change Mitigation by Sustainable Training in Niğde	Niğde Ömer Halisdemir University	-	12	47.000,00
Stand up to Climate Change	Mersin Metropolitan Municipality	Mersin University,	18	189.807,30
Change Yourself, Not Climate	GoverNorate of Manisa	Recycling Industry Association (GEKSANDER)	18	49.110,40
Action of 'We Struggle with Climate Change with Our Bicycles'	Lüleburgaz Municipality	CEIPES Centro Internazionale Per La Promozione Dell'educazione E Lo Sviluppo	12	48.305,79
Eco Towns of Kayseri	Kayseri Directorate of Provincial Food Agriculture and Livestock	Lüleburgaz Bicycle Association	8	49.485,15
Increase of Awareness of Public Understanding through Building Stakeholder Capacity on National Climate Action	Kadir Has University	Cappadocia Organic Farming Producer Union Association	10	48.743,69
Improving climate change awareness and engagement in Istanbul	Istanbul Metropolitan Municipality	-	18	180.274,00
A Better Environment Starts with You!	GoverNorate of Hatay	Antakya Environment Protection Association	12	48.986,45
For a Sustainable Future in Hatay	Metropolitan Municipality of Hatay	Municipality and Energy Law Research Institute Association	15	197.713,53
Capacity Building in Climate Change Adaptation of Agriculture, Forestry, and Fisheries	Fırat University	Meydancık Village GoverNorate	12	45.799,87
Community Capacity Building in Higher Education Against Climate Change: Managing Perceptions, Raising Awareness and Strengthening the Resilience	Dokuz Eylul University	-	18	36.148,80
Power the Revolution for Climate Action	Denizli Metropolitan Municipality	-	24	167.649,56
Enhancing Awareness of Female Labor Force for Agricultural System in a Changing Climate	Boğaziçi University	Rize Municipality	12	49.500,00
Better Futures with Enhanced Capacity and Awareness on Climate Change	GoverNorate of Bilecik	Edebali Culture and Research Association, Bilecik Şeyh Edebali University, and others	18	44.132,58

Climate Camps

Recognizing that the development of public awareness on climate change is as important as the least mitigation and adaptation efforts, Ministry of Environment and Urbanization has launched the campaign named Climate Camps for this purpose. Within the scope of the campaign, 6 different climate camps were held in Konya (July 18 to August 5, 2016) and Eskisehir (July 25 to August 12, 2016) for 120 upper primary school students selected from various cities throughout the nationwide. It is aimed to inform the students in climate camps about the ways in which natural resources can be consumed appropriately, the social precautions to be taken and the behaviors that students should exhibit as climate volunteers. In climate camps, each of which lasts one week; the students were given theoretical and practical trainings on climate change. In the theoretical lectures, the scientific basis of climate change, methods of combating climate change and measures to be taken against it, were explained. In practical trainings; experiments which students can observe, such as greenhouse gas effect and temperature increase were carried out.

In addition to the trainings during the camps, science centers in Eskişehir and Konya were visited. Trips to the facilities contributing to the combat with climate change were organized. Nature and environment trips were organized for students to observe the fight against climate change. In addition, tree-planting activities, museum visits, documentary-film demonstrations, workshops were also conducted.

The Ministry's Protection of Ozone Layer Division of Climate Change Department also conducts a project named "Hydrofluorocarbons Phase Out Management Plan (HPMP) Project, Phase I".

Voice of Meteorology

Turkish State Meteorological Service (TSMS) provides information on scientific findings of climate and climate change and projections by participating to projects, meetings, panels, workshops, conferences, congresses and symposiums where civil society organizations, universities and other public institutions organized.

TSMS conducts public awareness-raising activities on weather forecasts, climate, climate change, meteorology, meteorological disasters, renewable energy systems and the environment with the broadcasts of "Voice of Meteorology (MeteorFM)" radio channel. Recently, Meteorology TV has started test broadcasts as well, for the same broadcasting purposes.

TSMS has developed a smart phone app to provide information about the instantaneous measurements, radar and satellite data, warnings, weather and sea forecasts, sea water temperatures and sNow thicknesses. The app is used by approximately 2 million mobile phone users. TSMS also uses the internet and social media effectively to inform the public and raise the awareness. TSMS contributes to the awareness of young people in meteorology and climate issues in primary and secondary schools within the scope of the protocol with the Ministry of National Education. To date, over 100 schools have been visited.

The Family Education Program

The Family Education Program offered by the Ministry of Family and Social Policy in the context of preventive policies; is an important step towards increasing quality of life by informing and raising awareness among parents. This program is made up of a number of modules, including education and communication, law, economics, media, and healthcare that encompass the complete daily life to enable family members to comprehensively understand the kNowledge, skills and attitudes of the basic family life skills required contemporarily. "Energy saving" is a sole module and the concept of greenhouse effect and global warming are covered in detail within the scope of "Energy, Country and World". Within this family education program, 2685 people have been trained in this module since 2013.

Water Ambassadors

Technical Assistance for Water Ambassadors Education and Awareness Raising Project" was put into practice to create public awareness through trainings and communicationcampaigns and to raise young generations as water ambassadors. Project was co-financed by the European Union and the Republic of Turkey and implemented with the cooperation of the Ministry of National Education (MEB), the General Directorate of State Hydraulic Works (DSİ), , and the General Directorate of Turkish Radio and Television Corporation (TRT). The Project, was started in January 2017 and completed at the end of 2017, was conducted inWestern Mediterranean Basin, Konya Closed Basin, Eastern Black Sea Basin and in Ankara. The budget of the project was 2 million 349 thousand Euro. The target group of the project was the public, particularly, the pre-primary, primary and secondary school students, university students, youth, teachers and mothers. Project aimed to protect environment inTurkey and to contribute to the sustainability of rational water use. The objectives were toraise awareness on environmental protection and to ensure productive use of water resources. Within the scope of the project, education and media channels were used to raise public awareness, particularly the children and the youth on productive water use and environmentalprotection. Water Ambassadors Clubs are being established in the schools, starting from pilotbasins. Various communication tools were used to share information and to improve skills and knowledge. The project also supported the education and training personnel of the stakeholders and 120000 individuals were trained in three pilot basins. Furthermore, national and international communication campaigns were organized to raise awareness on rational water use and environmental protection. For the sustainability of the Project, DSİ is continuing planning of new activities in cooperation with all potential institutions in addition to MEB and TRT. Additionally, DSI is willing to disseminate the Project all around the world, in this regard making some connections and open to every cooperation proposals. More details can be found at project website http://waterambassadors.org and social media account https://www.facebook.com/Su-Elçileri-476431165817637/.

9.3.1 Energy Efficiency

The energy efficiency policies are one of the main fields required to be sensitively discussed because of its direct relation with the economic growth and social development objectives' sustainability and its key role played in reducing the total greenhouse gas emission. Energy saving, and efficiency is one of the most important components of Turkey's 2023 national strategy objectives and energy policies such as providing energy demand safety, reducing the external dependence risks, protecting environment and increasing the efficiency of the struggle against the climate change. Through the energy efficiency studies, it was aimed to be reduced energy intensity of Turkey (energy consumed per national income) as 20% until 2023 compared to 2011. Furthermore, under National Energy Efficiency Action Plan that will be implemented in the period of 2017-2023, it is aimed to reduce the primary energy consumption of Turkey by 14 % until 2023.

The Energy Efficiency Forum and Fair, realized with national and international participation within the scope of the events of the Energy Efficiency Week, organized in the second week of January each year by the General Directorate of Energy Affairs within the scope of the Energy Efficiency Law No. 5627 dated 8/4/2007, is organized to make the energy efficiency movement widespread. The events including in the Energy Efficiency Forum and Fair, organized every year, are as follows: Platforms such as conferences, panels etc., fair events including energy efficiency product and techNologies, awarding the institutions and person who carried out successful works last year, and various cultural and arts activities.

Families at home consume significant amount of energy for the activities such as heating, cooling, lighting, cleaning and personal care. Women play an important role during daily home activities, so on the energy consumption. For this reason; the awareness of women, as target group, about energy consumption and energy efficiency should be raised. The aim of the "Energy Lady" project is to teach women to use energy efficiently to contribute to the domestic and national economy. The project is a joint project of the Ministry of Energy and Natural Resources and the Ministry of Family and Social Policies, continues its Turkey tour, and already reached 20000 women from 20 provinces, as of June 2018.

Energy Kid project

Energy Kid project is joint campaign by Ministry of Energy and Natural Resources, Ministry of National Education and Energy Efficiency Association. Raising awareness about energy efficiency of children, who are going to build their families in the future, is a very important issue. In this context; the aim of the project is, to teach children how to use energy efficiently, thereby, to contribute to domestic and global economy. Tens of thousands of children across the country are expected to be reached with theater shows, cartoons, computer games and other visual activities to raise awareness of reducing energy consumption at home. As of August 2018, Energy efficiency has been introduced and explained to more than 25000 primary school students from all provinces of Turkey.

Within the activity series of energy kid project, "Impact of Global Warming-Climate Change to the World" themed poster competition was organized among primary school students in 2016-2017 academic year. About 600 posters from 22 provinces participated in the competition. The names of the awarded students were announced in Energy Efficiency Association and Energy Kid websites, and the winners are awarded by the gifts.

Ministry of Energy and Natural Resources conducts projects titled "energy efficient industry", "energy efficient transportation" and "energy efficient building" as well.

9.3.2 Climate Action Week

The EU Delegation in Turkey, via the EU Information Centres Network, launched a campaign to raise awareness on, discuss and debate climate action between 16 and 27 October 2017. The EU Climate Action week was launched in Ankara at the Erimtan Museum. The launch event hosted two exhibitions courtesy of the Italian Embassy [4 Projects for Development] and the Swedish Embassy [Facing Climate Change], bringing together EU Member States, representatives from ministries, NGOs and other stakeholders.

The South-Eastern city of Gaziantep hosted the next high-level climate change event. The highlight of the event was a tree planting ceremony attended by local public and high school students from the Renewable Energy Vocational High School. A mature olive tree, which had been uprooted to make place for urban areas, found a new home in the garden of the Gaziantep Ecological Building. In parallel, students attend a workshop on renewable energy where they built their own wind turbines and discussed the importance of renewable energy in the fight against climate change. Local events in 18 further cities took place in the following days, including panel discussions, seminars, tree planting activities, competitions, film screenings, workshops, concerts, trekking and exhibitions.

The closing event took place in the Northern Black Sea city of Trabzon, in a remote mountain village, with the participation of the local community and 150 university students. According to studies, Trabzon seems to be the least climate-change-affected region in Turkey. EU Climate Change experts, however, conveyed the message that No one can escape the effects of climate change and gave examples related to the region with a focus on fisheries. The discussion underlined the importance of the Paris Climate Agreement ratification, while informing about EU-Turkey cooperation in the field of climate change.

The events aimed at improving dialogue platforms at local level with key stakeholders from local government, civil society, academia, business and media. Furthermore, they aimed to emphasize the scope for individual action for climate change awareness and environmental protection. The campaign's key message was: "Everyone can make a difference," showing that individual and local action helps achieving the goals of the Paris Climate Agreement.

9.3.3 The use of internet and social media

Many of the campaigns make considerable use of the internet and social media. The campaigns use websites, Facebook pages, Twitter feeds, video productions, seminars, etc.

Table 9. 2 Videos or channels on climate change

Title	Link	Date
Pasaport – İklim Değişikliği (Climate Change)	https://youtu.be/0F4UjO_PjJ4	15 Oct 2018
Çünkü bu Senin İklimIN (IklimIN Project)	https://www.youtube.com/watch?v=JsBp9TkBdP8&feature=youtu.be	11 Oct 2018
Teke Tek Özel - Global Climate Change (ranked first in YouTube when searched with "climate change" keyword in Turkish)	https://www.youtube.com/watch?v=yKY28gFo9dA	5 Aug 2018
Capital and EkoNomist: Climate Change Summit	https://www.youtube.com/watch?v=z32CJbgaQck	17 July 2018
Rafadan Tayfa Cartoon / Episode: Climate Change	https://www.youtube.com/watch?v=nGQ1n41mcaM	09 Feb 2018
Our City: Can Climate Change Be Managed? Prof.Mikdat Kadıoğlu	https://www.youtube.com/watch?v=wh-vJzGxnZs	08 Jan 2018
Climate Change will change the World and people! Prof.Levent Kurnaz	https://www.youtube.com/watch?v=BXoAOidHdXQ	28 Nov 2017
IklimIN Enhancing Required Joint Efforts on Climate Action Project Introduction Film	https://www.youtube.com/watch?v=zwDzaue_EBw	10 Nov 2017
Teke Tek Özel - (Climate / Prof.Celal Şengör, Prof. Mehmet Karaca)	https://www.youtube.com/watch?v=d5YQ4cl4huE	01 Oct 2017
Teke Tek Özel - (Global Climate Change)	https://www.youtube.com/watch?v=fNVGj2yV8IE	13 Aug 2017
Rafadan Tayfa Cartoon / Episode: Water is Life	https://www.youtube.com/watch?v=_tW6cS5J3ig	27 Feb 2017
BU+ Open Course: The effects of climate change on World and Turkey	https://www.youtube.com/watch?v=7BsB4oVluog	25 Jan 2017
Effects of Climate Change on Turkey	https://www.youtube.com/watch?v=zJwqYfjFyVs	24 Jan 2017
Climate Change and Forests	https://www.youtube.com/watch?v=ebx7zeb7UEE	25 Nov 2016
Climate change, the enemy of Nature	https://www.youtube.com/watch?v=Zz-ro645QGk	22 Nov 2016
Teke Tek Özel - (Recent Climate Change Impacts)	https://www.youtube.com/watch?v=tjFm5UJsihw	02 Mar 2016
Raising Awareness Project for Climate Change Introduction Film	https://www.youtube.com/watch?v=v1MW9-Yw758	19 Jan 2016
TEMA- Climate Change	https://www.youtube.com/watch?v=1SiMpWkrVyY	17 Aug 2015
TEMA- Climate Change 2	https://www.youtube.com/watch?v=F4i4ca84xis	17 Aug 2015
National Geographic Turkiye	https://www.youtube.com/user/natgeotvturkiye	Channel
Water Ambassadors	https://www.youtube.com/channel/UCKtj2buJbqssNAzMHYBg_Wg	Channel
Energy Kid	http://www.enerjicocuk.org/en	Channel
TEMA Channel	https://www.youtube.com/user/tema/videos	Channel

9.4 TRAINING PROGRAMMES

There are many institutions and NGOs provide training programmes.

GHG Related Training by Chamber of Environmental Engineers

Chamber of Environmental Engineers have carried out and supported many activities throughout Turkey in the field of climate change. In recent years, 326 people, which are mostly Environmental Engineers, have participated in Chamber's GHG training sessions. GHG training subjects are as follows:

- GHG Emissions Calculation Methods,
- GHG Emissions Management System,
- EU Floral Greenhouse Gas Directive and Application Regulations,
- Monitoring and Reporting GHG Emissions, and
- Advanced Level Monitoring, Reporting and Verifying GHG Emissions.

Energy Efficiency Training

The main studies carried out by the General Directorate of Energy Affairs (GDEA) within the scope of the training-audit activities are as follows:

- Fulfill the activities concerning the energy management in the industrial enterprises and buildings,
- Organize the energy manager certification trainings,
- Organize the survey project certification trainings,
- Organize the international energy manager training programmes for Asia, Middle East and Balkans and the Black Sea Economic Cooperation countries to improve the regional cooperation,
- Create the energy efficiency awareness,
- Determine the energy saving focuses and amounts,
- Aid in establishing an efficient energy management system in the industrial enterprises, public, commercial and service buildings.
- Audit public buildings and issue energy performance certificate (EKB) for these buildings or have them audited and issued EKB by authorized ESCOs in cooperation with the concerning institution, and publish sectoral energy efficiency reports in accordance with the results of these audits.

There is also an ongoing project, titled "International Energy Efficiency and Energy Management in Industry and Buildings Training Project", which gets renewed in every 3 years. The partners of this project are: General Directorate of Energy Affairs, Japan International Cooperation Agency (JICA), and Turkish Cooperation and Coordination Agency (TIKA). The purpose of the project is to improve kNowledge and technics related to energy efficiency and management in industry and buildings. All participants are expected to have a common sense in this training to contribute significantly to the reduction of CO_2 emissions to the limits foreseen by UNFCCC and to form technical groups for using energy efficiently.

Awareness and Engagement Training for Staffs of İstanbul Districts

In the framework of "Improving Climate Change Awareness and Engagement in Istanbul" organized by the Istanbul Metropolitan Municipality, trainings were given to technical staff from 39 districts in Istanbul between June 7th and July 9th, 2018 in order to strengthen cooperation with local authorities playing a key role in combating climate change and to increase technical capacity.

Power the Revolution for Climate Action

Denizli Metropolitan Municipality recently launched a project on climate change adaptation and mitigation. IPA project named "Power the Revolution for Climate Action" is being carried out to contribute to the global efforts for

the mitigation of climate change, adaptation to reduce the vulnerability of natural and human system against actual or expected climate change effects, awareness of the municipal staffs/local decision makers about climate change effects. Within this project, training on "Global and National Policies on Combating Climate Change" was organized. In the training organized for Denizli Metropolitan Municipality staffs, global and national policies on combating climate change, Denizli specific effects of climate change, and fight against climate change and the status of cities, adaptation and mitigation measures were delivered in May 2018.

Combatting Forest Fires

General Directorate of Forestry (GDF) gathers multi-stakeholder meetings to create Sustainable Forest Management (SFM) criteria and indicative set. SFM criteria and indicators are important both for forest sustainability and for combating climate change. Combatting forest fires is important for GDF. In order to combat the increasing fires due to climate change, GDF train both its staff and the forest villagers.

9.5 ACCESS TO INFORMATION: RESOURCE AND INFORMATION CENTRES

Many organizations in Turkey act as climate change resource or information centers for public. Access to information is maintained via television and radio broadcasts and news, publications, internet pages and channels, newspapers, journals, seminars, workshops, and conferences in Turkey.

Related Ministries publish monthly journals. Many institutions prepare fact sheets and handouts. Kickoff and final meetings of projects are very common and open to public. Public service broadcastings and short films that are aired on TV and radio channels play an important role in terms of raising public awareness.

Reports on climate change, prepared by The Chamber of Environmental Engineers, have been made available to the public through press and publications. The Chamber organizes seminars, workshops, conferences and meetings about climate change, and publishes monthly bulletins.

The aim of the "Climate Changes Impact on Water Resources Project" is to identify the impact of climate change scenarios on the surface and ground waters and to determine adaptation activities in the basins of Turkey. This project designated all the effects of climate change on water resources in basins of Turkey and paved the way for long-term measures. The studies are carried out for 25 river basins incorporating whole Turkey and projection period covers the years between 2015-2100. GIS based Climate-Water Database is being constituted in order to store and query all the produced data in the scope of the Project such as climate projections, hydrological projections etc.

Table 9. 3 Portals on climate change

Title	Link
Climate change portal by Ministry of Environment and Urbanization	http://iklim.csb.gov.tr
Frequently asked questions about climate change by Directorate General of Environmental Management	http://cygm.csb.gov.tr/sss/iklim-degisikligi
National Climate Change Documents	http://iklim.csb.gov.tr/dokumanlar-i-101
Climate News	https://www.iklimhaber.org
IklimIN Enhancing Required Joint Efforts on Climate Action Project	http://www.iklimin.org/en
Climate Change Impacts on Water Resources Project	http://iklim.ormansu.gov.tr
Bogazici University, Center for Climate Change and Policy Studies	https://climatechange.boun.edu.tr
TSMS articles related to climate change	https://www.mgm.gov.tr/iklim/yayinlar.aspx
The portal for the process of Istanbul action plan preparation	https://www.iklim.istanbul
Raising Awareness Project for Climate Change	http://www.iklimicindegisin.org
Climate Change Action Plan Monitoring System	http://apps.csb.gov.tr/iklim
Archives and Preparation Portal for Climate Change National Communications	http://idub.csb.gov.tr
Voluntary Carbon Market Project Registration System and Ozone-depleting Substances Tracking System and GHG Tracking System	http://online.cevre.gov.tr/KullaniciIslemleri/Giris
The Chamber of Environmental Engineers	http://www.cmo.org.tr/english
Energy Efficiency Association	http://www.enver.org.tr/en
Energy Kid	http://www.enerjicocuk.org/en
Channel Economy – Climate Economy YouTube Channel	https://www.youtube.com/channel/UCTnu7XHgL9YO9SUYz7m1z3g/search?query=iklim
Low Carbon Turkey	http://www.lowcarbonturkey.org/

9.6 INVOLVEMENT OF THE PUBLIC AND NON-STATE ACTORS

Being one of the biggest environmental challenge in history, climate change requires a solution which can integrate not only the state actors but all stakeholder groups such as NGOs, academia, businesses, etc. In Turkey, several Non-state stakeholder groups are already aware of the climate change and have already initiated activities in various areas and stages which can all lead to increase resilience to climate change.

Besides their own activities, NGOs, including environmental, business, social and research organizations, participate in various workshops, events and working groups where they have the possibility to have their messages be delivered to state institutions and other stakeholder groups. Below aer some initiatives lead by environmental NGOs:

Ecoliteracy Pre-Schools

AKD Kids Konya Branch has been TEMA Foundation Volunteer (The Turkish Foundation for Combating Soil Erosion, for Reforestation and the Protection of Natural Habitats) since the year of 2017 and has adopted education system based on ecology in which the most significant education device is "nature". The nature activities practiced in this kind of pre-schools can be explained as work that is helping kids asking questions, revealing ideas, searching and defining concepts, observing the nature, making use of their natural curiosity. By means of this kind of practice, children are able to gain social values in the group such as helping, sharing and taking responsibilities.

TEMA Unites Celebrities to Support Environmental Education

A successful fundraising campaign, organized by TEMA, brought together celebrities on national television to raise funds for environmental education. TEMA is one of biggest environmental NGOs in Turkey, supported by more than 0.7 million of volunteers. It has been the first NGO to identify and publicize soil erosion as a serious threat to the Turkey's environment as well as to its economic and social life. The foundation has achieved significant national impact with the help of volunteers who planted millions of saplings and tree seeds across the country. The foundation also implements livelihood projects on climate change along with advocacy and education programs that include training for farmers. For over twenty years, TEMA has carried out environmental education programs with the help of volunteer teachers who work with school children to build their understanding of nature and the role they can play as the caretakers and nurturers of the Earth. In 2012, the foundation received the UNCCD Land for Life Award for its continuous efforts in promoting the sustainable land management.

Also, NGOs conduct project to increase awareness among different stakeholder groups regarding climate change and how to tackle it. Below (Table 9.3) are some representative projects which are implemented NGOs:

Table 9. 4 Representative projects implemented by NGOs

Project Name	Description	Time Period	Financing	Implementing business repersentatives
Innovative production processes	Starting from 2003, Halkalı Paper and Cardboard Industry Ltd. has been implementing innovative process optimization measures which has lead to GHG emission reduction over the years. The measures include low carbon techNology use for de-sulphurization process in paper production.	2003-2018	556.800 $	Halkalı Paper and Cardboard Industry Ltd.
Use of alternative fuels in cement industry	Also, biogas is captured and utilized for electricity generation which again reduces GHG emissions. Both processes also generate waste heat which is again used for the processes	-		Akçansa
Green Loans	Akçansa utilizes alternative fuels such as activated sludge, old tires, waste oils and fuels produced from waste in order to use less fossil fuels. The share of alternative fuel use has been % 6,0 in 2016 and % 8,4 in 2017.	2018		Garanti Bank
Innovative efficiency processes	In 2008 Garanti Bank announced "Green Bonds" which determines the interest rates of loans to the sustainability performance of the company.	-		TÜPRAŞ

Also, Turkish Stock Exchange Market, Borsa Istanbul (BIST) has launched "BIST Sustainability Index" on the 4th of November, 2014. BIST Sustainability Index aims to provide a benchmark for Borsa İstanbul companies with high performance on corporate sustainability and to increase the awareness, knowledge and practice on sustainability in Turkey. Moreover, the index is a platform for institutional investors to demonstrate their commitment to companies managing environmental, social and governance (ESG) issues with high performance.

9.7 INTERNATIONAL COOPERATION

Turkish institutions support people to attend international activities and, encourage hosting international activities. Turkish experts cooperate with other experts to contribute to IPCC meetings and reports. Turkish universities, ministries and other institutions like the Scientific and Technological Research Council of Turkey support personnel, academic staff and researchers to present their institution and work in the international activities. Supported personnel are expected to cooperate and seek collaboration opportunities, exchange ideas with international partners besides their participations and presentations. Many researchers, personnel from various ministries and institutions, and academic staff presented their work related to climate change issues in international organizations.

Turkish Delegation participated in all Subsidiary Body for Implementation Meetings (SBI), Subsidiary Body for Scientific and Technological Advice Meetings (SBSTA) and Ad Hoc Working Group on the Paris Agreement (APA 1) sessions organized within the scope of United Nations Framework Convention on Climate Change as well as interim sessions before UNFCCC -Conference of Parties (COP).

The Department of Protection of Ozone Layer attends Montreal Protocol Meeting of the Parties (MOP); Open Ended Working Group of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer as well as Regional Ozone Network for Europe and Central Asia (ECA) cooperation meetings.

TSMS has organized more than 60 international training and workshops to meet the training needs of meteorological services of underdeveloped countries since the establishment of the World Meteorological Organization (WMO) Regional Training Center. More than 1000 trainees attended these training and workshops. The international trainings are organized in specific topics such as weather forecasting, digital weather forecasting models, ground observations and automatic meteorological stations, atmospheric observation systems, meteorological radars, climate monitoring and climate change, flash flood early warning systems, agricultural meteorology. Many participants in the trainings are trainees from Balkan countries, Turkic Republics and African countries. Training programmes are carried out in the premises of Ankara, Alanya and Istanbul, which are the facilities of regional training center, taking into account the capacity and content of the training. Alternative venue such as social facility or hotel can be used considering the number of participants and evaluating the transportation and financial opportunities. Training programmes on various topics were organized for particularly Ethiopian staff (19-28 January 2016), Somalian staff (21 March - 01 April 2016), staff from Turkic Republics (11-15 April 2016), staff from Balkan countries and Turkic Republics (25-29 April 2016), staff from Mauritania and Senegal (30 May – 3 June 2016).

General Directorate of Renewable Energy organizes the international energy manager training programmes for Asia, Middle East and Balkans to improve the regional cooperation.

The president of the chamber of environmental engineers, participated to the workshop on water management and nature conservation in Brussels in October 2016. He was invited to the EU Commission and had a talk about the effects of climate change on water management.

Covenant of Mayors for Climate and Energy

The Covenant of Mayors is the world's largest movement for local climate and energy actions. The EU Covenant of Mayors for Climate & Energy brings together thousands of local authorities voluntarily committed to implementing EU climate and energy objectives. The Covenant of Mayors was launched in 2008 in Europe with the ambition to gather local authorities voluntarily committed to achieving and exceeding the EU climate and energy targets. The number of signatories from Turkey increases as the increase of climate change awareness.

Table 9. 6 Covenant of Mayors Signatories

Signatories	Population	Commitments	Signed up	Action plan
Antalya Metropolitan	2043432	2020	2013	2014
Bagcilar	762000	2030ADAPT	2016	NA
Bayindir	40216	2030ADAPT	2017	NA
Besiktas	190000	NF	NF	NF
Bornova	412275	2020	2011	2013
Bursa Metropolitan	2842547	2030ADAPT	2016	2017
Çankaya	914501	2020	2015	2017
Eskisehir Metropolitan	826716	NF	NF	NF
Gaziantep	1947244	2030ADAPT	2017	NA
Istanbul Metropolitan	14804116	NF	NF	NF
İzmir Metropolitan	4113072	2020	2015	2016
Kadikoy	553000	2020	2012	2016
Karşıyaka	312213	2020	2011	2012
Maltepe	460955	2020	2014	2016
Nilüfer	350000	2020ADAPT	2014	2016
Pendik	691681	2030ADAPT	2017	NA
Seferihisar	35000	2020	2011	2013
Sisli	272380	2030ADAPT	2017	NA
Tepebaşi	333553	2020	2013	2014

ICLEI - Local Government for Sustainability

ICLEI founded in 1990 as the International Council for Local Environmental Initiatives. Its main goal is to build and serve a worldwide movement of local authorities to achieve tangible improvements in global sustainability with specific focus on environmental conditions through cumulative local actions

ICLEI promotes local action for global sustainability and supports cities to become sustainable, resilient, resource-efficient, biodiverse, low-carbon; to build a smart infrastructure; and to develop an inclusive, green urban economy.

7 local authorities from Turkey are members of ICLEI;

- Seferihisar Municipality
- Kadiköy Municipality
- Sisli Municipality
- Kartal Municipality
- Tepebaşı Municipality
- Gaziantep Metroplitan Municipality
- Konya Metropolitan Municipality

UCLG for Environment

United Cities and Local Governments (UCLG) policies are developed through its committees that it has launched. These committees deal with policy preparations and implementation in priority areas and they set the next working program. They contribute to the works for enriching the discussions within UCLG by elaborating proposals and cooperation initiatives. UCLG operates the advocacy and representation of the local and regional authorities in the issue of environment through four main subjects in its international agenda, and it ensures the participation of local authorities in policy making processes. In this regard, UCLG develops implementation, action, and campaign methods and policies related to the topics in its agenda and makes the announcement to the world. Climate change is defined as one of the four main subjects.

UCLG-MEWA (UCLG Middle East and West Asia Section) Committee on Environment was established by the decision taken at UCLG-MEWA Executive Bureau and Council Joint Meeting held in Adana, Turkey on 19 December 2014. This Committee operates the works of local authorities which are the main actors in the fight against environment problems in order to make them more active in this field and contribute to the solution, thus; mobilizes these institutions which have vital importance with regards to the future of the cities and societies. In this regard, the topics of climate change, renewable energy, urban agriculture areas, sustainable waste management and pollution (land, water, air, noise) have been set as a major discussion topic of the local authorities in the region. Through this new platform, the information and experience exchange between local authorities and other relevant actors were ensured by carrying out cooperation activities. Istanbul Metropolitan Municipality has been appointed as president and secretariat of the committee and many other Turkish municipalities are co-presidents and members of this committee.

9.7.1 International Events in Turkey

Organized international events can make very serious contributions to the host country in terms of creating international cooperation. For this reason, Turkey always encourages institutions to host organizations.

3rd Meeting of the UCLG-MEWA Committee on Environment took place on 7-8 August 2018, under the auspices of Selçuklu Municipality, in Konya, Turkey. In the meeting, participants discussed the issues on the policies on fighting against climate change, process of the preparation of action plan, water and wastewater management strategies in the cities, and resilient cities on climate change. During the meeting, participants reviewed the current situation on the implementation of the leading international agreements on climate change. The details for the preparation processes for the carbon inventory and climate action plans were also addressed.

7th Global Conference on Global Warming-2018 (GCGW-2018) which was held in Izmir, Turkey between June 24-28, 2018. The GCGW has been organized successfully as a leading congress in the area since 2008; and GCGW-2018 was the 7th one of this conference series. The previous conferences have been held in various parts of the world.

The 14th International training on combating desertification took place between 9-14 May 2018, bringing together 26 experts from 15 African countries. The course was organized by Turkey's General Directorate of Combating Desertification and Erosion (CDE) and covered technical issues, such as causes of desertification and land degradation, production of seed and seedlings, afforestation, erosion control and participatory approach to increase the level of regional collaboration in sharing technical experience among the countries. The training is one of the actions under the Ankara Initiative, launched at the UNCCD COP12 to strengthen the implementations of UNCCD between 2016 and 2019.

The Ankara Initiative supports the global sustainable development agenda and leverages lessons learned from Turkey's experience in sustainable land management (SLM). Turkey invited participants from the eligible countries of Eastern Europe, Caucasus and Central Asia to take part in similar training program, which took place on 22-26 May 2017 in Konya and Mersin, Turkey. The course was open to two representatives per country and was aimed at related decision makers, forest engineers and NGOs involved in the management of environmental problems related to desertification, land degradation, afforestation, erosion control and forestry. Another international training on combating desertification and soil erosion for Central Asian and Balkan countries took place on 11-16 July 2018, bringing together experts and participants from various institutions, organizations and NGOs. Workshop sessions focused on approaches to combat land degradation and deforestation, introduced participants to forest fire prevention measures, seedling production techniques for nurseries, income generating approaches to afforestation and methods for increasing soil organic carbon.

IV. Turkey Climate Change Congress - TCLCC'2017, co-organized by many institutions and Water Foundation, was held in Medipol University Kavacik South Campus, Istanbul between July 5-7, 2017.

World Meteorological Organization (WMO), United States National Oceanographic and Atmospheric Administration (NOAA) and the International Development Agency (USAID) and TSMS jointly organized "8th International Workshop on Climate Variability and Predictions" was held in Ankara between the dates of 25-29 April 2016.

The International Climate Change Safranbolu Conference, organized by the Ministry of Environment and Urbanization in cooperation with the Economic Cooperation Organization (ECO) and the ECO Institute of Environmental Science and Technology (ECO-IEST) was held from 25 to 27 March 2015, in historic city of Safranbolu in Turkey. The agenda of the sessions were about 2015 Paris Agreement and the intended nationally determined contributions to be submitted to UNFCCC and enhancing the cooperation between ECO and UNFCCC to develop a regional strategy to combat climate change.

Desertification and Combating Soil Erosion

The Directorate General of Combating Desertification and Erosion carries out bilateral cooperation activities with primarily African as well as a number of Central Asian and European countries in the fields of combating desertification, offsetting land degradation, floods and erosion.

The Directorate General of Combating Desertification and Erosion (CDE) has cooperation and carries out joint projects with the United Nations Convention to Combat Desertification Secretariat (UNCCD), the UNCCD Northern Mediterranean Regional Coordination Unit (RCU), the United Nations Convention on Biological Diversity Secretariat (UNCBD), the Food and Agriculture Organization of the United Nations (FAO, FAO-SEC), the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), the African Union – Strategy for Africa (AU), the Pan African Agency of the Great Green Wall, the League of Arab States (LAS), the Arab Organization for Agricultural Development (AOAD).

12th Conference of Parties (COP 12) to the United Nations Convention to Combat Desertification (UNCCD)

The 12th Conference of Parties (COP12) to the United Nations Convention on Combating Desertification was hosted by the Ministry of Forestry and Water Affairs from 12-23 October 2015 in Ankara, Turkey.

The 12th Conference received 56 high-level participants including ministers, deputy ministers, the speaker of the Grand National Assembly, and high-level officials from the UN, and 70 participants among parliamentarians. The total number of participants reached 6700. Non-governmental organisations as well as private sector showed high interest in the Conference.

Recep Tayyip Erdoğan, President of the Republic of Turkey, participated in the opening ceremonies of the High-Level Session of the Conference between 20-21 October 2015. On behalf of Turkey, the Minister of Forestry and Water Affairs, Prof Dr Veysel Eroğlu will assume the COP12 Presidency for a period of 2 years. Parties adopted 37 significant decisions, and published 6 declarations regarding combat against desertification

17th of June 2019, World Day to Combat Desertification

The World Day to Combat Desertification is observed every year to promote public awareness of international efforts to combat desertification. The day is a unique moment to remind everyone that land degradation neutrality (LDN) is achievable. The commemoration of the day is led by the Secretariat of the United Nations Convention to Combat Desertification. Turkey is going to host World Day to Combat Desertification on 17th of June 2019.

9.7.2 Awards in International Arena

Turkish institutions, individuals or companies attend international organizations to seek cooperation or collaboration opportunities, and sometimes they benchmark their efforts in international arenas. The advertised satisfying benchmark results might serve to public awareness affirmatively.

Winner of 'Data for Climate Action' Challenge

Global Pulse, the United Nations innovation initiative on big data and data science, and Western Digital Corp. (NASDAQ: WDC) announced the winning solutions of the Data for Climate Action (D4CA) challenge at an event during COP23. The challenge was an unprecedented open-innovation competition to harness data science and big data to accelerate climate solutions. The challenge was organized by UN Global Pulse with the support of the Skoll Global Threats Fund and Western Digital. "A Framework for the Optimization of Winter Wheat Seeding Date" project using weather data, a team based in Turkey developed a framework to determine the best winter seeding date for wheat in the context of climate adaptation, which was then visualized using tools from Tableau. This project was announced as winner of data visualization in this challenge.

9.8 MONITORING, REVIEW AND EVALUATION OF THE IMPLEMENTATION OF ARTICLE 6 OF THE CONVENTION

One of the working groups formed under CCAMCB is Education, Raising Awareness, and Capacity Building Working Group. This working group, coordinated by the Ministry of Environment and Urbanization, is responsible for providing the necessary contribution to the preparation of national reports submitted to the UNFCCC, developing policy in the field of education, training, and informing the public, conducting the studies towards raising awareness by maintaining the cooperation between institutions, reporting of the conducted studies nationwide about primary school, secondary school, and high school education, education materials, training programmes, source and information centers, public informing campaigns, participation of public and Non-governmental organizations in climate change campaign studies, and reporting of the studies done about participation in international activities (MoEU, 2013). CCAMCB and its stakeholders monitor, review and evaluate the implementation of Article 6 of the Convention.

9.9 PUBLIC PARTICIPATION IN THE PREPARATION AND DOMESTIC REVIEW OF NATIONAL COMMUNICATION

7th National Communication has been prepared within the framework of the Project: "Support for the Preparation of Turkey's 7th National Communication and 3rd Biennial Report to be Submitted to UNFCCC" Public participation to the preparation of the 7th National Communication has been provided though establishment of the following Thematic Working Groups (TWG) throughout the Project:

- TWG on GHG Inventory
- TWG on Climate Change Impacts, Vulnerabilities and Adaptation
- TWG on Finance, Technology Transfer and Capacity Building
- TWG on Education, Training and Public Awareness
- TWG on Research and Systematic Observation
- TWG on Mitigation

The TWG meetings brought together several stakeholder groups such as state institutions, academia, NGOs, business associations and experts who made contributions to the preparation of the National Communication.

10

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11

ANNEXES

11.1 ANNEX I: CRF TABLES- SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES

7th National Communciation involves the latest GHG inventory data which is submitted in April 2018. However, at the time of the submission of NC7 and resubmission of BR3, the BR-CTF application did not allow to upload the latest year of the inventory (2016) due to the technical configuration of the BR-CTF application maintained by the Secretariat. Therefore, GHG emissions data for the period 1990–2016 is reported in the NC7, while in the BR3 (CTF table 1) the year 2016 is not reported.

Summary tables for the latest GHG inventory is given below:

1 ANNEXES

1.1 ANNEX I: CRF TABLES- SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES

SUMMARY 1.A SUMMARY REPORT FOR NATIONAL GREENHOUSE GAS INVENTORIES
(Sheet 1 of 3)

Inventory 2016
Submission 2018 v1
TURKEY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO_2 emissions/ removals	CH_4	N_2O	$HFCs^{(1)}$	$PFCs^{(1)}$	Unspecified mix of HFCs and $PFCs^{(1)}$	SF_6	NF_3	NO_x	CO	NMVOC	SO_2
	(kt)			(kt CO_2 equivalent)			(kt)					
Total national emissions and removals	334531,55	2189,35	107,90	4719,62	24,58	NO	0,08	NO	699,56	2015,07	1067,80	2247,30
1. Energy	346906,91	407,72	13,02						695,30	1992,75	252,10	2246,43
A. Fuel combustion Reference approach(2)	345517,75											
Sectoral approach(2)	346748,84	82,23	13,01						695,30	1992,75	252,10	2246,43
1. Energy industries	143327,03	1,97	4,14						309,50	40,09	3,42	1468,38
2. Manufacturing industries and constructio	59461,34	3,28	0,50						130,25	444,96	49,66	475,04
3. Transport	80207,78	15,41	4,19						137,93	249,21	49,24	2,38
4. Other sectors	63752,70	61,56	4,19						117,61	1259,48	149,78	300,64
5. Other	IE	IE	IE						IE	IE	IE	IE
B. Fugitive emissions from fuels	157,95	325,49	0,00						NE,IE,NA	O,NE,NA	NO,NE,IE	NE,IE,NA
1. Solid fuels	NE	223,83	NO,NE						IE,NA	NA	NO,NE,IE	NO,NA
2. Oil and natural gas and other emissions from energy production	157,95	101,66	0,00						NO,NE,NA	NO,NE	NO,NE	NE,IE,NA
C. CO_2 Transport and storage	0,13											
2. Industrial processes and product use	54617,39	0,69	4,09	4719,62	24,58		0,08		3,82	7,17	352,37	0,56
A. Mineral industry	41923,97								NO	NO	NO	NO
B. Chemical industry	1135,96	NO,IE,NA	4,09						3,48	0,04	NA	NA
C. Metal industry	11411,24	0,69	NA		24,57				0,05	5,52	4,97	0,28
D. Non-energy products from fuels and solvent use	146,22	NE,NA	NE,NA						NA	NA	259,37	NA
E. Electronic industry				0,09	0,01		0,00					
F. Product uses as substitutes for ODS				4719,53								
G. Other product manufacture and use	NA	NA	NE,NA				0,08		NA	NA	NA	NA
H. Other[3]	NE,NA	NE,NA	NA						0,29	1,61	88,03	0,58
3. Agriculture	1295,35	1215,77	83,21						NO,NE,NA	O,NE,NA	418,83	NA
A. Enteric fermentation		1076,94										
B. Manure management		124,48	10,74								202,76	
C. Rice cultivation		9,72									NO	
D. Agricultural soils		NO	72,35						NA	NA	216,06	
E. Prescribed burning of savannas		NO	NO						NO	NO	NO	
F. Field burning of agricultural residues		4,63	0,12						NE	NE	NE	
G. Liming	NE											
H. Urea application	1295,35											
I. Other carbon-contining fertilizers	NE											
J. Other	NO	NO	NO						NO	NO	NO	NA
4. Land use, land-use change and forestry [4]	-68289,24	0,64	0,63						0,41	14,60	NE	NE
A. Forest land [5]	-60396,66	0,64	0,04						0,41	14,60	NE	
B. Cropland [6]	-44,16	NO,NE,IE	0,00									
C. Grassland [6]	2728,95	NO,NE	0,62						NE	NE	NE	
D. Wetlands [6]	NO,NE	NO,NE	NO,NE									
E. Settlements [6]	44,54	NO	NO,NE									
F. Other land [6]	NO,NE	NE	NE									
G. Harvested wood products	-10621,91											
H. Other [6]	NE	NE	NE						NE	NE	NE	NE
5. Waste	1,13	564,53	6,94						0,03	0,56	44,50	0,00
A. Solid waste disposal [7]	NA	467,25							NO,NA	NO,NA	44,43	
B. Biological treatment of solid waste [7]		0,36	0,02						NA	NE,NA	NA	
C. Incineration and open burning of waste [7]	1,13	0,07	0,00						0,03	0,56	0,01	0,00
D. Wastewater treatment and discharge		96,85	6,91						NA	NA	0,06	
E. Other [8]	NO	NO	NO						NO	NO	NO	NO
6. Other ***(please specify)*** **[8]**	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo items:[7]												
International bunkers	13635,78	0,34	0,37						4,08	2,37	0,97	0,30
Aviation	10629,74	0,07	0,30						4,08	2,37	0,97	0,30
Navigation	3006,04	0,27	0,08						NE	NE	NE	NE
Multilateral operations	NO	NO	NO						NO	NO	NO	NO
CO_2 emissions from biomass	11940,31											
CO_2 captured	NO											
Long-term storage of C in waste disposal sites	NA											
Indirect N_2O			NO,NE									
Indirect CO_2	NO,NE											

(1) The emissions of hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), unspecified mix of HFCs and PFCs and other fluorinated gases are to be expressed as carbon dioxide (CO_2) equivalent
(2) For verification purposes, Parties are requested to report the results of their calculations using the Reference approach and to explain any differences with the Sectoral approach in the
(3) 2.H. Other includes pulp and paper and food and beverages industry.
(4) For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).
(5) CO_2 from categories solid waste disposal on land and waste incineration should only be included if it stems from non-biogenic or inorganic waste streams. Only emissions from waste incineration without energy recovery are to be reported in the waste sector, whereas emissions from incineration with energy recovery are to be reported in the energy sector.
(6) If reporting any country-specific category under sector "6. Other", detailed explanations should be provided in Chapter 8: Other (CRF sector 6) of the national inventory report (NIR).
(7) Parties are asked to report emissions from international aviation and international navigation and multilateral operations, as well as CO_2 emissions from biomass and CO_2 captured, under Memo Items. These emissions should not be included in the national total emissions from the energy sector. Amounts of biomass used as fuel are included in the national energy consumption but the corresponding CO_2 emissions are not included in the national total as it is assumed that the biomass is produced in a sustainable manner. If the biomass is harvested at an unsustainable rate, net CO_2 emissions are accounted for as a loss of biomass stocks in the Land Use, Land-use Change and Forestry sector.

SUMMARY 2 SUMMARY REPORT FOR CO_2 EQUIVALENT EMISSIONS
(Sheet 1 of 1)

Inventory 2016
Submission 2018 v1
TURKEY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CO_2[1]	CH_4	N_2O	HFCs	PFCs	SF_6	Unspecified mix of HFCs and PFCs	NF_3	Total
	CO_2 equivalent (kt)								
Total (net emissions)[1]	334531,55	54733,63	32155,68	4719,62	24,58	1824,09	NO	NO	427989,15
1. Energy	346906,91	10192,98	3878,54						360978,43
A. Fuel combustion (sectoral approach)	346748,84	2055,78	3877,90						352682,52
1. Energy industries	143327,03	49,35	1233,43						144609,80
2. Manufacturing industries and constructio	59461,34	82,01	147,78						59691,13
3. Transport	80207,78	385,35	1248,07						81841,20
4. Other sectors	63752,70	1539,07	1248,62						66540,39
5. Other	IE	IE	IE						IE
B. Fugitive emissions from fuels	157,95	8137,20	0,64						8295,78
1. Solid fuels	NE	5595,76	NO,NE						5595,76
2. Oil and natural gas	157,95	2541,44	0,64						2700,03
C. CO_2 transport and storage	0,13								0,13
2. Industrial processes and product use	54617,39	17,21	1219,15	4719,62	24,58	1824,09			62422,04
A. Mineral industry	41923,97								41923,97
B. Chemical industry	1135,96	NO,IE,NA	1219,15						2355,11
C. Metal industry	11411,24	17,21	NA		24,57				11453,02
D. Non-energy products from fuels and solvent use	146,22	NE,NA	NE,NA						146,22
E. Electronic Industry				0,09	0,01	0,04			0,14
F. Product uses as ODS substitutes				4719,53					4719,53
G. Other product manufacture and use	NA	NA	NE,NA			1824,05			1824,05
H. Other	NE,NA	NE,NA	NA						NE,NA
3. Agriculture	1295,35	30394,17	24796,19						56485,70
A. Enteric fermentation		26923,48							26923,48
B. Manure management		3112,03	3199,84						6311,87
C. Rice cultivation		242,97							242,97
D. Agricultural soils			NO	21560,60					21560,60
E. Prescribed burning of savannas		NO	NO						NO
F. Field burning of agricultural residues		115,69	35,75						151,44
G. Liming	NE								NE
H. Urea application	1295,35								1295,35
I. Other carbon-containing fertilizers	NE								NE
J. Other	NO	NO	NO						NO
4. Land use, land-use change and forestry[1]	-68289,24	16,03	195,00						-68078,21
A. Forest land	-60396,66	16,03	10,57						-60370,06
B. Cropland	-44,16	NO,NE,IE	0,02						-44,14
C. Grassland	2728,95	NO,NE	184,41						2913,36
D. Wetlands	NO,NE	NO,NE	NO,NE						NO,NE
E. Settlements	44,54	NO	NO,NE						44,54
F. Other land	NO,NE	NE	NE						NO,NE
G. Harvested wood products	-10621,91								-10621,91
H. Other	NE	NE	NE						NE
5. Waste	1,13	14113,24	2066,81						16181,19
A. Solid waste disposal	NA	11681,29							11681,29
B. Biological treatment of solid waste		8,99	6,43						15,41
C. Incineration and open burning of waste	1,13	1,65	0,28						3,07
D. Waste water treatment and discharge		2421,31	2060,10						4481,42
E. Other	NO	NO	NO						NO
6. Other ***(as specified in summary 1.A)***	NO	NO	NO	NO	NO	NO	NO	NO	NO

Memo items:[2]									
International bunkers	13635,78	8,62	111,64						13756,05
Aviation	10629,74	1,86	88,61						10720,20
Navigation	3006,04	6,76	23,04						3035,85
Multilateral operations	NO	NO	NO						NO
CO_2 emissions from biomass	11940,31								11940,31
CO_2 captured	NO								NO
Long-term storage of C in waste disposal sites	NA								NA
Indirect N_2O			NO,NE						
Indirect CO_2 [3]	NO,NE								
Total CO_2 equivalent emissions without land use, land-use change and forestry									496067,36
Total CO_2 equivalent emissions with land use, land-use change and forestry									427989,15
Total CO_2 equivalent emissions, including indirect CO_2, without land use, land-use change and forestry									NA
Total CO_2 equivalent emissions, including indirect CO_2, with land use, land-use change and forestry									NA

(1) For carbon dioxide (CO_2) from land use, land-use change and forestry the net emissions/removals are to be reported. For the purposes of reporting, the signs for
(2) See footnote 7 to table Summary 1.A.
(3) In accordance with the UNFCCC Annex I inventory reporting guidelines, for Parties that decide to report indirect CO_2, the national totals shall be provided with and without indirect CO_2.

TABLE 10 EMISSION TRENDS
GHG CO_2 eq emissions
(Sheet 1 of 6)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year(1)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	(kt CO_2 eq)													
Total (net emissions)(2)	181792,04	181792,04	188173,72	201743,59	203473,68	195988,23	213287,87	231818,08	242732,78	241155,14	239541,32	258754,41	235312,66	244856,75
1. Energy	134327,90	134327,90	139276,71	145377,56	152693,95	149313,39	162696,10	179801,83	191782,50	191595,06	189794,83	212330,42	195152,82	201935,46
A. Fuel combustion (sectoral approach)	130027,67	130027,67	135111,25	141237,38	148646,26	145387,20	158817,04	175940,16	187578,05	186983,96	184188,97	206381,03	189518,36	196731,03
1. Energy industries	37004,37	37004,37	38723,77	43327,67	42827,32	49227,91	50567,37	54525,75	59598,28	65153,69	70304,97	78014,18	80169,62	74418,01
2. Manufacturing industries and construction	32381,05	32381,05	35854,22	34561,62	35875,01	31766,23	36430,59	46483,19	51772,47	51340,45	43521,82	53668,89	41110,33	52715,85
3. Transport	26968,90	26968,90	25673,33	26365,69	32142,84	30639,87	34112,99	36271,47	34689,82	32781,98	34617,15	36464,87	36454,76	36234,00
4. Other sectors	33673,33	33673,33	34859,93	36982,40	37801,09	33753,20	37706,10	38659,74	41517,48	37707,84	35745,03	38233,10	31783,65	33363,18
5. Other	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
B. Fugitive emissions from fuels	4300,11	4300,11	4165,34	4140,05	4047,57	3926,06	3878,92	3861,55	4204,33	4610,98	5605,73	5949,26	5634,33	5204,30
1. Solid fuels	3388,43	3388,43	3084,89	3072,61	3028,00	2925,51	2841,26	2769,14	3027,13	3430,83	4366,53	4640,19	4319,03	3846,28
2. Oil and natural gas and other emissions from energy production	911,68	911,68	1080,45	1067,43	1019,57	1000,55	1037,66	1092,41	1177,20	1180,15	1239,20	1309,07	1315,30	1358,02
C. CO_2 transport and storage	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13
2. Industrial Processes	22893,94	22893,94	24864,09	24338,16	24865,48	24508,75	26128,67	26944,72	27820,36	28107,28	26487,13	26643,60	26593,87	27914,03
A. Mineral industry	13452,14	13452,14	14952,93	15584,74	16147,93	16814,93	17585,72	17845,25	18709,91	18804,52	17888,20	18456,25	18138,78	18754,33
B. Chemical industry	2124,03	2124,03	1843,05	1931,91	1818,76	1395,89	1895,64	1848,23	1920,40	1773,88	1237,65	1132,61	1002,07	1603,61
C. Metal industry	7134,41	7134,41	7877,67	6658,20	6724,86	6124,00	6444,48	6524,49	6391,97	6730,22	6492,29	5994,85	6348,18	6157,19
D. Non-energy products from fuels and solvent use	183,37	183,37	190,44	163,32	173,93	173,93	202,82	223,46	242,33	203,41	249,99	277,11	214,02	283,01
E. Electronic industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Product uses as ODS substitutes	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	115,66	232,00	417,19
G. Other product manufacture and use	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	503,30	555,75	595,25	618,99	667,13	658,81	698,71
H. Other	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA
3. Agriculture	42402,30	42402,30	43282,64	43437,65	44009,35	41682,28	40987,45	41721,85	39827,87	41247,16	41808,37	40032,91	37695,28	35537,83
A. Enteric fermentation	22314,09	22314,09	23129,27	22929,38	22536,03	22235,07	21704,60	21677,39	20203,63	19781,00	19850,48	19123,92	18606,33	16878,48
B. Manure management	4111,49	4111,49	4352,38	4262,86	4385,07	4633,84	4426,76	4498,32	4169,11	4397,23	4479,44	4240,37	4242,64	3748,25
C. Rice cultivation	100,19	100,19	99,85	94,11	101,50	89,71	112,60	125,73	124,25	135,19	146,65	128,04	131,99	134,89
D. Agricultural soils	15085,06	15085,06	14922,35	15367,69	16010,72	13964,29	13999,92	14557,17	14467,14	15910,58	16273,01	15598,25	13884,18	13935,46
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field burning of agricultural residues	331,53	331,53	342,59	324,85	349,28	306,76	317,64	329,11	331,74	365,25	325,46	324,87	303,07	313,83
G. Liming	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
H. Urea application	459,95	459,95	436,20	458,75	626,74	452,60	425,92	534,13	532,00	657,91	733,33	617,47	527,07	526,92
I. Other carbon-containing fertilizers	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. Land use, land-use change and forestry(2)	-28922,68	-28922,68	-30574,43	-22956,46	-29878,49	-31565,70	-28906,75	-29347,24	-29914,35	-33340,57	-32579,59	-34739,75	-39089,92	-35963,74
A. Forest land	-27041,35	-27041,35	-28744,45	-28791,32	-29061,40	-31552,69	-28872,08	-29345,28	-32085,74	-33296,87	-34343,20	-34648,63	-38294,95	-38321,04
B. Cropland	-37,15	-37,15	-30,81	-24,47	-18,16	-11,82	-5,51	0,87	7,21	13,48	19,86	-502,18	-509,33	-520,48
C. Grassland	99,07	99,07	129,80	160,49	191,21	221,94	252,67	283,39	393,75	504,15	995,85	-247,78	-136,91	-16,35
D. Wetlands	1741,74	1741,74	991,58	889,76	185,39	690,47	341,33	594,51	2664,71	5101,17	1279,81	1232,81	875,86	3181,71
E. Settlements	683,21	683,21	683,21	683,21	683,21	683,21	683,21	683,21	683,21	683,21	683,21	683,21	629,49	629,49
F. Other land	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE
G. Harvested wood products	-4368,20	-4368,20	-3603,75	-3878,13	-1858,75	-1596,81	-1306,36	-1563,95	-1577,50	-1754,65	-1215,13	-1257,17	-1654,08	-917,07
H. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
5. Waste	11090,59	11090,59	11324,71	11546,69	11783,40	12049,51	12382,41	12696,92	13216,40	13546,20	14030,58	14487,23	14960,62	15433,16
A. Solid waste disposal	6729,60	6729,60	6903,19	7076,58	7272,47	7463,27	7652,25	7963,38	8342,49	8787,12	9263,73	9712,25	10182,02	10632,20
B. Biological treatment of solid waste	19,23	19,23	19,23	19,23	19,23	19,23	15,91	17,90	18,06	16,65	22,57	23,93	21,83	38,36
C. Incineration and open burning of waste	105,48	105,48	107,27	109,05	110,83	112,60	103,14	111,51	159,20	98,33	89,22	87,99	87,50	52,01
D. Waste water treatment and discharge	4236,28	4236,28	4295,02	4341,83	4380,87	4454,42	4611,10	4604,15	4696,66	4644,08	4655,06	4663,06	4669,26	4710,60
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other *(as specified in summary 1.A)*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo items:														
International bunkers	939,37	939,37	1149,40	1161,83	1301,66	1149,14	1407,54	1410,05	1887,39	2049,60	2429,31	2904,39	2362,03	4378,07
Aviation	556,50	556,50	721,86	810,89	985,80	795,00	814,08	1011,23	1380,12	1535,93	1526,39	1612,26	1605,89	2671,19
Navigation	382,87	382,87	427,54	350,94	315,86	354,14	593,46	398,82	507,28	513,67	902,92	1292,13	756,14	1706,88
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 emissions from biomass	32841,81	32841,81	32874,32	32874,05	32635,17	32484,98	32330,40	32234,97	32147,25	31974,71	30742,14	29720,99	28530,38	27455,69
CO_2 captured	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Long-term storage of C in waste disposal sites	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indirect N_2O	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE
Indirect CO_2 (3)	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE
Total CO_2 equivalent emissions without land use, land-use change and forestry	210714,73	210714,73	218748,15	224700,05	233352,18	227553,93	242194,62	261165,32	272647,13	274495,70	272120,91	293494,15	274402,58	280820,48
Total CO_2 equivalent emissions with land use, land-use change and forestry	181792,04	181792,04	188173,72	201743,59	203473,68	195988,23	213287,87	231818,08	242732,78	241155,14	239541,32	258754,41	235312,66	244856,75
Total CO_2 equivalent emissions, including indirect CO_2, without land use, land-use change and forestry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total CO_2 equivalent emissions, including indirect CO_2, with land use, land-use change and forestry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Note: All footnotes for this table are given at the end of the ta

TABLE 10 EMISSION TRENDS
GHG CO_2 eq emissions
(Sheet 1 of 6)

Inventory 2016
Submission 2018 v1
TURKEY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year(1)	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Change from base to latest reported year
	(kt CO_2 eq)	(kt CO_2 eq)														%
Total (net emissions)(2)	181792,04	258626,78	270421,97	290001,36	311275,71	346546,85	347420,76	351860,80	356607,05	383314,54	396328,31	381823,64	393656,59	406261,50	427989,15	135,43
1. Energy	134327,90	216412,60	223093,67	240329,11	259959,13	291049,97	288443,90	293982,21	292323,66	313375,15	320114,01	308771,37	321255,33	339721,86	360978,43	168,73
A. Fuel combustion (sectoral approach)	130027,67	211409,50	218193,52	234774,10	254043,42	283249,88	280166,41	285972,61	284204,75	304499,69	310942,14	300611,06	311330,35	334474,66	352682,52	171,24
1. Energy industries	37004,37	74534,90	75530,11	90612,64	96221,38	113966,46	119399,45	119687,73	114022,78	125714,95	126772,16	121430,46	131996,17	136335,11	144 609,80	290,79
2. Manufacturing industries and construction	32381,05	62509,29	60575,86	59019,48	67755,81	69564,79	45977,19	45718,38	54434,98	56596,06	57701,54	51776,65	52295,38	57308,53	59 691,13	84,34
3. Transport	26968,90	37824,81	42048,05	42041,16	45423,90	52098,69	48166,33	47906,78	45391,99	47385,83	62522,98	68364,92	73559,27	75797,65	81 841,20	203,47
4. Other sectors	33673,33	36540,50	40039,50	43100,82	44642,33	47619,94	66623,44	72659,72	70355,00	74802,85	63943,45	58539,02	53479,53	65033,36	66 540,39	97,61
5. Other	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0,00
B. Fugitive emissions from fuels	4300,11	5002,97	4900,03	5554,88	5915,58	7799,97	8277,37	8009,48	8118,78	8875,33	9171,75	8160,19	9924,86	5247,08	8295,78	92,92
1. Solid fuels	3388,43	3477,09	3333,86	3743,47	3949,56	5576,41	5986,10	5942,38	6043,35	6472,26	6641,35	5961,00	7026,90	2483,67	5 595,76	65,14
2. Oil and natural gas and other emissions from energy production	911,68	1525,88	1566,16	1811,40	1966,02	2223,56	2291,27	2067,09	2075,43	2403,07	2530,39	2199,19	2897,96	2763,41	2 700,03	196,16
C. CO_2 transport and storage	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,00
2. Industrial Processes	22893,94	29127,57	31828,85	32603,97	37435,87	39977,45	41932,10	43438,20	49215,31	54413,15	56780,54	59809,23	60204,41	59574,35	62422,04	172,66
A. Mineral industry	13452,14	19516,64	20996,85	23276,16	25334,88	27580,27	29114,97	30255,74	33389,19	35294,01	36370,23	39583,14	39792,46	38430,63	41 923,97	211,65
B. Chemical industry	2124,03	1501,75	1576,54	1706,56	1896,04	1119,43	1094,39	1392,26	1987,13	3114,19	3297,10	2848,02	2962,25	3064,81	2 355,11	10,88
C. Metal industry	7134,41	6447,06	7164,83	7174,54	7338,06	8062,37	8367,80	8217,87	9183,37	10455,46	10927,87	11030,06	10485,31	11022,44	11 453,02	60,53
D. Non-energy products from fuels and solvent use	183,37	274,75	359,07	445,74	471,68	449,28	359,66	396,21	431,59	853,74	605,52	533,59	399,16	266,50	146,22	-20,26
E. Electronic industry	NO	NO	NO	NO	NO	NO	NO	NO	0,14	0,14	0,14	0,14	0,14	0,14	0,14	100,00
F. Product uses as ODS substitutes	NO	628,80	909,37	1146,88	1424,19	1713,19	1896,14	2111,28	3054,19	3432,55	4256,75	4470,16	4927,46	4804,95	4 719,53	100,00
G. Other product manufacture and use	NO,NE,NA	758,53	822,19	884,09	971,02	1052,90	1099,14	1064,84	1167,71	1263,06	1322,94	1344,32	1637,63	1984,85	1 824,05	100,00
H. Other	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	0,00
3. Agriculture	42402,30	38913,33	39824,02	40771,65	41968,07	41686,81	39739,66	40557,33	42826,37	45125,81	50610,34	53627,96	53742,13	53650,01	56485,70	33,21
A. Enteric fermentation	22314,09	18464,11	18956,77	19663,12	20130,33	20552,49	20057,02	19576,40	20912,21	22806,30	25739,85	26850,50	27094,48	26888,01	26 923,43	20,66
B. Manure management	4111,49	4149,08	3937,14	4133,22	4352,62	4444,57	4351,58	4343,12	4840,34	5038,88	5770,99	6066,85	6297,51	6175,05	6 311,87	53,52
C. Rice cultivation	100,19	142,91	156,16	183,46	212,06	202,87	215,89	208,73	202,13	204,33	249,03	230,66	229,54	239,99	242,97	142,51
D. Agricultural soils	15085,06	15284,53	15801,86	15893,89	16202,08	15679,64	14309,36	15566,10	16019,59	16297,48	17999,82	19448,48	19133,94	19375,44	21 560,60	42,93
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
F. Field burning of agricultural residues	331,53	307,27	339,92	284,80	278,13	240,93	240,97	270,27	207,13	221,26	210,88	224,17	198,97	160,93	151,44	-54,32
G. Liming	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0,00
H. Urea application	459,95	565,41	632,18	613,16	592,34	566,30	564,84	592,72	644,98	557,53	639,77	807,30	787,69	810,59	1 295,33	181,63
I. Other carbon-containing fertilizers	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0,00
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
4. Land use, land-use change and forestry(2)	-28922,68	-41722,63	-40799,72	-42652,80	-45546,96	-43911,12	-40492,39	-44006,63	-45956,63	-48092,48	-49303,17	-57158,06	-58152,08	-63668,94	-68078,21	135,38
A. Forest land	-27041,35	-40687,28	-40335,55	-41437,09	-42731,72	-42113,79	-38490,41	-41847,23	-43946,40	-45155,61	-45733,48	-52520,32	-53252,03	-56488,52	-60 370,06	123,25
B. Cropland	-37,15	-522,39	-515,13	-510,40	-523,52	190,58	194,90	184,45	194,24	191,38	197,07	202,71	205,50	213,16	-44,14	18,81
C. Grassland	99,07	99,78	307,75	330,78	341,94	1560,99	1781,21	2280,80	2275,08	2244,54	2589,06	2624,26	2659,04	2789,26	2 913,36	2840,66
D. Wetlands	1741,74	737,22	793,50	1498,75	260,22	640,90	16,68	237,38	60,87	7,85	NO,NE	NO,NE	NE,NO	NO,NE	NO,NE	
E. Settlements	683,21	629,49	629,49	629,49	629,49	44,56	44,56	44,56	44,56	44,56	44,56	44,56	44,56	44,56	44,54	-93,48
F. Other land	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NE,NO	NO,NE	NO,NE	0,00
G. Harvested wood products	-4368,20	-1979,46	-1679,80	-3164,34	-3523,38	-4234,35	-4039,34	-4906,58	-4584,98	-5425,20	-6400,37	-7509,27	-7809,15	-10227,40	-10 621,91	143,16
H. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0,00
5. Waste	11090,59	15895,93	16475,14	16919,43	17459,61	17743,75	17797,49	17889,68	18198,35	18492,92	18126,59	16773,13	16606,80	16984,25	16181,19	45,90
A. Solid waste disposal	6729,60	11104,52	11622,15	12085,72	12560,21	12884,95	13060,86	13122,11	13358,60	13644,22	13213,98	12148,20	12163,81	12556,95	11 681,29	73,58
B. Biological treatment of solid waste	19,23	32,61	35,11	28,36	17,98	33,40	24,53	31,54	23,02	29,13	18,03	16,02	14,85	16,02	15,41	-19,85
C. Incineration and open burning of waste	105,48	60,97	73,96	42,93	58,14	59,45	56,43	45,97	31,57	28,77	24,70	12,90	1,29	2,07	3,07	-97,09
D. Waste water treatment and discharge	4236,28	4697,81	4793,91	4762,42	4823,28	4765,93	4655,66	4690,07	4785,15	4790,80	4869,88	4596,00	4426,84	4409,21	4 481,42	5,79
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
6. Other *(as specified in summary 1.A)*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
Memo items:																
International bunkers	939,37	4770,15	6201,97	6768,69	6198,59	6141,24	7382,21	8181,66	8339,60	8797,45	10394,22	11655,46	13299,27	13948,73	13756,05	1364,39
Aviation	556,50	2785,67	3001,90	3358,07	3040,06	3762,44	5033,90	5299,44	5908,33	6826,62	7749,70	8734,46	10006,84	11179,50	10 720,20	1826,37
Navigation	382,87	1984,48	3200,07	3410,62	3158,53	2378,80	2348,31	2882,22	2431,27	1970,83	2644,53	2921,00	3292,42	2769,23	3 035,85	692,91
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
CO_2 emissions from biomass	32841,81	26370,34	25358,84	24373,84	23495,12	22670,27	22028,51	21118,32	20504,25	16117,34	11572,32	19890,40	15012,35	12598,54	11 940,31	-63,64
CO_2 captured	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
Long-term storage of C in waste disposal sites	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
Indirect N_2O	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	0,00
Indirect CO_2 (3)	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	0,00
Total CO_2 equivalent emissions without land use, land-use change and forestry	210714,73	300349,42	311221,69	332654,16	356822,67	390457,97	387913,15	395867,43	402563,69	431407,02	445631,48	438981,70	451808,67	469930,44	496067,36	135,42
Total CO_2 equivalent emissions with land use, land-use change and forestry	181792,04	258626,78	270421,97	290001,36	311275,71	346546,85	347420,76	351860,80	356607,05	383314,54	396328,31	381823,64	393656,59	406261,50	427989,15	135,43
Total CO_2 equivalent emissions, including indirect CO_2, without land use, land-use change and forestry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
Total CO_2 equivalent emissions, including indirect CO_2, with land use, land-use change and forestry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00

Note: All footnotes for this table are given at the end of the ta

SEVENTH NATIONAL COMMUNICATION
OF TURKEY UNDER THE UNFCCC

TABLE 10 EMISSION TRENDS

CO_2

(Sheet 2 of 6)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year(1)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	(kt)													
1. Energy	124822,78	124822,78	129929,65	135929,76	143129,82	140158,93	153352,10	170347,01	181807,04	181459,07	178859,41	200985,63	184614,22	191743,34
A. Fuel combustion (sectoral approach)	124602,45	124602,45	129666,15	135676,12	142898,78	139939,91	153142,86	170138,47	181600,44	181264,83	178681,01	200817,66	184459,42	191594,98
1. Energy industries	36882,90	36882,90	38597,47	43183,39	42689,68	49062,32	50401,31	54345,52	59403,12	64944,02	70083,52	77776,11	79928,71	74208,19
2. Manufacturing industries and construction	32224,93	32224,93	35682,97	34407,07	35722,49	31632,27	36279,83	46274,59	51539,11	51092,67	43315,39	53390,92	40924,78	52460,48
3. Transport	26250,81	26250,81	24982,32	25639,91	31268,75	29789,14	33179,97	35277,22	33702,48	31816,76	33634,52	35490,22	35533,74	35316,14
4. Other sectors	29243,80	29243,80	30403,39	32445,75	33217,86	29456,18	33281,75	34241,14	36955,73	33411,38	31647,57	34160,40	28072,17	29610,17
5. Other	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
B. Fugitive emissions from fuels	220,20	220,20	263,37	253,51	230,92	218,89	209,11	208,41	206,48	194,12	178,28	167,85	154,67	148,24
1. Solid fuels	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2. Oil and natural gas and other emissions from energy production	220,20	220,20	263,37	253,51	230,92	218,89	209,11	208,41	206,48	194,12	178,28	167,85	154,67	148,24
C. CO_2 transport and storage	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13
2. Industrial processes	21197,08	21197,08	23144,31	22649,01	23516,52	23142,40	24505,44	24840,61	25642,62	25899,78	24333,11	24403,89	24365,13	25372,83
A. Mineral industry	13452,14	13452,14	14952,93	15584,74	16147,93	16814,93	17585,72	17845,25	18709,91	18804,52	17888,20	18456,25	18138,78	18754,33
B. Chemical industry	1060,35	1060,35	994,04	973,14	880,69	747,41	891,36	832,65	880,94	784,67	315,03	285,44	264,66	772,11
C. Metal industry	6501,23	6501,23	7006,91	5927,82	6313,97	5406,13	5825,54	5939,25	5809,44	6107,18	5879,89	5385,09	5747,67	5563,39
D. Non-energy products from fuels and solvent use	183,37	183,37	190,44	163,32	173,93	173,93	202,82	223,46	242,33	203,41	249,99	277,11	214,02	283,01
E. Electronic industry														
F. Product uses as ODS substitutes														
G. Other product manufacture and use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
H. Other	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA
3. Agriculture	459,95	459,95	436,20	458,75	626,74	452,60	425,92	534,13	532,00	657,91	733,33	617,47	527,07	526,92
A. Enteric fermentation														
B. Manure management														
C. Rice cultivation														
D. Agricultural soils														
E. Prescribed burning of savannas														
F. Field burning of agricultural residues														
G. Liming	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
H. Urea application	459,95	459,95	436,20	458,75	626,74	452,60	425,92	534,13	532,00	657,91	733,33	617,47	527,07	526,92
I. Other carbon-containing fertilizers	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. Land use, land-use change and forestry (2)	-28980,62	-28980,62	-30620,68	-23015,03	-29947,05	-31693,18	-28960,47	-29421,36	-29973,97	-33408,55	-32652,26	-34869,34	-39177,46	-36063,24
A. Forest land	-27074,81	-27074,81	-28764,23	-28821,41	-29099,47	-31647,69	-28891,33	-29382,93	-32101,80	-33314,21	-34358,13	-34717,12	-38314,30	-38344,68
B. Cropland	-47,63	-47,63	-41,29	-34,94	-28,64	-22,29	-15,99	-9,61	-3,26	3,01	9,39	-508,93	-516,08	-527,23
C. Grassland	85,07	85,07	113,80	142,49	171,22	199,94	228,67	257,40	360,67	463,98	948,58	-302,13	-198,35	-85,46
D. Wetlands	1741,74	1741,74	991,58	8893,76	185,39	690,47	1413,53	594,51	2664,71	510,11	1279,81	1232,81	875,86	3181,71
E. Settlements	683,21	683,21	683,21	683,21	683,21	683,21	683,21	683,21	683,21	683,21	683,21	683,21	629,49	629,49
F. Other land	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE
G. Harvested wood products	-4368,20	-4368,20	-3603,75	-3878,13	-1858,75	-1596,81	-1306,36	-1563,95	-1577,50	-1754,65	-1215,13	-1257,17	-1654,08	-917,07
H. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
5. Waste	27,40	27,40	27,86	28,32	28,78	29,24	26,79	28,96	41,35	25,54	23,17	22,85	22,72	9,82
A. Solid waste disposal	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
B. Biological treatment of solid waste														
C. Incineration and open burning of waste	27,40	27,40	27,86	28,32	28,78	29,24	26,79	28,96	41,35	25,54	23,17	22,85	22,72	9,82
D. Waste water treatment and discharge														
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other *(as specified in summary 1.A)*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Memo items:														
International bunkers	930,78	930,78	1138,96	1151,44	1290,14	1138,84	1394,62	1397,47	1870,62	2031,47	2407,30	2877,79	2340,89	4338,33
Aviation	551,80	551,80	715,77	804,05	977,48	788,29	807,21	1002,70	1368,47	1522,97	1513,51	1598,65	1592,34	2648,65
Navigation	378,98	378,98	423,19	347,39	312,66	350,55	587,41	394,77	502,15	508,50	893,79	1279,14	748,55	1689,68
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 emissions from biomass	32841,81	32841,81	32874,32	32874,05	32635,17	32484,98	32330,40	32234,97	32147,25	31974,71	30742,14	29720,99	28530,38	27455,69
CO_2 captured	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Long-term storage of C in waste disposal sites	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indirect N_2O														
Indirect CO_2 (3)	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE
Total CO_2 equivalent emissions without land use, land-use change and forestry	146507,20	146507,20	153538,02	159065,85	167301,87	163783,17	178310,25	195750,70	208023,00	208042,30	203949,03	226029,84	209529,14	217652,91
Total CO_2 equivalent emissions with land use, land-use change and forestry	117526,58	117526,58	122917,34	136050,82	137354,82	132089,99	149349,79	166329,34	178049,03	174633,75	171296,76	191160,50	170351,68	181589,68
Total CO_2 equivalent emissions, including indirect CO2, without land use, land-use change and forestry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total CO_2 equivalent emissions, including indirect CO2, with land use, land-use change and forestry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Note: All footnotes for this table are given at the end of the t

TABLE 10 EMISSION TRENDS

CO_2

(Sheet 2 of 6)

Inventory 2016

Submission 2018 v1

TURKEY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year(1)	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Change from base to latest reported year
	(kt)	(kt)														%
1. Energy	124822,78	205989,66	212480,03	228972,50	248009,98	276736,04	272245,18	277515,70	276009,67	296691,18	304437,92	294046,42	305210,02	328847,93	346906,91	177,92
A. Fuel combustion (sectoral approach)	124602,45	205844,35	212339,70	228830,77	247874,75	276603,01	272110,19	277377,36	275853,39	296540,54	304294,10	293900,76	305064,41	328693,21	346748,84	178,28
1. Energy industries	36882,90	74001,00	74877,26	89822,09	95334,70	112795,41	118170,56	118300,15	112786,98	124406,04	125578,05	120178,08	130647,98	135132,73	143.327,03	288,60
2. Manufacturing industries and construction	32224,93	62215,95	60278,11	58746,95	67420,21	69211,41	45791,68	45526,30	54216,78	56378,80	57488,54	51579,42	52088,33	57084,69	59.461,34	84,52
3. Transport	26250,81	36892,84	41061,32	41043,83	44376,84	50988,90	47116,86	46871,23	44382,60	46366,82	61248,52	67478,09	72084,28	74271,58	80.207,78	205,54
4. Other sectors	29243,80	32734,57	36123,01	39217,90	40743,00	43607,29	61031,09	66679,69	64467,02	69388,88	59978,99	54665,17	50243,82	62204,22	63.752,70	118,00
5. Other	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0,00
B. Fugitive emissions from fuels	220,20	145,18	140,20	141,60	135,10	132,90	134,86	138,22	156,16	150,52	143,69	145,54	145,49	154,59	157,95	-28,27
1. Solid fuels	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0,00
2. Oil and natural gas and other emissions from energy production	220,20	145,18	140,20	141,60	135,10	132,90	134,86	138,22	156,16	150,52	143,69	145,54	145,49	154,59	157,95	-28,27
C. CO_2 transport and storage	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,13	0,00
2. Industrial processes	21197,08	26396,43	28792,48	31304,19	32928,41	35548,93	37576,03	38653,93	42867,78	47491,33	49052,41	51924,81	51561,77	51198,81	54617,39	157,66
A. Mineral industry	13452,14	19516,64	20996,85	23276,77	25334,88	27580,27	29114,97	30255,74	33389,19	37294,01	36370,23	39583,14	39792,46	38430,63	41.923,97	211,65
B. Chemical industry	1060,35	747,88	860,19	977,08	253,56	40,62	270,83	52,34	333,60	1379,60	1520,72	1061,95	1154,13	1613,94	1.135,96	7,13
C. Metal industry	6501,23	5857,15	6576,38	6605,21	6868,30	7478,75	7830,56	7949,63	8713,41	9963,98	10555,94	10746,14	10216,02	10887,74	11.411,24	75,52
D. Non-energy products from fuels and solvent use	183,37	274,75	359,07	445,74	471,68	449,28	359,66	396,21	431,59	853,74	605,52	533,59	399,16	266,50	146,22	-20,26
E. Electronic industry																
F. Product uses as ODS substitutes																
G. Other product manufacture and use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
H. Other	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	0,00
3. Agriculture	459,95	565,41	632,18	613,16	592,34	566,30	564,84	592,72	644,98	557,55	639,77	807,30	787,69	810,59	1.295,35	181,63
A. Enteric fermentation																
B. Manure management																
C. Rice cultivation																
D. Agricultural soils																
E. Prescribed burning of savannas																
F. Field burning of agricultural residues																
G. Liming	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0,00
H. Urea application	459,95	565,41	632,18	613,16	592,34	566,30	564,84	592,72	644,98	557,55	639,77	807,30	787,69	810,59	1.295,35	181,63
I. Other carbon-containing fertilizers	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0,00
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
4. Land use, land-use change and forestry (2)	-28980,62	-41824,38	-40909,83	-42758,64	-45667,27	-44042,80	-40688,45	-44164,95	-46110,90	-48245,64	-49497,59	-57358,15	-58329,47	-63855,38	-68289,24	135,64
A. Forest land	-27074,81	-40705,74	-40349,08	-41444,87	-42753,24	-42146,19	-38573,09	-41860,25	-43955,69	-45165,75	-45762,83	-52553,00	-53259,76	-56496,99	-60.396,66	123,07
B. Cropland	-47,63	-529,14	-521,88	-517,15	-530,27	190,56	194,88	184,43	194,22	191,36	197,05	202,69	205,48	213,14	-44,16	-7,28
C. Grassland	85,07	23,23	217,93	239,47	249,91	1461,73	1667,86	2135,51	2130,12	2101,54	2424,01	2456,87	2489,40	2611,31	2.728,95	3107,80
D. Wetlands	1741,74	737,22	793,50	1498,75	260,22	640,90	16,68	237,38	60,87	7,85	NO,NE	NO,NE	NE,NO	NO,NE	NO,NE	
E. Settlements	683,21	629,49	629,49	629,49	629,49	44,56	44,56	44,56	44,56	44,56	44,56	44,56	44,56	44,56	44,54	-93,48
F. Other land	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NE,NO	NO,NE	NO,NE	0,00
G. Harvested wood products	-4368,20	-1979,46	-1679,80	-3164,34	-3523,38	-4234,35	-4039,34	-4906,58	-4584,98	-5425,20	-6400,37	-7509,27	-7809,15	-10227,40	-10.621,91	143,16
H. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0,00
5. Waste	27,40	11,51	4,53	8,11	10,98	11,23	10,66	8,68	5,96	5,43	4,66	2,44	0,48	0,76	1,13	-95,86
A. Solid waste disposal	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
B. Biological treatment of solid waste																
C. Incineration and open burning of waste	27,40	11,51	4,53	8,11	10,98	11,23	10,66	8,68	5,96	5,43	4,66	2,44	0,48	0,76	1,13	-95,86
D. Waste water treatment and discharge																
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
6. Other *(as specified in summary 1.A)*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
Memo items:																
International bunkers	930,78	4726,51	6144,26	6705,97	6141,29	6086,12	7316,49	8108,61	8265,77	8720,45	10302,77	11552,99	13182,48	13827,13	13635,78	1364,98
Aviation	551,80	2762,16	2976,57	3329,73	3014,41	3730,69	4991,42	5254,72	5858,47	6769,01	7684,30	8660,75	9922,40	11085,16	10.629,74	1826,37
Navigation	378,98	1964,35	3167,69	3376,24	3126,88	2355,43	2325,07	2853,89	2407,30	1951,44	2618,47	2892,24	3260,08	2741,97	3.006,04	693,19
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
CO_2 emissions from biomass	32841,81	26370,34	25358,84	24373,84	23495,12	22670,27	22028,51	21118,32	20504,25	16117,34	11572,32	19890,40	15012,35	12598,54	11.940,31	-63,64
CO_2 captured	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
Long-term storage of C in waste disposal sites	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
Indirect N_2O																
Indirect CO_2 (3)	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	0,00
Total CO_2 equivalent emissions without land use, land-use change and forestry	146507,20	232963,02	241909,22	260897,95	281541,72	312862,50	310396,70	316771,03	319528,40	344745,50	354134,76	346780,97	357559,96	380858,10	402820,78	174,95
Total CO_2 equivalent emissions with land use, land-use change and forestry	117526,58	191138,63	200999,39	218139,32	235874,45	268819,70	269708,25	272606,08	273417,50	296499,86	304637,17	289422,81	299230,49	317002,72	334531,55	184,64
Total CO_2 equivalent emissions, including indirect CO2, without land use, land-use change and forestry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
Total CO_2 equivalent emissions, including indirect CO2, with land use, land-use change and forestry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00

Note: All footnotes for this table are given at the end of the t

SEVENTH NATIONAL COMMUNICATION
OF TURKEY UNDER THE UNFCCC

TABLE 10 EMISSION TRENDS

CH_4

(Sheet 3 of 6)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year(1)	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	(kt)													
1. Energy	302,35	302,35	296,20	298,66	292,47	277,01	280,40	279,07	298,60	306,50	338,65	352,93	327,41	312,14
A. Fuel combustion (sectoral approach)	139,19	139,19	140,16	143,24	139,85	128,76	133,64	132,98	138,72	129,86	121,58	121,70	108,25	109,92
1. Energy industries	0,43	0,43	0,43	0,48	0,44	0,55	0,57	0,60	0,66	0,69	0,83	0,95	0,97	0,93
2. Manufacturing industries and construction	2,14	2,14	2,35	2,11	2,07	1,81	2,04	2,86	3,22	3,44	2,85	3,89	2,57	3,56
3. Transport	3,95	3,95	3,81	4,16	5,00	4,94	5,45	5,86	7,02	7,46	7,78	8,91	8,43	7,86
4. Other sectors	132,67	132,67	133,56	136,50	132,33	121,46	125,57	123,66	127,83	118,27	110,13	107,95	96,28	97,57
5. Other	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
B. Fugitive emissions from fuels	163,16	163,16	156,04	155,42	152,63	148,25	146,76	146,09	159,88	176,64	217,07	231,23	219,16	202,22
1. Solid fuels	135,54	135,54	123,40	122,90	121,12	117,02	113,65	110,77	121,09	137,23	174,66	185,61	172,76	153,85
2. Oil and natural gas and other emissions from energy production	27,62	27,62	32,64	32,51	31,51	31,23	33,11	35,33	38,79	39,41	42,41	45,62	46,40	48,37
C. CO_2 transport and storage														
2. Industrial processes	0,32	0,32	0,30	0,31	0,31	0,32	0,30	0,33	0,34	0,32	0,31	0,35	0,33	0,30
A. Mineral industry														
B. Chemical industry	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	NO,IE,NA
C. Metal industry	0,32	0,32	0,30	0,31	0,31	0,31	0,30	0,32	0,34	0,32	0,30	0,35	0,33	0,30
D. Non-energy products from fuels and solvent use	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NE,NA	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE
E. Electronic industry														
F. Product uses as ODS substitutes														
G. Other product manufacture and use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
H. Other	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE
3. Agriculture	1000,79	1000,79	1037,25	1024,06	1012,99	1008,79	983,43	984,36	915,58	906,91	912,00	873,35	855,34	770,80
A. Enteric fermentation	892,56	892,56	925,17	917,18	901,44	889,40	868,18	867,10	808,15	791,24	794,02	764,96	744,25	675,14
B. Manure management	94,08	94,08	97,62	93,20	96,81	106,43	101,04	102,18	92,33	99,10	102,17	93,35	96,55	80,68
C. Rice cultivation	4,01	4,01	3,99	3,76	4,06	3,59	4,50	5,03	4,97	5,41	5,87	5,12	5,28	5,40
D. Agricultural soils	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field burning of agricultural residues	10,13	10,13	10,47	9,93	10,67	9,37	9,71	10,06	10,14	11,16	9,95	9,93	9,26	9,59
G. Liming														
H. Urea application														
I. Other carbon-containing fertilizers														
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. Land use, land-use change and forestry	0,81	0,81	0,48	0,73	0,92	2,29	0,46	0,91	0,39	0,42	0,36	1,65	0,47	0,57
A. Forest land	0,81	0,81	0,48	0,73	0,92	2,29	0,46	0,91	0,39	0,42	0,36	1,65	0,47	0,57
B. Cropland	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE
C. Grassland	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
D. Wetlands	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
E. Settlements	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Other land	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
G. Harvested wood products														
H. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
5. Waste	383,89	383,89	392,21	400,51	409,68	418,63	430,76	444,21	465,54	476,58	495,17	512,74	532,11	550,40
A. Solid waste disposal	269,18	269,18	276,13	283,06	290,90	298,53	306,09	318,53	333,70	351,49	370,55	388,49	407,28	425,29
B. Biological treatment of solid waste	0,45	0,45	0,45	0,45	0,45	0,45	0,37	0,42	0,42	0,39	0,53	0,56	0,51	0,89
C. Incineration and open burning of waste	2,69	2,69	2,74	2,78	2,83	2,87	2,63	2,85	4,06	2,51	2,28	2,25	2,23	1,43
D. Waste water treatment and discharge	111,56	111,56	112,90	114,21	115,50	116,78	121,67	122,42	127,35	122,19	121,82	121,44	122,09	122,78
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other *(as specified in summary 1.A)*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total CH_4 emissions without CH_4 from LULUCF	1687,34	1687,34	1725,96	1723,54	1715,46	1704,75	1694,90	1707,97	1680,06	1690,32	1746,13	1739,37	1715,20	1633,63
Total CH_4 emissions with CH_4 from LULUCF	1688,15	1688,15	1726,43	1724,27	1716,38	1707,04	1695,36	1708,87	1680,45	1690,73	1746,49	1741,02	1715,66	1634,20
Memo items:														
International bunkers	0,04	0,04	0,04	0,04	0,04	0,04	0,06	0,04	0,06	0,06	0,09	0,13	0,08	0,17
Aviation	0,00	0,00	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,02
Navigation	0,04	0,04	0,04	0,03	0,03	0,03	0,05	0,04	0,05	0,05	0,08	0,12	0,07	0,16
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 emissions from biomass														
CO_2 captured														
Long-term storage of C in waste disposal sites														
Indirect N_2O														
Indirect CO_2 (3)														

(Note: All footnotes for this table are given at the end of the table on sheet 6.

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year(1)	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Change from base to latest reported year
	(kt)	(kt)														%
1. Energy	302,35	306,66	304,80	329,62	343,80	421,64	485,54	491,46	493,95	498,34	511,87	469,03	515,31	286,07	407,72	34,85
A. Fuel combustion (sectoral approach)	139,19	112,37	114,43	113,12	112,60	114,98	159,86	176,64	175,47	149,37	150,77	148,47	124,16	82,40	82,23	-40,92
1. Energy industries	0,43	0,91	0,97	1,18	1,25	1,52	1,51	1,72	1,74	1,91	1,91	1,78	1,96	1,96	1,97	356,53
2. Manufacturing industries and construction	2,14	4,11	4,18	3,83	4,77	5,05	2,63	2,73	3,09	3,11	3,03	2,79	2,96	3,21	3,28	53,35
3. Transport	3,95	8,08	8,35	8,59	9,22	10,45	10,53	10,96	11,44	11,49	12,60	13,03	13,62	14,54	15,41	289,87
4. Other sectors	132,67	99,26	100,93	99,52	97,36	97,96	145,18	161,23	159,19	132,86	133,24	130,86	105,62	62,68	61,56	-53,60
5. Other	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0,00
B. Fugitive emissions from fuels	163,16	194,29	190,37	216,51	231,20	306,66	325,68	314,83	318,48	348,97	361,10	320,56	391,15	203,67	325,49	99,49
1. Solid fuels	135,54	139,08	133,35	149,74	157,98	223,06	239,44	237,70	241,73	258,89	265,65	238,44	281,08	99,35	223,83	65,14
2. Oil and natural gas and other emissions from energy production	27,62	55,20	57,02	66,77	73,21	83,61	86,23	77,13	76,75	90,08	95,44	82,12	110,08	104,33	101,66	268,03
C. CO_2 transport and storage																
2. Industrial processes	0,32	0,32	0,33	0,37	0,35	0,37	0,38	0,36	0,41	0,45	0,51	0,53	0,55	0,60	0,69	116,90
A. Mineral industry																
B. Chemical industry	0,00	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	NO,IE,NA	
C. Metal industry	0,32	0,32	0,33	0,37	0,35	0,37	0,38	0,36	0,41	0,45	0,51	0,53	0,55	0,60	0,69	118,16
D. Non-energy products from fuels and solvent use	NE,NA	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NE,NA	NE,NA	NE,NA	0,00
E. Electronic industry																
F. Product uses as ODS substitutes																
G. Other product manufacture and use	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
H. Other	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NE,NA	NE,NA	NE,NA	0,00
3. Agriculture	1000,79	842,88	849,73	880,93	912,23	924,89	902,60	885,17	949,73	1025,28	1159,50	1209,95	1225,58	1211,27	1215,77	21,48
A. Enteric fermentation	892,56	738,56	758,27	786,52	813,23	822,10	802,28	783,06	836,49	912,25	1029,59	1074,02	1083,78	1075,52	1076,94	20,66
B. Manure management	94,08	89,21	74,82	78,36	82,03	87,32	84,32	85,50	98,83	98,09	113,50	119,86	126,53	121,24	124,48	32,31
C. Rice cultivation	4,01	5,72	6,25	7,34	8,48	8,11	8,64	8,35	8,09	8,17	9,96	9,23	9,18	9,60	9,72	142,51
D. Agricultural soils	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
F. Field burning of agricultural residues	10,13	9,39	10,39	8,70	8,50	7,36	7,36	8,26	6,33	6,76	6,44	6,85	6,08	4,92	4,63	-54,32
G. Liming																
H. Urea application																
I. Other carbon-containing fertilizers																
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
4. Land use, land-use change and forestry	0,81	0,44	0,33	0,19	0,52	0,78	1,99	0,31	0,22	0,24	0,71	0,79	0,19	0,20	0,64	-20,50
A. Forest land	0,81	0,44	0,33	0,19	0,52	0,78	1,99	0,31	0,22	0,24	0,71	0,79	0,19	0,20	0,64	-20,50
B. Cropland	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	NO,NE,IE	0,00
C. Grassland	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NO,NE	NO,NE	0,00
D. Wetlands	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NO,NE	NO,NE	0,00
E. Settlements	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
F. Other land	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0,00
G. Harvested wood products																
H. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0,00
5. Waste	383,89	568,56	591,16	607,80	628,72	639,19	642,10	644,71	654,37	664,32	646,74	591,35	583,78	597,76	564,53	47,06
A. Solid waste disposal	269,18	444,18	464,89	483,43	502,41	515,40	522,43	524,88	534,34	545,77	528,56	485,93	486,55	502,28	467,25	73,58
B. Biological treatment of solid waste	0,45	0,76	0,82	0,66	0,42	0,78	0,57	0,74	0,54	0,68	0,42	0,37	0,35	0,37	0,36	-19,85
C. Incineration and open burning of waste	2,69	1,68	0,66	1,18	1,60	1,64	1,56	1,27	0,87	0,79	0,68	0,36	0,03	0,04	0,07	-97,54
D. Waste water treatment and discharge	111,56	121,94	124,79	122,53	124,29	121,37	117,53	117,83	118,62	117,08	117,08	104,69	96,85	95,07	96,85	-13,18
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
6. Other *(as specified in summary 1.A)*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
Total CH_4 emissions without CH_4 from LULUCF	1687,34	1718,43	1746,02	1818,73	1885,12	1986,09	2030,62	2021,70	2098,46	2188,38	2318,62	2270,86	2325,22	2095,71	2188,70	29,71
Total CH_4 emissions with CH_4 from LULUCF	1688,15	1718,87	1746,34	1818,92	1885,64	1986,87	2032,61	2022,01	2098,69	2188,63	2319,33	2271,65	2325,41	2095,91	2189,35	29,69
Memo items:																
International bunkers	0,04	0,20	0,31	0,34	0,31	0,24	0,25	0,29	0,26	0,22	0,29	0,32	0,36	0,33	0,34	780,78
Aviation	0,00	0,02	0,02	0,02	0,02	0,03	0,03	0,04	0,04	0,05	0,05	0,06	0,07	0,08	0,07	1825,75
Navigation	0,04	0,18	0,29	0,31	0,29	0,21	0,21	0,26	0,22	0,18	0,24	0,26	0,29	0,25	0,27	666,51
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
CO_2 emissions from biomass																
CO_2 captured																
Long-term storage of C in waste disposal sites																
Indirect N_2O																
Indirect CO_2 (3)																

(Note: All footnotes for this table are given at the end of the table on sheet 6.

TABLE 10 EMISSION TRENDS

N_2O

(Sheet 4 of 6)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
	(kt)													
1. Energy	6,53	6,53	6,52	6,65	7,56	7,48	7,83	8,32	8,42	8,30	8,29	8,46	7,90	8,02
A. Fuel combustion (sectoral approach)	6,53	6,53	6,51	6,65	7,55	7,48	7,83	8,31	8,42	8,30	8,28	8,46	7,90	8,01
1. Energy industries	0,37	0,37	0,39	0,44	0,43	0,51	0,51	0,55	0,60	0,65	0,67	0,72	0,73	0,63
2. Manufacturing industries and construction	0,34	0,34	0,38	0,34	0,34	0,30	0,33	0,46	0,51	0,54	0,45	0,61	0,41	0,56
3. Transport	2,08	2,08	2,00	2,09	2,51	2,44	2,67	2,85	2,72	2,61	2,65	2,52	2,38	2,42
4. Other sectors	3,73	3,73	3,75	3,77	4,28	4,23	4,31	4,45	4,58	4,50	4,51	4,61	4,38	4,41
5. Other	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE
B. Fugitive emissions from fuels	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
1. Solid fuels	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE
2. Oil and natural gas and other emissions from energy production	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
C. CO_2 transport and storage														
2. Industrial processes	3,57	3,57	2,88	3,22	3,15	2,18	3,37	3,41	3,49	3,32	3,10	2,84	2,47	2,79
A. Mineral industry														
B. Chemical industry	3,57	3,57	2,85	3,22	3,15	2,18	3,37	3,41	3,49	3,32	3,10	2,84	2,47	2,79
C. Metal industry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
D. Non-energy products from fuels and solvent use	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE
E. Electronic industry														
F. Product uses as ODS substitutes														
G. Other product manufacture and use	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3. Agriculture	56,79	56,79	56,76	58,31	60,60	53,72	53,61	55,63	55,06	60,12	61,33	59,00	52,97	52,82
A. Enteric fermentation														
B. Manure management	5,90	5,90	6,42	6,49	6,59	6,62	6,38	6,52	6,24	6,44	6,46	6,40	6,14	5,81
C. Rice cultivation														
D. Agricultural soils	50,62	50,62	50,08	51,57	53,73	46,86	46,98	48,85	48,55	53,39	54,61	52,34	46,59	46,76
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
F. Field burning of agricultural residues	0,26	0,26	0,27	0,26	0,28	0,24	0,25	0,26	0,26	0,29	0,26	0,26	0,24	0,25
G. Liming														
H. Urea application														
I. Other carbon containing fertilizers														
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
4. Land use, land-use change and forestry	0,13	0,13	0,12	0,14	0,15	0,24	0,14	0,17	0,17	0,19	0,21	0,30	0,25	0,29
A. Forest land	0,04	0,04	0,03	0,04	0,05	0,13	0,03	0,05	0,02	0,02	0,02	0,09	0,03	0,03
B. Cropland	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,02	0,02	0,02
C. Grassland	0,05	0,05	0,05	0,06	0,07	0,07	0,08	0,09	0,11	0,13	0,16	0,18	0,21	0,23
D. Wetlands	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
E. Settlements	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO
F. Other land	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
G. Harvested wood products														
H. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
5. Waste	4,92	4,92	5,01	5,05	5,08	5,22	5,33	5,24	5,16	5,39	5,46	5,52	5,49	5,58
A. Solid waste disposal														
B. Biological treatment of solid waste	0,03	0,03	0,03	0,03	0,03	0,03	0,02	0,03	0,03	0,02	0,03	0,03	0,03	0,05
C. Incineration and open burning of waste	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,04	0,05	0,03	0,03	0,03	0,03	0,02
D. Waste water treatment and discharge	4,86	4,86	4,94	4,99	5,01	5,15	5,27	5,18	5,08	5,33	5,40	5,46	5,43	5,51
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
6. Other *(as specified in summary 1.A)*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Total direct N_2O emissions without N_2O from LULUCF	71,81	71,81	71,13	73,23	76,38	68,60	70,14	72,60	72,12	77,13	78,17	75,83	68,83	69,21
Total direct N_2O emissions with N_2O from LULUCF	71,93	71,93	71,25	73,37	76,53	68,83	70,28	72,77	72,29	77,32	78,38	76,12	69,08	69,50
Memo items:														
International bunkers	0,03	0,03	0,03	0,03	0,04	0,03	0,04	0,04	0,05	0,06	0,07	0,08	0,06	0,12
Aviation	0,02	0,02	0,02	0,02	0,03	0,02	0,02	0,03	0,04	0,04	0,04	0,04	0,04	0,07
Navigation	0,01	0,01	0,01	0,01	0,01	0,01	0,02	0,01	0,01	0,01	0,02	0,03	0,02	0,04
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CO_2 emissions from biomass														
CO_2 captured														
Long-term storage of C in waste disposal sites														
Indirect N_2O	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE
Indirect CO_2 [2]														

Note: All footnotes for this table are given at the end of the table on sheet 6.

TABLE 10 EMISSION TRENDS

N_2O

(Sheet 4 of 6)

Inventory 2016
Submission 2018 v1
TURKEY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[1]	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Change from base to latest reported year
	(kt)								(kt)							%
1. Energy	6,53	9,25	10,05	10,46	11,26	12,66	13,62	14,03	13,31	14,18	9,66	10,06	10,61	12,49	13,02	99,27
A. Fuel combustion (sectoral approach)	6,53	9,25	10,04	10,45	11,25	12,66	13,62	14,02	13,30	14,18	9,66	10,06	10,61	12,49	13,01	99,33
1. Energy industries	0,37	1,72	2,11	2,55	2,87	3,80	4,00	4,51	4,00	4,23	3,85	4,05	4,36	3,87	4,14	1014,60
2. Manufacturing industries and construction	0,34	0,64	0,65	0,59	0,73	0,76	0,40	0,42	0,47	0,47	0,46	0,43	0,45	0,48	0,50	43,98
3. Transport	2,08	2,45	2,61	2,63	2,74	2,85	2,64	2,56	2,43	2,46	3,23	3,56	3,81	3,90	4,19	101,54
4. Other sectors	3,73	4,44	4,67	4,68	4,92	5,25	6,59	6,54	6,40	7,02	2,13	2,02	2,00	4,24	4,19	12,20
5. Other	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	IE	0,00
B. Fugitive emissions from fuels	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-30,44
1. Solid fuels	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	0,00
2. Oil and natural gas and other emissions from energy production	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-30,44
C. CO_2 transport and storage																
2. Industrial processes	3,57	2,53	2,40	2,45	5,81	3,62	2,76	4,50	5,55	5,82	5,96	5,99	6,07	4,87	4,09	14,62
A. Mineral industry																
B. Chemical industry	3,57	2,53	2,40	2,45	5,81	3,62	2,76	4,50	5,55	5,82	5,96	5,99	6,07	4,87	4,09	14,62
C. Metal industry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
D. Non-energy products from fuels and solvent use	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NA,NE	NE,NA	NE,NA	NE,NA	0,00
E. Electronic industry																
F. Product uses as ODS substitutes																
G. Other product manufacture and use	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NO,NE,NA	NE,NA	0,00
H. Other	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
3. Agriculture	56,79	57,97	60,23	60,86	62,31	60,40	55,74	59,85	61,87	63,54	70,41	75,74	74,88	75,70	83,21	46,53
A. Enteric fermentation																
B. Manure management	5,90	6,44	6,93	7,30	7,72	7,59	7,53	7,40	7,95	8,68	9,84	10,30	10,52	10,55	10,74	81,87
C. Rice cultivation																
D. Agricultural soils	50,62	51,29	53,03	53,34	54,37	52,62	48,03	52,24	53,76	54,69	60,40	65,26	64,21	65,02	72,35	42,93
E. Prescribed burning of savannas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
F. Field burning of agricultural residues	0,26	0,24	0,27	0,23	0,22	0,19	0,19	0,21	0,16	0,18	0,17	0,18	0,16	0,13	0,12	-54,32
G. Liming																
H. Urea application																
I. Other carbon containing fertilizers																
J. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
4. Land use, land-use change and forestry	0,13	0,30	0,34	0,34	0,36	0,38	0,49	0,50	0,50	0,49	0,59	0,61	0,58	0,61	0,65	416,23
A. Forest land	0,04	0,02	0,02	0,01	0,03	0,04	0,11	0,02	0,01	0,01	0,04	0,04	0,01	0,01	0,04	-20,50
B. Cropland	0,04	0,02	0,02	0,02	0,02	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-99,82
C. Grassland	0,05	0,26	0,30	0,31	0,31	0,33	0,38	0,49	0,49	0,48	0,53	0,56	0,57	0,60	0,62	1217,28
D. Wetlands	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NO,NE	NO,NE	0,00
E. Settlements	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NE,NO	NO,NE	NO,NE	0,00
F. Other land	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0,00
G. Harvested wood products																
H. Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	0,00
5. Waste	4,92	5,61	5,68	5,76	5,81	5,88	5,82	5,92	6,15	6,31	6,56	6,67	6,75	6,84	6,94	40,98
A. Solid waste disposal																
B. Biological treatment of solid waste	0,03	0,05	0,05	0,04	0,03	0,05	0,03	0,04	0,03	0,04	0,03	0,02	0,02	0,02	0,02	-19,85
C. Incineration and open burning of waste	0,04	0,02	0,01	0,02	0,02	0,02	0,02	0,02	0,01	0,01	0,01	0,01	0,00	0,00	0,00	-97,40
D. Waste water treatment and discharge	4,86	5,53	5,62	5,70	5,76	5,81	5,76	5,85	6,11	6,25	6,52	6,64	6,73	6,82	6,91	42,35
E. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
6. Other *(as specified in summary 1.A)*	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
Total direct N_2O emissions without N_2O from LULUCF	71,81	75,36	78,36	79,52	84,89	82,56	77,95	84,29	86,88	89,85	92,59	98,47	98,31	99,90	107,25	49,36
Total direct N_2O emissions with N_2O from LULUCF	71,93	75,66	78,70	79,86	85,25	82,94	78,44	84,80	87,38	90,35	93,18	99,08	98,89	100,51	107,90	50,00
Memo items:																
International bunkers	0,03	0,13	0,17	0,18	0,17	0,16	0,20	0,22	0,23	0,24	0,28	0,32	0,36	0,38	0,37	1367,18
Aviation	0,02	0,08	0,08	0,09	0,08	0,10	0,14	0,15	0,16	0,19	0,21	0,24	0,28	0,31	0,30	1826,37
Navigation	0,01	0,05	0,08	0,09	0,08	0,06	0,06	0,07	0,06	0,05	0,07	0,07	0,08	0,07	0,08	665,43
Multilateral operations	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
CO_2 emissions from biomass																
CO_2 captured																
Long-term storage of C in waste disposal sites																
Indirect N_2O	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	NO,NE	0,00
Indirect CO_2 [2]																

Note: All footnotes for this table are given at the end of the table on sheet 6.

TABLE 10 EMISSION TRENDS

HFCs, PFCs, SF_6, and NF_3
(Sheet 5 of 6)

Inventory 2016
Submission 2018 v1
TURKEY

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Change from base to latest reported year
	(kt)														(kt)														%
Emissions of HFCs and PFCs - (kt CO_2 equivalent)	625,30	625,30	863,34	722,59	403,08	710,00	611,44	577,15	574,01	615,00	604,82	716,65	824,20	1003,57	1210,59	1489,50	1706,85	1885,15	2287,63	2423,86	2370,54	3516,02	3913,01	4615,90	4740,85	5182,97	4924,76	4744,21	658,71
Emissions of HFCs - (kt CO_2 equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	115,65	232,00	417,19	628,80	909,37	1146,88	1424,19	1713,19	1896,14	2111,28	3054,28	3432,64	4256,83	4470,24	4927,55	4805,04	4719,62	100,00
HFC-23	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,00	100,00
HFC-32	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00	0,00	0,00	0,00	0,00	100,00
HFC-41	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	100,00
HFC-43-10mee	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00	0,00	0,00	0,00	0,00	100,00
HFC-125	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,02	0,03	100,00
HFC-134	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00	0,00	0,00	0,00	0,00	100,00
HFC-134a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,03	0,16	0,29	0,43	0,63	0,79	0,98	1,18	1,30	1,43	2,07	2,29	2,77	2,88	3,14	3,00	2,93	100,00
HFC-143	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	100,00
HFC-143a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00	0,00	0,00	0,00	0,00	100,00
HFC-152																													
HFC-152a	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00	0,00	0,00	0,01	0,01	0,01	0,02	0,02	0,04	0,18	0,33	0,64	0,85	1,11	1,27	1,42	1,37	100,00
HFC-161																													
HFC-227ea	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,01	0,01	0,02	0,02	0,03	0,03	0,04	0,04	100,00
HFC-236cb																													
HFC-236ea																													
HFC-236fa	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	100,00
HFC-245ca	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	100,00
HFC-245fa	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO,IE	0,01	0,01	0,01	100,00
HFC-365mfc	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	100,00
Unspecified mix of HFCs[4] - (kt CO_2 equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	
Emissions of PFCs - (kt CO_2 equivalent)	625,30	625,30	863,34	722,59	403,08	710,00	611,44	577,15	574,01	615,00	604,82	601,00	592,20	586,39	581,79	580,13	559,96	460,96	574,44	527,72	259,26	461,74	480,36	359,06	270,60	255,42	119,72	24,58	-96,07
CF_4	0,08	0,08	0,11	0,09	0,05	0,09	0,08	0,07	0,07	0,08	0,08	0,08	0,07	0,07	0,07	0,07	0,07	0,06	0,07	0,07	0,03	0,06	0,06	0,05	0,03	0,03	0,02	0,00	-96,07
C_2F_6	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	-96,06
C_3F_8																													
C_4F_{10}																													
$c\text{-}C_4F_8$																													
C_5F_{12}																													
C_6F_{14}																													
$C_{10}F_{18}$																													
$c\text{-}C_3F_6$																													
Unspecified mix of PFCs[4] - (kt CO_2 equivalent)																													
Unspecified mix of HFCs and PFCs - (kt CO_2 equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
Emissions of SF_6 - (kt CO_2 equivalent)	NO	NO	NO	NO	NO	NO	NO	503,30	555,75	595,25	618,99	667,13	658,81	698,71	758,55	822,19	884,09	971,02	1052,90	1099,14	1064,84	1167,75	1263,10	1322,98	1344,17	1637,67	1984,90	1824,09	100,00
SF_6	NO	NO	NO	NO	NO	NO	NO	0,02	0,02	0,03	0,03	0,03	0,03	0,03	0,03	0,04	0,04	0,04	0,05	0,05	0,05	0,06	0,06	0,06	0,07	0,09	0,08	0,08	100,00
Emissions of NF_3 - (kt CO_2 equivalent)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
NF_3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00

Note: All footnotes for this table are given at the end of the table on sheet 6.

TABLE 10 EMISSION TRENDS
SUMMARY
(Sheet 6 of 6)

Inventory 2016
Submission 2018 v1
TURKEY

GREENHOUSE GAS EMISSIONS	Base year[1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Change from base to latest reported year
	CO_2 equivalent (kt)														CO_2 equivalent (kt)														(%)
CO_2 emissions without net CO_2 from LULUCF	146507,20	146507,20	153538,82	159065,85	167301,87	163783,17	178310,25	195750,70	208023,08	208042,30	203949,03	226029,84	209529,14	217652,91	232963,02	241909,22	260897,95	281541,72	312862,50	310396,70	316771,03	319528,40	344745,50	354134,76	346780,97	357559,96	380858,10	402820,78	174,95
CO_2 emissions with net CO_2 from LULUCF	117526,58	117526,58	122917,34	136050,82	137354,82	132089,99	149349,79	186329,34	178049,03	174633,75	171296,76	191160,50	170351,68	181589,68	191138,63	200999,39	218139,32	235874,65	268819,70	269708,25	272606,08	273417,59	296499,86	304637,17	289422,81	299230,49	317003,72	334531,55	184,64
CH_4 emissions without CH_4 from LULUCF	42183,50	42183,50	43148,94	43088,60	42886,46	42638,78	42372,39	42699,16	42001,53	42257,90	43653,17	43484,24	42879,95	40840,76	42960,65	43650,41	45468,20	47127,92	49652,22	50765,47	50542,52	52461,56	54709,60	57965,47	56771,52	58130,48	52392,72	54717,60	29,71
CH_4 emissions with CH_4 from LULUCF	42203,66	42203,66	43160,86	43106,73	42909,40	42676,02	42383,98	42721,85	42011,20	42268,34	43662,17	43525,51	42891,61	40855,01	42971,78	43658,57	45472,89	47140,89	49671,75	50815,30	50550,36	52467,16	54715,71	57983,16	56791,22	58135,13	52397,82	54733,63	29,69
N_2O emissions without N_2O from LULUCF	21398,73	21398,73	21197,85	21823,02	22760,78	20441,99	20900,54	21635,01	21492,84	22985,25	23294,90	22596,20	20510,48	20624,52	22456,60	23350,36	23697,07	25296,85	24602,73	23227,98	25118,50	25889,96	26775,82	27592,36	29344,19	29297,59	29769,97	31960,68	49,36
N_2O emissions with N_2O from LULUCF	21436,50	21436,50	21232,19	21863,45	22806,38	20512,21	20942,66	21686,44	21542,79	23042,79	23358,58	22684,61	20586,36	20709,78	22547,23	23452,32	23798,22	25404,20	24714,88	23374,21	25268,98	26038,63	26922,87	27769,10	29524,59	29470,32	29951,30	32155,68	50,00
HFCs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	115,66	232,00	417,19	628,80	909,37	1146,88	1424,19	1713,19	1896,14	2111,28	3054,28	3432,64	4256,83	4470,24	4927,55	4805,04	4719,62	100,00
PFCs	625,30	625,30	863,34	722,59	403,08	710,00	611,44	577,15	574,01	615,00	604,82	601,00	592,20	586,39	581,79	580,13	559,96	460,96	574,44	527,72	259,26	461,74	480,36	359,06	270,60	255,42	119,72	24,58	-96,07
Unspecified mix of HFCs and PFCs	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
SF_6	NO	NO	NO	NO	NO	NO	NO	503,30	555,75	595,25	618,99	667,13	658,81	698,71	758,55	822,19	884,09	971,02	1052,90	1099,14	1064,84	1167,75	1263,10	1322,98	1344,17	1637,67	1984,90	1824,09	100,00
NF_3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
Total (without LULUCF)	210714,73	210714,73	218748,15	224700,05	233352,18	227553,93	242194,62	261165,32	272647,13	274495,70	272120,91	293494,15	274402,58	280220,48	300349,82	311221,69	332654,16	356822,67	390457,97	387913,35	395867,43	402563,69	431407,02	445631,48	438981,70	451808,67	469930,44	496067,36	135,42
Total (with LULUCF)	181792,04	181792,04	188173,72	201743,59	203473,68	195988,23	213287,87	231818,08	242732,78	241155,14	239541,32	258754,41	235312,66	244856,75	258626,78	270421,97	290001,36	311275,21	346546,85	347420,76	351860,80	356607,05	383314,54	396328,31	381823,64	393656,59	409261,50	427989,15	135,43
Total (without LULUCF, with indirect)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00
Total (with LULUCF, with indirect)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0,00

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Base year[1]	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Change from base to latest reported year
	CO_2 equivalent (kt)														CO_2 equivalent (kt)														(%)
1. Energy	134327,90	134327,90	139276,71	145377,58	152693,95	149313,39	162696,10	179801,83	191782,50	191595,06	188794,83	212330,42	195152,82	201935,46	216412,60	223093,67	240329,11	259959,13	291049,97	288443,90	293982,21	292323,66	313375,15	320114,01	308771,37	321255,33	339721,86	360978,43	168,73
2. Industrial processes and product use	22893,94	22893,94	24864,09	24338,16	24865,48	24508,75	26128,67	26944,72	27820,36	28107,28	26487,13	26643,60	26593,87	27914,03	29127,57	31828,85	34633,97	37435,87	39977,45	41932,10	43438,20	49215,31	54413,15	56780,54	59809,23	60204,41	59574,33	62422,04	172,66
3. Agriculture	42402,30	42402,30	43282,64	43437,63	44009,35	41682,28	40987,45	41721,85	39827,87	41247,16	41808,37	40032,91	37695,28	35537,83	38913,33	39824,02	40771,65	41968,07	41686,81	39739,66	40557,33	42826,37	45125,81	506 10,34	53627,96	53742,13	53650,01	56485,70	33,21
4. Land use, land-use change and forestry[5]	-28922,68	-28922,68	-30574,43	-22956,46	-29878,49	-31565,70	-28906,75	-29347,24	-29914,35	-33340,57	-32579,59	-34739,75	-39089,92	-35963,74	-41722,63	-40799,72	-42652,80	-45546,96	-43911,12	-40492,39	-44006,63	-45956,63	-48092,48	-49303,17	-57158,06	-58152,08	-63668,94	-68078,21	135,38
5. Waste	11090,59	11090,59	11324,71	11546,69	11783,40	12049,51	12382,41	12696,92	13216,40	13546,20	14030,58	14487,23	14960,62	15433,16	15895,93	16475,14	16919,43	17459,61	17743,75	17797,49	17889,68	18198,35	18492,92	18126,59	16773,13	16606,80	16984,25	16181,19	45,90
6. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	0,00
Total (including LULUCF)[6]	181792,04	181792,04	188173,72	201743,59	203473,68	195988,23	213287,87	231818,08	242732,78	241155,14	239541,32	258754,41	235312,66	244856,75	258626,78	270421,97	290001,36	311275,21	346546,85	347420,76	351860,80	356607,05	383314,54	396328,31	381823,64	393656,59	409261,50	427989,15	135,43

(1) The column "Base year" should be filled in only by those Parties with economies in transition that use a base year different from 1990 in accordance with the relevant decisions of the COP. For these Parties, this different base year is used to calculate the percentage change in the final column of this table.
(2) Fill in net emissions/removals as reported in table Summary 1.A. For the purposes of reporting, the signs for removals are always negative (-) and for emissions positive (+).
(3) In accordance with the UNFCCC reporting guidelines, for Parties that decide to report indirect CO2 the national totals shall be provided with and without indirect CO_2.
(4) In accordance with the UNFCCC reporting guidelines, HFC and PFC emissions should be reported for each relevant chemical. However, if it is not possible to report values for each chemical (i.e. mixtures, confidential data, lack of disaggregation), this row could be used for reporting aggregate figures for HFCs and PFCs, respectively. Note that the unit used for this row is kt of CO_2 equivalent and that
(5) Includes net CO_2, CH_4 and N_2O from LULUCF.

Documentation box:
• Parties should provide detailed explanations on emissions trends in chapter 2: Trends in Greenhouse Gas Emissions and, as appropriate, in the corresponding Chapters 3 - 8 of the national inventory report (NIR). Use this documentation box to provide references to relevant sections of the NIR if any additional information and further details are needed to understand the content of this table.
• Use the documentation box to provide explanations if potential emissions are reported.

Documentation box	the years 1990-1999. Therefore bearing dominant technology in the sector in those years in mind, we assumed all activity data belongs to 1.A1.a.i sub-sector, and used IE notation key for the years 1990-1999 in 1.A1.a.ii sub-sector. 1.A.1.a.ii Liquid Fuels Liquid: Activity data was disaggregated for the years 1990-1999. Therefore bearing domin

11.2 ANNEX 1: SUMMARY OF REPORTING OF THE SUPPLEMENTARY INFORMATION UNDER THE KYOTO PROTOCOL

INFORMATION	SECTION
National system in accordance with Article 5, paragraph 1	3.3
National registry	3.1.4
Supplementary relating to the mechanisms pursuant to Article 6, 12 and 17	5.5
Policies and measures in accordance with Article 2	4.3.3
Domestic and regional programmes and/or legislative	3.3-4.1-4.2
arrangements and enforcement and administrative procedures	
Information under Article 10	3.3
10A	4.3, 6.4
10 b	7
10 c	4.3.4.2
10d	8, 9.7
10e	4.3.3.3
Minimization of Adverse Impacts in Accordance with Article 3, Paragraph 14 of the Kyoto Protocol	7
Financial Resources, Contributions and Technology Transfer	

11.3 ANNEX III: REPRESENTATIVE PROJECTS IMPLEMENTED BY LOCAL AUTHORITIES

Local Government	Project Name	Description	Time Period	Budget and Source of Financing
Aydın Metropolitan Municipality	Power Generation from Landfill Gas	Two power plants generate power from LFG of total capacity of 7.6 MWe. Third power plant is under construction.	-	-
Elazığ Municipality	Power Generation from Landfill Gas	-	2014 -	
Erzurum Metropolitan Municipality (EMM)	Power Generation from Landfill Gas			10.000.000 TRY
	Sustainable Public Transport	The Metropolitan Municipality purchased 30 CNG buses to be added to public transport fleet		5.880.000,00 EUR
Gaziantep Metropolitan Municipality (GMM)	Preparation of Climate Change Action Plan	Preparation of GHG emission mitigation ad adaptation action plan in transport, waste, water management, service, industry and building sectors.	2011	ADEME & GMM
	Sustainable Public Transport	The Metropolitan Municipality purchased CNG buses to be added to public transport fleet	-	-
İstanbul Metropolitan Municipality (IMM	Preparation of Climate Change Action Plan	Preparation of GHG emission mitigation ad adaptation action plan in İstanbul	2017	2.714.000 TRY (IMM)
	Monitoring Gas Consumption for Thermo-Rehabilitation of Buildings Project	Monitoring of energy use effort heating in buildings and integrate to GIS system in order to categorize and analyze energy use behavior and GHG emissions in similar type of buildings		EU Funded
	Increasing energy efficiency of Chisinau and Sevastopol municipalities based on existing positive experience	Promotion of Energy efficient Technologies, applications and behavior through Exchange of best practices and experience.	completed	640.000 € AB

İzmir Metropolitan Municipality (İMM	Production of biogas from activated sludge and utilizing dry activated sludge as alternative fuel	Production of biogas from activated sludge, and utilization of dried activated sludge for cement factories as fuel	-	-
	Power Generation from Landfill Gas	Construction of an LFG power plant	2016 2020	1.000.000 €
	Solar PV installations in public buildings		2016-2020	1.000.000 €
	Energy efficient lighting installations		2016-2020	70.000 €
	Public awareness campaigns for energy efficiency		2016-2020	300.000 €
	Sustainable transport projects	Several Projects to increase efficiency of the traffic, such as adaptive traffic management system, which leads to reduced fuel consumption of vehicles	2016-2020	
	Electric buses	The Metropolitan Municipality purchased 400 electric buses to be added to public transport fleet	2018-2020	120.000.000 €
	Geothermal heating for 40,000 households	İnstallation of geothermal heating systems for 400,000 households	2016-2020	37.500.000 €
Kocaeli Metropolitan Municipality (KMM)	Capacity Building on Climate Change Resilience	• Preparation of Climate Change Action Plan • Public awareness campaigns • Capacity Building activities • Preparation of GHG emission inventory	2017	190.117,76 € EU & Kocaeli Metropolitan Municipality
Malatya Metropolitan Municipality	Integrated Environmental Management Project	Extended environmental management and power generation from LFG	ongoing	
Mersin Metropolitan Municipality	Stand up to Climate Change	To increase the capacity of Mersin waste management with the cooperation of local representatives in order to create the awareness about the "Climate Change" of the public, to provide adaptation and to reduce the factors that cause climate change	18 months	210.000 € EU-IPA
Muğla Metropolitan Municipality (MMM)	Extending bike roads	Increasing the bicycle paths along the city center	-	(MMM)
Van Metropolitan Municipality	Power Generation from Landfill Gas	Construction of an LFG power plant	2018-2019	
	Rehabilitation of dump sites	Rehabilitation of 11 dump sites in Van	2018-2020	VMM
Denizli Metropolitan Municipality (DMM)	Power Generation from Landfill Gas	Construction of an LFG power plant	-	DMM
	Climate Change Action Plan	Preparation of climate action plan and implementation of mitigation actions within the plan	2017-2019	186.436 € EU – Turkey

Nevşehir Metropolitan Municipality (NMM)	Power Generation from Landfill Gas	Power is generated from landfill gas with a capacity of 1.6 MW		10.000.000 TRY
	Solar PV installations in public buildings	Solar PV panels have been installed to Municipality buildings in order to promote solar PV technology use.	2011	7.220 USD$ (NMM)
	Zero Waste Project	Promotion of zero waste concept in Nevşehir through impleöemtation in municipality buildings.	2018 -	50.000 TRY NMM
Eskişehir Metropolitan Municipality	Integrated waste management and power generation plants	An integrated waste management and power generation plant has been constructed with 11.2 MW power generation capacity		
	Improvement of Traffic Flow	A traffic control system has been established in order to optimize the traffic flow and reduce carbon emissions from vehicles, including a monitoring system for emissions in the junctions.	2011-2014	1.500.000 TRY BEBKA (Bursa- Eskişehir-Bilecik Development Agency)
Ordu Metropolitan Municipality (OMM)	Power Generation from Landfill Gas	Construction of an LFG power plant		14.988.689,00 TRY (OMM)
	Sustainable transport investments	Renewal of the public transport fleet with energy efficient vehicles	ongoing	-
Tekirdağ Metropolitan Municipality	Extension of Air Quality Monitoring Stations	Increasing number of stations with additional parameters to be monitored	2015-2018	-
	Phasing out of coal for heating	Phasing out coal consumption for heating of public buildings	2015-2018	-
	Promotion of energy efficient buildings	Promotion of energy efficiency measures in all buildings	2015-2020	-
	Promotion of reducing coal combustion	Promotion of phasing out coal consumption in private enterprises which provide service to public institutions	2015-2018	-

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