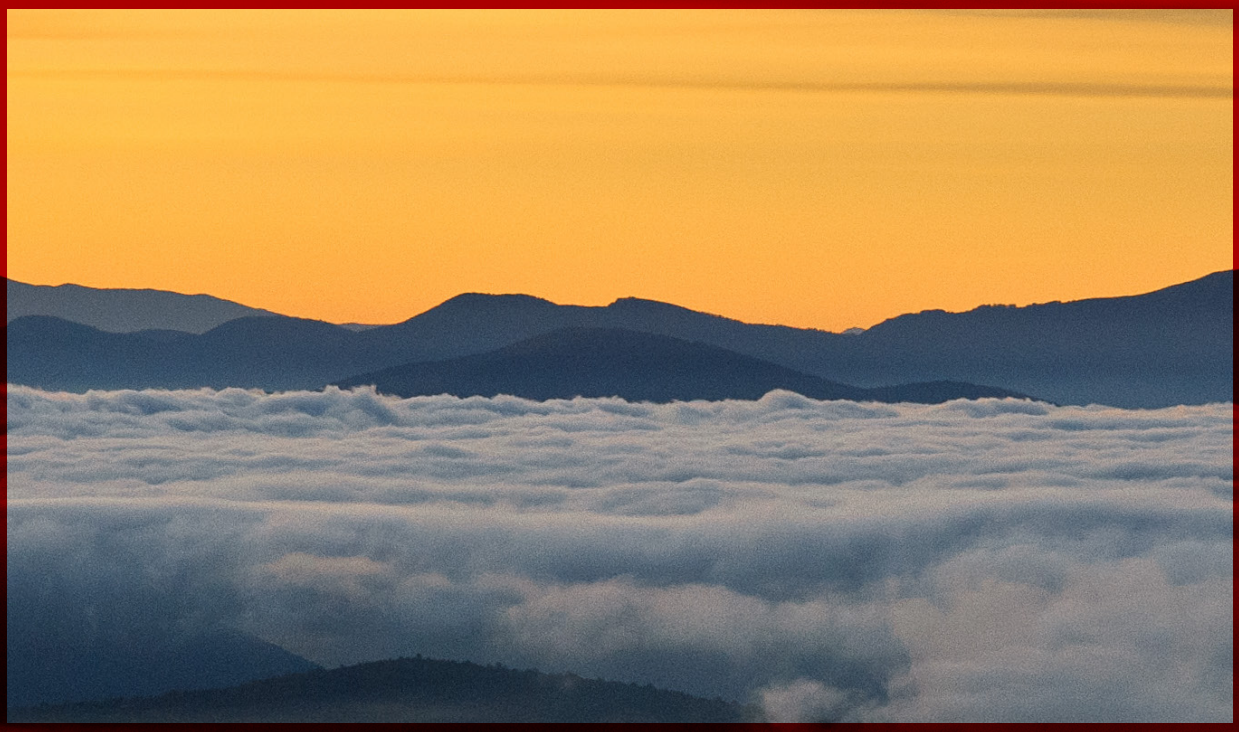
First Biennial Update Report on Climate Change



MINISTRY OF ENVIRONMENT
AND PHYSICAL PLANNING
GOVERNMENT OF THE REPUBLIC OF MACEDONIA

Empowered lives.
Resilient nations.

The First Biennial Update Report is a significant national contribution to fulfilling the country's commitments to the UNFCCC.

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Abbreviations

AFOLU	Agriculture, forestry and other land use
BUR	Biennial Update Report
CFL	Compact Fluorescent Lamp
CH_4	Methane
CHP	Combined heat and power
CO_2	Carbon dioxide
COP	Conference of the Parties
CORINAIR	CORe INventory AIR emissions - Emission Inventory Guidebook
DALY	Disability-Adjusted Life Year
ECRAN	Environment and Climate Regional Accession Network
EE	Energy Efficiency
EMI	Emission Monitoring Industry
ETS	Emission Trading System
EU	European Union
FAO	Food and Agriculture Organization
FBUR	First Biennial Update Report
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHG	Greenhouse gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GRB	Gender Responsive Budgeting
HFC	Hydrofluorocarbons
HPP	Hydro power plant
IEA	International Energy Agency
IPARD	Instrument for Pre-accession Assistance for Agriculture and Rural Development
IPCC	Inter-governmental Panel on Climate Change
IPMVP	International Performance Measurement and Verification Protocol
IPPU	Industrial processes and product use
ISO	International Standardisation Organization
LEAP	Local Environment Action Plan
LEDS	Low Emission Development Strategy
LULUCF	Land Use, Land-Use Change and Forestry
MMR	Monitoring Mechanism Regulation
MOEPP	Ministry of Environment and Physical Planning
MRV	Measurement, Reporting and Verification system
NAMA	Nationally Appropriate Mitigation Actions
NGO	Non-governmental organization
NMVOC	Non-Methane Volatile Organic Compounds

NOx	Nitrous Oxides
PFC	Perfluorocarbons
PHEV	Plug-in Hybrid Electric Vehicles
PP	Power Plant
PV	Photovoltaic
QA/QC	Quality Assurance / Quality Control
QAT	Quality Assurance Team
RES	Renewable energy source
SF_6	Sulfur hexafluoride
SME	Small and Medium Enterprises
SO_x	Sulphur Oxides
SWD	Solid waste disposal
SWDS	Solid waste disposal sites
TNC	Third National Communication
TPP	Thermal Power Plant
UN	United Nations
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
WAM	Scenario With Additional Measures
WEM	Scenario With Existing Measures
WHO	World Health Organisation
WOM	Scenario WithOut Measures
WRI	World Resource Institute
ZELS	Association of the units of Local Self-Government of The Republic of Macedonia

Units

EUR	Euro
GWh	Gigawatt hour
kt	kilo tonne
ktoe	kilo tonne of oil equivalent
m^3	cubic meter
MEUR	Million Euros
MKD	Macedonian Denar
Mt	Mega tonne
MW	Megawatt
Nm^3	Normal cubic meter

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Foreword

Dear readers,

As a signatory of the United Nations Framework Convention for Climate Change (UNFCCC), the Republic of Macedonia, and particularly the Ministry of Environment and Physical Planning, is working to meet all its obligations arising from the Convention. At the same time, efforts are being made to further boost national capacities for fulfilling upcoming commitments towards the Convention and the European Union.

The results achieved through these consistent efforts to improve environmental protection, however, will remain incomplete until policies and measures for dealing with climate change are incorporated at both national and global level. We have therefore undertaken a series of activities to assess national capacities for tackling climate change and to move towards a green economy.

This report, produced with the support of the United Nations Development Programme, is a significant national contribution to fulfilling the country's commitments to the UNFCCC. These commitments, which are also relevant even for EU member states, include the need to increase the accuracy of the national inventory of Greenhouse Gases and to assess the potential of all relevant sectors for reducing climate change. The report determines institutional and other needs for channelling and integrating all aspects of climate change in national and sectoral policies.

The measures and actions proposed in the report will be in accordance with the future National Strategy for Energy. In this way we are successfully responding to the recommendations of the latest EU Progress Report in the area of climate change, energy and the harmonization of national policies with the European package for energy and climate.

Nurhan Izairi
Minister of Environment and
Physical Planning

Chapter 1: Executive Summary

This First Biennial Update Report (FBUR) on Climate Change (CC) consolidates sectoral analyses on Greenhouse Gas (GHG) emissions and provides transparency for Macedonia's progress with mitigation actions and their effects. The FBUR builds on the findings and recommendations of the Third National Communication to the UNFCCC (submitted in 2014) and captures information from the outcomes of on-going complementary projects in the country. The ultimate goal of the FBUR report is to assist the Republic of Macedonia with the mainstreaming and integration of climate change consideration into national and sectorial policies and to continue to strengthen institutional and technical capacities with climate change mitigation and sustainable development. The level of detail and analysis of the report is reflective of the status of Macedonia as an EU candidate country and Contracting Party to the Energy Community – meaning that the country has made significant efforts in improving its reporting as well as undergoing mitigation actions.

1.1. National Circumstances

According to recent estimations[1], the Republic of Macedonia has a growing population with currently 2,103,000 inhabitants.[2] Approximately 25% of the population lives in the capital city of Skopje. Exports of goods and services currently count as 53.8% of the Gross Domestic Product (GDP).[3] Such an open economy for a small country has made Macedonia vulnerable to external events such as the economic crisis of 2009. Nonetheless, recently, Macedonia has made good progress in its economic reform agenda as evidenced by a real GDP growth rate of 2.7% in 2013 compared to 2012.[4]

Service activities contribute 62.3% to the GDP while industrial activities comprise 27.5%[5]. Both are sensitive to the state of the economy. The agriculture sector, including the value added in the processing industry, contributes 10.2% of the country's GDP and provides employment to 36% of the workforce. Forestry is also important to the economy of Macedonia. Approximately, 92% of total forest area has an economical character, and around 8% are protective and protected forests. Agriculture and natural resource-based rural economies are particularly vulnerable to various anthropogenic stressors, including climatic hazards, variability, and long-term climate change.

In spite of a diversified, improving economy, Macedonia still has room for improvements in terms of energy production. The production of electricity is predominantly from aging coal-fired power plants that account for approximately 66% of power generation. Hydropower accounts for approximately 34% of power generation.[6] The Residential and Commercial sectors comprise almost 70% of electricity demand whereas Industry only accounts for ~30% of the demand. The transport sector accounts for almost 25% of energy demand which is almost entirely from imported oil products as there is no domestic production.

Within the transport sector, the road transport has the highest share in the energy consumption (98%) and is dominant in the transport sector in general. Since 2000, there has been a significant drop in gasoline consumption and a significant increase in diesel consumption, since diesel vehicles have become more attractive. The vehicle fleet is generally very old with the age of passenger cars averaging 15 years.[7] The same is true of buses and goods vehicles.

The Ministry of Environment and Physical Planning (MOEPP) has been designated as the National Focal Point to the UNFCCC and as Designated National Authority (DNA) for Kyoto Protocol implementation. Other ministries that have responsibilities related to climate change include the Ministry of Agriculture, Forestry and Water Economy, the Ministry of Economy, the Ministry of Transport and Communication, the Ministry of Health and the Ministry of Finance. A National Climate Change Committee (NCCC) provides high-level support and guidance for overall climate change policies in the country and a National Council for Sustainable Development advises on economic affairs.

1 Republic of Macedonia, Population: 2013. Latest population statistics estimated since last census in 2002. http://countryeconomy.com/demography/population/macedonia
2 Although the fertility rate is declining in the country, similar to Europe, the population has an increasing trend.
3 IMF World Economic Outlook, April 2014. https://www.gfmag.com/global-data/country-data/macedonia-gdp-country-report
4 Republic of Macedonia State Statistical Office http://www.stat.gov.mk/PrikaziSoopstenie_en.aspx?rbrtxt=32
5 CIA, World Fact Book
6 World Bank (2013) 10 Facts about FYR Macedonia's energy sector. http://www.worldbank.org/en/news/video/2013/07/23/macedonia-energy.
7 For the sake of comparison, in 2011 in Slovenia, the number of passenger cars per 1000 inhabitants was 519, with the average age of the passenger cars of 8.4 years.

Climate change issues are incorporated into the Law on Environment, including details on the preparation of GHG emissions inventories. The Law also includes an action plan on measures and activities to abate the increase of GHG emissions and to mitigate the adverse impacts of climate change. In the past decade, a number of other laws, regulations and strategies that incorporate mitigation considerations have been adopted, such as the Strategy for Energy Development in the Republic of Macedonia for the Period 2008-2020 with a Vision to 2030 (2010), the Renewable Energy Sources Strategy of Macedonia till 2020 (2010) and the National Strategy for Energy Efficiency in the Republic of Macedonia till 2020 (2010). The Government has also adopted eight Laws on Ratification of five Protocols under the United Nations Economic Commission for Europe (UNECE) Convention on Long-range Transboundary Air Pollution.

Three National Communications to the UNFCCC published in 2003, 2008 and 2014, respectively, have informed the international community on mitigation actions taken by Republic of Macedonia to address climate change issues. In the context of its accession process to the European Union (EU) (a high priority for Macedonia), the Republic of Macedonia has already initiated the process of harmonizing its mitigation approach towards EU commitments to the UNFCCC and sections of the EU ***acquis communautaire*** related to climate change. As a member of the EU, Macedonia would be obligated to participate in the EU Emissions Trading System (EU ETS).

With its obligations to the UNFCCC and the EU, Macedonia's Strategy for Energy Development offers a set of ambitious and specific numerical targets for 2020 following the EU climate change policy track. Targets include reducing the energy intensity of the economy by 30% relative to 2006 and increasing the share of renewables (including hydropower and wood heat) to more than 20% of total final energy. The contribution of renewable energy sources (excluding biomass) to total primary energy is expected to grow by 119% over the period 2011 – 2050, primarily due to expected additional wind capacity (Third National Communication on Climate Change). However, half of the country's electricity is still projected to come from lignite-fired plants, both in 2020 and in 2030, and the overall total electricity demand is projected to grow by around 52% by 2030.

1.2. National GHG Inventory

The Republic of Macedonia has conducted a national inventory of anthropogenic emissions by sources and removal by sinks of all greenhouse gases (GHGs) to identify the major sources and removals/sinks of greenhouse gases with greater confidence so as to adhere to its targets and inform policy decisions. The inventory includes a database of six direct gases; CO_2, CH_4, N_2O, PFCs, HFCs and SF_6, and four indirect gases; CO, NOx, NMVOC and SO_2. It is based upon updated work from Macedonia's Third National Communication on Climate Change (TNC) which considered the time frame 2003–2009 and was prepared in accordance with the 1996 Revised IPCC Guidelines for National Greenhouse Gas Inventories and the 2000 IPCC Good Practice Guidance. To report up-to-date GHG trends in the FBUR, the TNC inventory has been updated to consider the period 1990 – 2012 using the newest IPCC 2006 Inventory Software.

GHG inventory preparation was coordinated by the Ministry of Environment and Physical Planning and managed by a GHG inventory team with support from a national technical advisor and the Global Support Programme (GSP). Quality Assurance / Quality Control was ensured through a formalized QA / QC process along with reviews from national experts from the Macedonian Academy of Sciences and Arts. The GSP provided a review from an experienced consultant that highlighted improvements in preparing an extensive, detailed and complete series of emissions data.

The total net emissions in the whole inventory period of 1990 – 2012 demonstrated a slight increase of 0.4% compared to the year 1990. The five most emitting key source categories in Macedonia are:

- CO_2 emissions from Energy Industries (coal, lignite) (49.5%);
- CH_4 emissions from Solid Waste Disposal Sites (11.7%);
- CO_2 emissions from Mobile Combustion, including Road Vehicles (11.6%);
- Manufacturing industries and construction (8.8%); and
- CH_4 emissions from Enteric Fermentation in Domestic Livestock (3.9%).

Overall, contributions to the national GHG emissions by sector during the period 1990 – 2012 are shown in Figure 1-1.

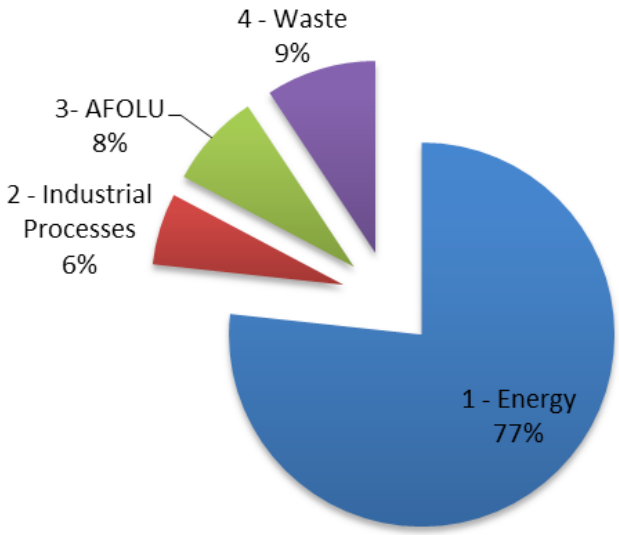


Figure 1-1: Contributions by sector to national GHG emissions during the period 1990 – 2012

Concerning the key source assessment by subcategories, the Energy Industries Subsector is the most dominant emission source in the entire emissions period, with average share of 50.2% in the year 1990, and 49.5% in the 2012.

The Manufacturing Industries and Construction subsector was the second national contributor in the year 1990 with an average share of 13.6% in the year 1990. In the last inventory year, 2012, this sector was responsible for 8.82% of the national GHG emissions, and was thereby considered the fourth contributor. The emissions of the Manufacturing subsector thus have a decreasing trend which can be attributed to decreased industrial activity in the country, partly explained by the closure of aluminium, lead and zinc production plants in 2003.

In contrast, emissions of the Road Transport subsector experienced a significant increase of the share of the total national emissions in the period 1990 – 2012; the average share of subsector emissions in the year 1990 was 6.2% of the national totals or 760.85 Gg of CO_2-eq., while in 2012 this subsector was responsible for 11.6% of the total national emissions or 1415.14 Gg of CO_2-eq.

Similarly, the emissions of the Solid Waste Disposal subsector significantly increased during the period 1990 – 2012 due to an increase in the population which has led to more consumption and waste generation.

In the category of Land-Use and Land Use Changes and Forestry (LULUCF) emissions were relatively unchanged, except in 2007, 2008 and 2012 when carbon sinks were significantly reduced due to large-scale forest fires. In the agricultural sector, the biggest part of CH_4 emissions (89%) were generated by enteric fermentation from domestic livestock and these emissions have been continuously decreasing in line with the reduction of the livestock population. Manure management emissions account for 8% of GHG emissions, while the remaining emissions come from rice fields and the burning of residues.

To improve upon future inventory data reporting for the Energy, Industrial Processes, Agriculture, Forestry and Other Land Uses and the Waste sectors it is recommended to develop category and activity specific emission factors. Furthermore in the Energy sector, fuel-specific and combustion-specific emission factors for road and railway transport are recommended to be developed. For the Industrial Processes sector, an active, online platform called Emission Monitoring in Industry (EMI) which enables industrial plants to report data for calculation of GHG emissions and other pollutants must be used in the future development of GHG inventories. For the Agriculture sector, the Tier 2 approach is recommended for estimating methane emissions from enteric fermentation from cattle by conducting more detailed analysis regarding the cattle characteristics in the country. In the Land Use, Land Use Change and Forestry sector the use of land and the land use change is encouraged to be tracked by analysing satellite images. In the Waste sector appropriate assessment studies for the composition of the solid waste disposal and the wastewaters composition are needed to achieve improved reporting methodologies in this sector.

1.3. Climate Change Mitigation and Action Plan

The climate change mitigation analysis for the First Biennial Update Report is a continuation of the analysis carried out in the Third National Communication. Taking into consideration the changes that happened in the interim period, first the baseline scenario was revised which reflects development without implementing mitigation measures, the so called scenario without measures (**WOM scenario**). Further on, using a **bottom-up approach** and starting from specific mitigation measures in **buildings**, **transport** and **energy supply sectors**, each measure has been modelled individually and its mitigation potential (achievable emissions reduction) and the specific reduction cost have been calculated.

The measures that have a relatively high degree of certainty for implementation (those which have already been started/planned for the near future, which are priority projects/polices in the sectoral strategic and planning documents or which are result of laws that have already been adopted recently or shall be adopted in the near future) are the so-called existing measures which are an integral part of the first mitigation scenario with existing measures (**WEM scenario**). A scenario with additional measures (**WAM scenario**) was developed for the purpose of prioritizing the further mitigation actions and measures and analyzing higher levels of ambition.

It has been shown that under the WOM scenario, the current emissions will have nearly doubled by 2030, with a dominance of power sector emissions (share of 60% to 70%). With the 11 measures included in the WEM scenario, a maximum emission reduction of 32% can be achieved in 2030 in comparison with the emission level of WOM scenario. Further on, the WAM scenario, which includes 14 measures (8 WEM measures, 3 improved WEM measures and 3 additional measures), can reduce the WOM scenario emission level on 2030 by 37% (see Table 1-1).

Table 1-1: Summary CO_2 emission results in 2020, 2030 and cumulatively by 2020 and 2030 in WOM, WEM and WAM scenarios

	Without measures (WOM)	With existing measures (WEM)	With additional measures (WAM)
CO_2 emissions in 2020 (kt)	11,561	9,269	8,694
CO_2 emissions in 2030 (kt)	17,891	12,124	11,214
Cumulative CO_2 emissions by 2020 (kt)	90,033	80,007	79,348
Cumulative CO_2 emissions by 2030 (kt)	212,634	173,301	165,032
Reduction compared to WOM (CO_2 emissions in 2020)		20%	25%
Reduction compared to WOM (CO_2 emissions in 2030)		32%	37%
Reduction compared to WOM (cumulative CO_2 emissions by 2020)		11%	12%
Reduction compared to WOM (cumulative CO_2 emissions by 2030)		18%	22%

It should be underlined that the results from this analysis are indicative and should be used in establishing/defining national contributions in the global mitigation efforts (UNFCCC process). Additionally, having in mind that WOM, WEM and WAM scenarios are the main element of reporting for the national mitigation efforts of Annex I countries, including EU member countries, this exercise has also contributed to capacity building in the country, both the analysis and the capacity of policy makers and all stakeholders to respond to more demanding reporting requirements.

Finally, taking also into account the mitigations analyses conducted under the Third National Communication, a tabular form of the various mitigation actions which Macedonia is currently implementing and considers or intends to implement in the coming decade is presented. For those which it is currently implementing, information on the steps taken to date is included. The types of mitigation actions include:

- The promotion of end-user energy efficiency;

- Increasing the level of renewable energy in electricity and heat production;
- Improvement of transport systems and the vehicle fleet;
- Encouraging the switch from high-carbon fuels to low-carbon fuels;
- Improvement of waste management;
- Improvement of agricultural management through a variety of cost-effective methods.

1.4. Trainings and Support Received

Macedonia received significant capacity building to assist with FBUR preparation between September 2013 and December 2014. Trainings supported the GHG inventory team and a Climate Change team to improve their knowledge and technical capacities on mitigation, Monitoring, Reporting and Validation (MRV), acumen with mitigation computer software, modelling of the energy alternatives, climate policy development, attracting climate finance, and linking climate and health.

Related to project finance and in general related to climate change, the European Union and their programs provided the highest amount of donations or 34.4% of finances needed for project realization. The United Nations with their programs and organizations contributed 11.1% to the total financing and the GEF contributed 9% to project financing.

Furthermore, with support from the UNDP Innovation Fund, UNDP is promoting innovation and the Skopje Green Route as an example of best practice to address climate change and transport. Thus far, the application has gained a vast user-base[8] and has been publicized in the EU for its success.

Similarly, through the Milieukontact Macedonia project financed by USAID, 8 municipalities in the country have developed GHG inventories on the local level.

1.5. Constraints and Gaps, and Related Financial, Technical and Capacity Needs

In order to fulfil the obligations arising from the Cancun and Durban Conference of Parties (COP) decisions related to the submission of national communications and biennial update reports, further support is needed to continue to develop and consolidate the existing technical and institutional capacity and to continue the efforts of integrating climate change into national policies, plans and programs.

Specifically, technical support is needed to ensure quality control of the national GHG inventory process. Furthermore, permanent administrative and financial support is needed in order to guarantee continuity and integrity with the GHG process. Along these lines, climate financing mechanisms should be exploited for sustainability.

1.6. Domestic Measurement, Reporting and Verification Systems

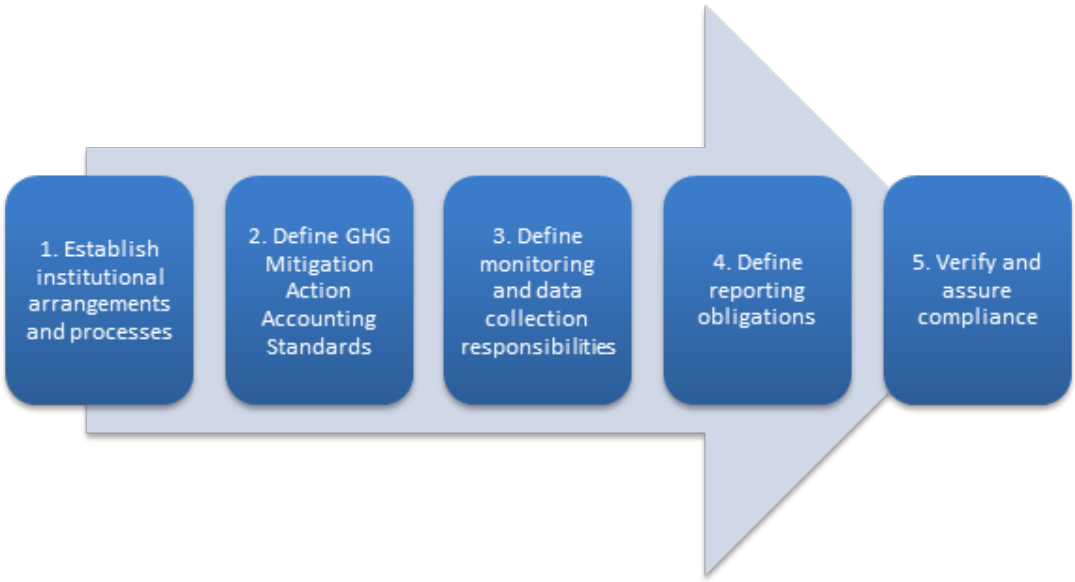
To report on the progress of mitigation actions, Macedonia has begun developing a Measurement, Reporting and Verification (MRV) system. As an EU candidate state and a Contracting Party to the European Energy Community, Macedonia will need to report on all of its mitigation actions that reflect these commitments. Most relevant, these reporting requirements include savings from energy efficiency programmes, the share of renewable energy, and emissions levels from large industries/combustion plants. Macedonia has to report to the EU using common reporting format that the EU normally uses, which not only complies with UNFCC reporting standards, but goes in many instances much further than UNFCCC These reporting requirements are already beyond the requirements of other non-Annex I countries.

The country has set up two separate "in-house" indicators sets that can be used for MRV purposes. First, the MOEPP developed set of environmental indicators in 2012. Second, and probably more relevant, the State Statistical Office established sustainable development indica-

8 #SkopjeGreenRoute is the second most trending hashtag on twitter in Macedonia

tors in 2014.[9] These indicators are more or less general, measuring progress on macro level, and may not be usable to measure progress at smaller-scale mitigation action. Therefore, as part of the preparation of the FBUR, the first potential comprehensive list of indicators proposed in the "Conceptual Framework and Pathway for Monitoring, Reporting and Verification (MRV) of Climate Change Mitigation Actions in Macedonia", will enable the country to improve the current MRV system and be able to measure progress at smaller-scales (e.g., individual projects with disaggregated metrics). One of the key recommendations is to develop metrics measuring co-benefits to more accurately report on economic and social development.

The pathway for establishing MRV framework in Macedonia lies in taking the five broad steps. Each of the steps involves its own particular processes and difficulties. Some of the steps will be directly determined by results of further analysis. The five steps are:



1.7.Other Relevant Information

1.7.1.Mainstreaming Gender in Climate Change

Macedonia recognizes that both women and men must be reached by climate change-related information and must participate in decision making. Consequently, Macedonia has developed a range of tools to address the gender dimensions of climate change mitigation in national and local level policy development and with technology transfer.

To improve the benefits of mitigation for women in various sectors, Macedonia identified critical leverage points. Currently, in the Energy and Transportation sector, single women and single-headed households are less capable of absorbing increasing energy costs for heating, cooling and transportation due to earning lower salaries in general. With Macedonia's plans for mitigation, women will be direct beneficiaries of emission reductions through improvements to energy efficiency in the home and public transportation. Similarly, in agriculture, considering women's substantial role on the family farm, women farmers will be trained in GHG reduction practices such as organic agriculture and sustainable soil management. Such actions are aimed to reduce the current gender disparity in Macedonia while enhancing the positive benefits of mitigation.

1.7.2.Public perceptions on climate change and awareness raising activities

UNDP and the MOEPP conducted an online survey in November 2014 to gather information on the public perception of climate change in order to provide insights to the FBUR. The survey aimed to identify key incentives for and challenges to environmental and climate conscious behaviour. The key findings were as follows:

9 http://www.stat.gov.mk/Publikacii/Odrzliv_Razvoj_2014.pdf

- Climate change was indicated by respondents to be the most serious threat to Macedonia, followed by poverty and lack of clean water. The principle reason why the participants want to take action to combat climate change is to be able to live in a healthy and clean environment.
- Over 50% of articipants reported that they had noticed changes in the environment or climate in the past 10 years.
- 85% of participants expressed a willingness to pay some additional amount for low emission sources.
- Participants voiced concern that corporations and industries, as well as citizens themselves have made insufficient efforts. Unsatisfactory efforts by the public administration, particularly on the local and regional level were also perceived.
- The principle media sources for information on climate change amongst participants include the internet followed closely by television.
- When making daily decisions, Macedonian are aware of efforts such as saving energy and water, using alternative transport modes, waste recycling and insulating a home to combat climate change.

A comparative analysis of responses by survey participants in Skopje versus smaller urban or rural surroundings found that smaller areas are more likely to install renewable energy equipment and are more willing to pay higher prices for energy produced from low carbon sources or renewable energy. Also, analysis of the sub-group of the youngest participants, age 25 or less, demonstrated that they are the most worried about climate change.

Additionally, a sub-set of respondents was analysed as those who work for public administration. The findings were generally consistent with those of the general public in terms of the perceived level of seriousness of climate change as a problem and perceptions as to whether enough was being done by specific types of stakeholders.

Chapter 2: National Circumstances

The Republic of Macedonia is a party to the United Nations Framework Convention on Climate Change (UNFCCC) as a non-Annex I country and party to the Kyoto Protocol without a quantified emissions limits and reduction commitment (QELRC). Macedonia acceded to the Copenhagen Accord and submitted a list of non-quantified mitigation actions. In accordance with Decision 17/CP.8 of the UNFCCC, as a Non-Annex I party, Macedonia is encouraged to provide information on programmes containing measures to mitigate climate change by addressing anthropogenic emission sources and promoting removals by sinks of all greenhouse gases (GHGs).

This First Biennial Update Report (FBUR) on Climate Change (CC) consolidates sectoral analyses on Greenhouse Gas (GHG) emissions and provides transparency for Macedonia's progress with mitigation actions and their effects. The FBUR builds on the findings and recommendations of the Third National Communication to the UNFCCC (submitted in 2014) and captures information from the outcomes of on-going complementary projects in the country. The ultimate goal of the FBUR report is to assist Macedonia with the mainstreaming and integration of climate change consideration into national and sectorial policies and to continue to strengthen institutional and technical capacities with climate change mitigation and sustainable development. The level of detail and analysis of the report is reflective of the status of Macedonia as an EU candidate country and Contracting Party to the Energy Community – meaning that the country has made significant efforts in improving its reporting as well as undergoing mitigation actions.

2.1. Country profile

2.1.1. Geography

The Republic of Macedonia is a small, landlocked country that is located in the middle of the Balkan Peninsula in Southern Europe, with a total surface area of 25,713 km^2, out of which hills and mountainous terrain cover 79%, plains 19.1%, and water surfaces approximately 1.9%. Macedonia's 246-km southern border is with Greece, a Member State of the European Union (EU), its 148-km eastern border is with Bulgaria (also an EU member state), its 221 km border to the north is with Serbia (Kosovo), and its 151 km border to the west is with Albania.

The Republic of Macedonia has a diverse topography with high mountains and deep valleys surrounded by mountains, picturesque rivers, large and small natural lakes, and spas. The highest point is the peak of Mount Korab, with a height of 2,764 m. Macedonian cultural sites and resources occupy an important place in world cultural heritage. Land used for agriculture in the form of cropland and pastures is substantial in Macedonia and occupies almost 50% of the surface area of the country. Forested land covers approximately one third of the territory of Macedonia.

The territory of the Republic of Macedonia is divided into four river basins: Vardar, Strumica, Crn Drim and Juzna Morava. The Vardar river basin is the largest (20,546 km^2 or 79.9% of the country's land area) and drains to the Aegean Sea. The Strumica river basin in the South East part of the country (1,520 km^2 or 5.9% of the country's land area) also drains to the Aegean Sea. The Crn Drim river basin is in the western part of the country (3,355 km^2 or 13% of the country's land area) and gravitates towards Adriatic Sea. The smallest river basin, the Juzna (South) Morava river basin (44 km^2 or 0.2% of the country's land area), is in the northern part of the country and drains to the Black Sea. Macedonia has three large natural lakes in the south of the country: Ohrid, Prespa and Dojran. Lake Ohrid is the deepest lake in the Balkans (286 m).

Several major transport routes connect Macedonia with Central and Eastern Europe, and with Southern and South East Europe and beyond. The basic infrastructure of the country is relatively well established and can be seen as a good foundation for further extension.

2.1.2. Biodiversity

The biodiversity of the Republic of Macedonia has been relatively well studied and documented in the national communications. Macedonia is noted for its species richness and level of endemism, underlining the country's importance of a "hotspot" for biodiversity in Europe. With a total of almost 700 endemic animal species, Macedonia represents one of the most important centres in Europe in spite of its small

land area (MOEPP 2004; Petkovski 2010). Three national parks have been recognized in the Republic of Macedonia: Mavrovo (731 km^2), Galičica (227 km^2) and Pelister (125 km^2). All three national parks are heritage sites of nature and culture. They offer great possibilities for the development of tourism, the preservation of natural resources, and scientific research.

2.1.3. Climate

In spite of the relatively small area of the Republic of Macedonia, the climate is diverse. The climate is influenced by the Mediterranean Sea and by the European continent to a varying extent. The country can be divided into the following eight climatic regions: sub-Mediterranean climate region (50 - 500 m, only in the area of Gevgeija and Valandovo); moderate-continental-sub-Mediterranean climate region (to 600 m); warm continental climate region (600 - 900 m); cold continental climate region (900 – 1,100 m); sub-forest-continental-mountainous climate region (1,100 -1,300 m); forest-continental mountainous climate region (1,300 – 1,650 m); sub-alpine mountainous climate region (1,650 – 2,250 m); and alpine mountainous climate region (> 2,250 m). Figure 2-1 depicts mean annual air temperature in Macedonia.

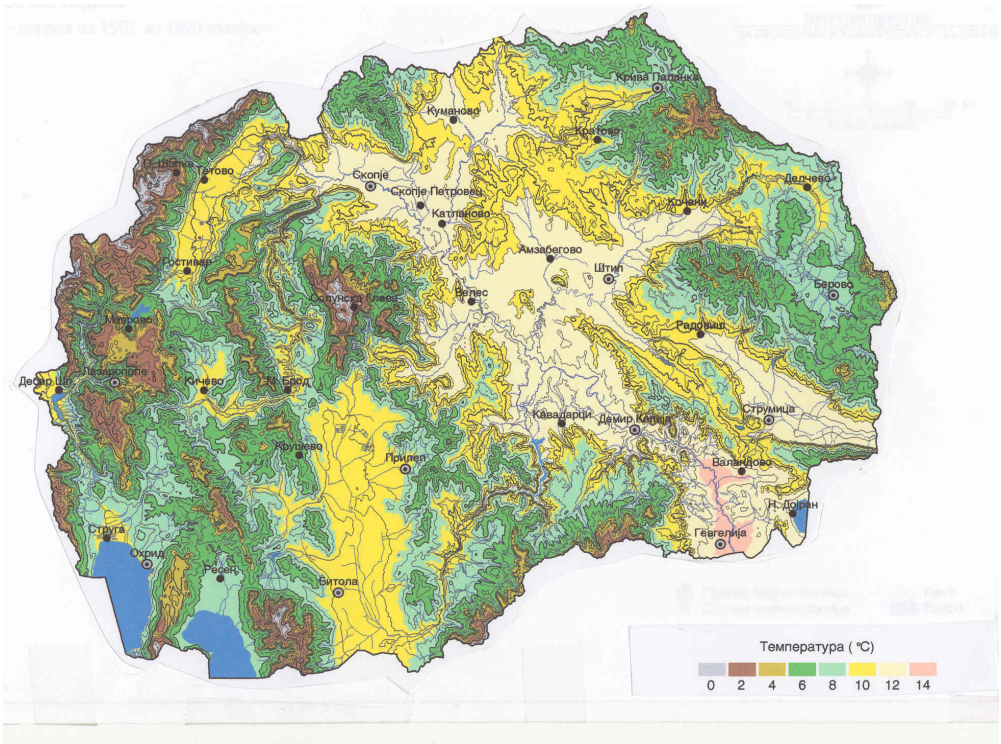


Figure 2-1: Mean annual air temperature in Republic of Macedonia

Source: Hydrometeorological Service 2013

The highest values of annual air temperatures in the Republic of Macedonia are recorded in the Gevgelija and Valandovo Region, where the mean annual air temperature is higher than 14°C. The coldest month in Macedonia is January, and on average July is the hottest month. With the exception of 2011, the six most recent years (2007-2012) were among the ten warmest years for the period between 1951 and 2012. The frequency of heat waves[10] has also increased from 1987 onwards. And in contrast to the first half of the period, a heat wave has been recorded in almost every year since 1987. It should also be noted that the greatest frequency of heat waves has occurred in the last ten years, with maximum occurrences at the greatest number of stations in 2012 and 2007.[11]

Precipitation in the Republic of Macedonia is unequally distributed. Two basic pluviometric regimes are present in Macedonia: Mediterranean and continental. In the area with the Mediterranean precipitation regime, November, October and December are the months with highest level of precipitation;

10 In accordance with the recommendations of the World Meteorological Organization (WMO) Working Group for Climate Change Detection and Indices (CCI/CLIVAR), the Heat Wave Duration Index (HWDI) has been used for the analysis of heat waves. This index determines a heat wave as a period of at least 6 successive days with a maximum air temperature (T_x) of 5°C higher than the average maximum temperature (T_{xavg}) for the period 1961–1990.

11 Hydrometeorological Service (2013)

in the area with a continental climate, the highest amount of rainfall occurs in May and June. The areas with highest precipitation are the mountain ranges in Western Macedonia; the area around the Shar Planina, Bistra and Stogovo mountains; and the mountain ranges of Jakupica, with the summit of Solunska Glava, and Baba, with the summit of Pelister, where annual precipitation totals about 1000 mm. The driest areas of the country are Ovche Pole, Tikvesh and the surrounding of Gradsko, where annual precipitation totals about 400 mm.

2.1.4. Population

According to recent estimations[12] [13], Macedonia has a population of 2,103,000, with an average density of 81 inhabitants per square kilometres, 65% of whom live in urban areas[14]. The western part of the country is the most heavily populated. Most of the population is concentrated in the urban areas. According to last census data, the average household had 3.58 members in 2002, down from 4.68 members in 1971. The fertility rate has declined from 1.9 births per woman in 1990 to 1.51 in 2013 and is now lower than the European average of 1.58.[15] The current trend is thus one of aging.

As in many other countries, people have migrated into the cities, looking for employment. Approximately 25% of the population lives in the capital city of Skopje, which is located in the northern part of the country. Other major cities are Bitola, Kumanovo, Prilep and Tetovo. The country is administratively divided into 84 municipalities and the City of Skopje is a separate entity made up of ten municipalities. Macedonia has also experienced sustained high rates of permanent and seasonal emigration.

Table 2-1: Enumerated and estimated population

Year	Population (thousands)
1921	809
1931	950
1948	1,153
1953	1,305
1961	1,406
1971	1,647
1981	1,909
1991	2,034
1994	1,946
2003	2,027
2004	2,032

Year	Population (thousands)
2005	2,037
2006	2,040
2007	2,044
2008	2,045
2009	2,051
2010	2,055
2011	2,058
2012	2,062
2013	2,103

Source: State Statistical Office

2.1.5. Health

Life expectancy at birth was 73.54 years (76 for females and 71 for males) in 2007 in the Republic of Macedonia, while disability-adjusted life expectancy was 63 years. The 2005 birth rate was 11.04 per 1,000 population and the mortality rate was 9 per 1,000, resulting in a natural increase of 2 per 1,000 population. The distribution of deaths by age shows the highest proportion of total deaths for age 75 at 43.6 per cent.

Chronic diseases present the biggest burden to public health analysed by direct cost to society as well as to the Government based on the disability-adjusted life years (DALYs). The total burden of the most common diseases in the Republic of Macedonia (circulatory, cancer and respiratory) is estimated as 67% of DALY from all causes of mortality. Health care in Republic of Macedonia is delivered through a system of health care institutions that cover the country's territory relatively evenly. This makes it possible for around 90% of the population to obtain health services in less than 30 minutes.

12 Republic of Macedonia, Population: 2013. Latest population statistics estimated since last census in 2002. http://countryeconomy.com/demography/population/macedonia
13 The World Bank Data Bank, 2013. http://data.worldbank.org/country/macedonia-fyr
14 Global Health Facts by the Henry J. Kaiser Family Foundation 2012, Urban Population, http://kff.org/global-indicator/urban-population/
15 Eurostat, Fertility indicators, latest update 31 October 2014 http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do

High-priority environmental health issues in the Republic of Macedonia include the following: access to safe drinking-water in rural areas, access to sanitation in almost the entire country; inadequate waste and waste water management at the state level; uncontrolled use of chemicals and pesticides; and inadequate air quality indoors and housing generally (in particular associated with poverty and children's exposure to environmental tobacco smoke).

2.1.6. Politics

The Republic of Macedonia became an independent state on September 8, 1991, following the disintegration of the former Socialist Federal Republic of Yugoslavia. The country became a candidate for EU membership in December 2005.

The political system is a parliamentary democracy. Government is organized on the principle of distribution of powers among the legislative (Parliament), executive (the President of the Republic, the Government), and judicial branches of government. The Parliament consists of 120 members with a four-year mandate. Members are elected by popular vote from party lists, based on the percentage that parties gain of the overall vote in each of six election districts, each district having 20 seats. The Prime Minister is the head of Government and is selected by the party or coalition that gains a majority of seats in parliament. The Prime Minister and other ministers must not be members of parliament. The Government consists of 15 ministries. The General Secretariat of the Government provides logistic and expert support to the government, to the President of the Government, Vice-Presidents of the Government, ministers (members of the government).

The President is elected by general, direct ballot for a term of five years and can serve for a maximum of two terms. The President exercises his/her rights and duties on the basis and within the framework of the Constitution and laws.

The court system consists of a Supreme Court, Constitutional Court, Administrative court, and appeal courts. The Judicial Council of the Republic of Macedonia governs the ethical conduct of judges and recommends the election of judges to parliament. The Supreme Court is the highest court in the country and is responsible for the equal administration of laws by all courts. Its judges are appointed by parliament without a time limit. The Constitutional Court is responsible for the protection of constitutional and legal rights and for resolving conflicts of power between the three branches of government. An independent public prosecutor with a six-year mandate is appointed by parliament.

2.1.7. Economy

Exports of goods and services currently count as 53.8% of the Gross Domestic Product (GDP).[16] Such an open economy for a small country has made Macedonia vulnerable to external events such as the economic crisis of 2009. Nonetheless, recently, Macedonia has made good progress in its economic reform agenda as evidenced by a 7% increase in GDP between 2012 and 2013.[17] More work needs to be done in building a favourable business climate in order to attract private investors and to create more jobs through private sector growth.

Service activities contribute 62.3% to the GDP while industrial activities comprise 27.5%[18]. Both are sensitive to the state of the economy. The agriculture sector, including the value added in the processing industry, contributes 10.2% of the country's GDP and provides employment to 36% of the workforce. Forestry is also important to the economy of Macedonia. Approximately, 92% of total forest area has an economical character, and around 8% are protective and protected forests. Agriculture and natural resource-based rural economies are particularly vulnerable to various anthropogenic stressors, including climatic hazards, variability, and long-term climate change.

Macedonia's economy is closely linked to Europe as a customer for exports and source of investment, and has suffered as a result of prolonged weakness in the Eurozone. Nonetheless, the Macedonian economy was relatively well insulated from the 2011 debt crisis in the Eurozone due to the absence of large macroeconomic imbalances and a stable financial system relying mainly on domestic sources of financing. Macedonia has shown continued modest GDP growth through 2013 after a small contraction in 2012. The real growth rate in GDP in 2013 was 3.1%.[19] In contrast, recently, the government has been loosening fiscal policy, and the budget deficit expanded to 4.2% of GDP in 2013.[20]

16 IMF World Economic Outlook, April 2014. https://www.gfmag.com/global-data/country-data/macedonia-gdp-country-report
17 Republic of Macedonia State Statistical Office http://www.stat.gov.mk/PrikaziSoopstenie_en.aspx?rbrtxt=32
18 CIA, World Fact Book
19 IMF World Economic Outlook April 2014
20 CIA World Fact Book

In 2013, the labour force in the Republic of Macedonia amounted to 960,700 persons. Unemployment has remained consistently high at more than 30% since 2008 (and equal to 30% in 2013).[21] It should be noted however, that unemployment statistics may be overstated based on the existence of an extensive grey market, estimated to be between 20% and 45% of GDP.

Table 2-2: Selected macroeconomic indicators, 2004-2013

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
GDP (million MKD) (1)	280,786	308,447	334,840	372,889	414,890	414,622	437,296	464,187	466,703	499,559
Real GDP growth rate (%) (1)	4.70%	4.70%	5.10%	6.50%	5.50%	-0.40%	3.40%	2.30%	-0.50%	2.70%
GDP per capita (EUR) (1)	2,252	2,470	2,682	2,982	3,308	3,300	3,459	3,665	3,680	3,930
Inflation (CPI, average) (%) (2)	-0.40%	0.50%	3.20%	2.30%	8.30%	-0.80%	1.60%	3.90%	3.30%	2.80%
Exports (million EUR) (2)	1,346	1,644	1,918	2,477	2,698	1,937	2,535	3,215	3,124	3,212
Imports c.i.f. (million EUR) (2)	2,354	2,606	2,980	3,834	4,664	3,637	4,137	5,053	5,071	4,968
Unemp-loyment rate (1)	37.2%	37.3%	36.0%	34.9%	33.8%	32.2%	32.0%	31.4%	31.0%	29.0%

Sources: (1) Republic of Macedonia State Statistical Office; (2) National Bank of the Republic of Macedonia (2014) Basic Economic Data. http://www.nbrm.mk/default-en.asp?ItemID=89A26FA4B8AA8F4CA6CF243F984FF307

2.1.8. Energy

The energy sector in the Republic of Macedonia has the following main characteristics.

- The production of electricity from older coal-fired power plants (approximately 66% of power generation) and hydropower (approximately 34% of power generation).[22]
- The transport sector accounts for almost 25% of energy demand which is almost entirely from imported oil products as there is no domestic production.
- The Residential and Commercial sectors comprise almost 70% of electricity demand whereas Industry only accounts for ~30% of the demand.

The share of total primary energy supply by Macedonia's various sources is shown in Figure 2-2.

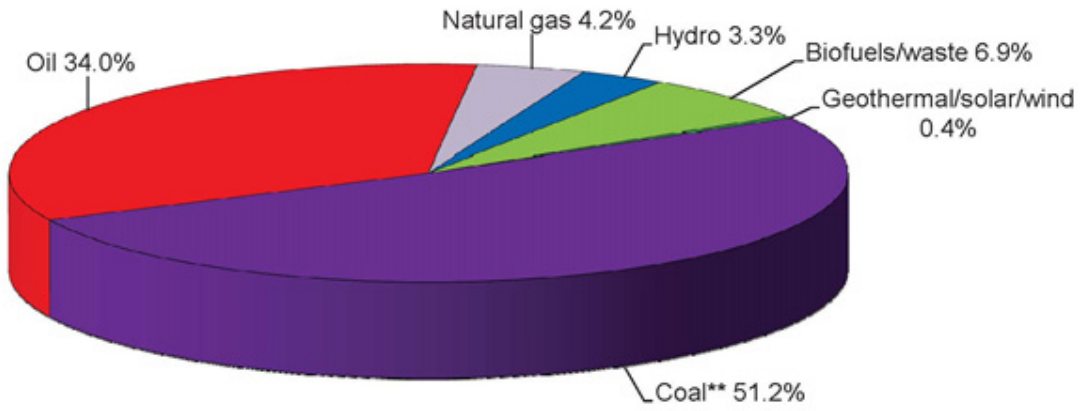


Figure 2-2: Share of total primary energy supply in 2012

Source: IEA Energy Statistics, http://www.iea.org/statistics

21 IMF World Economic Outlook April 2014 https://www.gfmag.com/global-data/country-data/macedonia-gdp-country-report

22 World Bank (2013) 10 Facts about FYR Macedonia's energy sector. http://www.worldbank.org/en/news/video/2013/07/23/macedonia-energy. Accessed 27 Nov. 2013

The breakdown of the sectors for final consumption of energy (in thousands of tonnes of oil equivalent) is provided below.

Table 2-3: Energy consumption in the Republic of Macedonia for 2012

	Coal and peat	Crude oil	Oil products	Natural gas	Nuclear	Hydro	Geo-thermal, solar, etc.	Bio-fuels and waste	Electricity	Heat	Total
Total	**151**	**0**	**847**	**23**	**0**	**0**	**9**	**189**	**602**	**52**	**1874**
Industry	148	0	226	20	0	0	0	7	190	3	594
Transport	0	0	459	0	0	0	0	0	1	0	461
Other	4	0	105	2	0	0	9	182	411	49	762
Residential	***2***	***0***	***34***	***0***	***0***	***0***	***0***	***170***	***281***	***34***	***521***
Commercial and public services	***2***	***0***	***57***	***2***	***0***	***0***	***1***	***11***	***129***	***15***	***217***
Agriculture/ forestry	***0***	***0***	***13***	***0***	***0***	***0***	***8***	***1***	***2***	***0***	***24***
Non-specified	***0***	***0***	***0***	***0***	***0***	***0***	***1***	***0***	***0***	***0***	***1***
Non-energy use	0	0	57	0	0	0	0	0	0	0	57
-of which petrochemical feedstocks	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***

Source: International Energy Agency (2014)

2.1.9. Transport

Within the transport sector, the road transport has the highest share in the energy consumption (98%) and is dominant in the transport sector in general. The Republic of Macedonia has relatively well-developed road transport infrastructure though the energy consumption in the sector is small comparing to the EU on a per-capita basis: 650 toe per 1000 inhabitants in the EU-27 compared to 200 toe per 1000 inhabitants in the Republic of Macedonia. In the last five years there has been a slight increase, but still national figures considerably lag behind European ones.

As to the energy mix, gasoline and diesel have a dominant role in the road transport sector. Since 2000, there has been a significant drop in gasoline consumption and a significant increase in diesel consumption, since diesel vehicles have become more attractive. LPG was introduced after 2000. The total number of the vehicles in the country according to fuel type for the period 2002-2010 is shown in Figure 2-3.

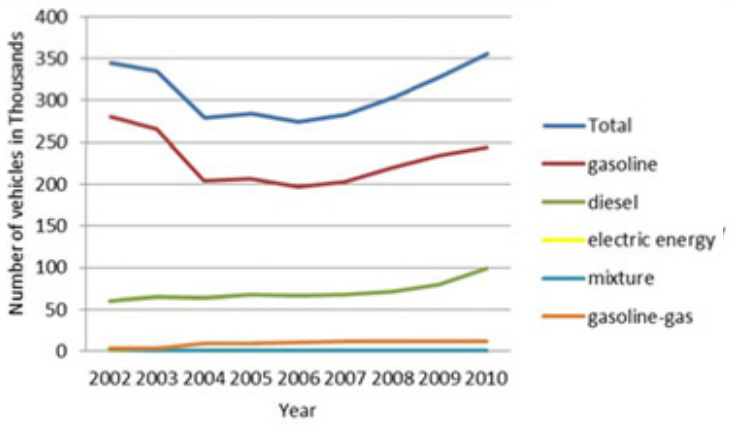


Figure 2-3: Total number of vehicles in the road transport

In 2010 there were 170 passenger cars per 1000 inhabitants. The vehicle fleet is generally very old with the average age of the passenger cars of about 15 years.[23] The same is true of buses and goods vehicles: 62% of the buses, 74% of the goods vehicles are older than 15 years in 2010 – though only 27% of special vehicles in 2010 were older than fifteen years.[24]

In the last four years there has been quite a big change when it comes to fleet renewal. In 2007 and 2008 a significant renewal of the fleet occurred, but during 2009 and 2010 the fleet size has increased via imported used vehicles (older than 2000). This is characteristic for cars and buses, while the number of goods vehicles older than 1997 was dramatically reduced in 2010. There has been an increase in new vehicles only among special vehicles.

2.1.10. Industry

Industry is important in the development of the Macedonian economy. Industrial activities comprise 27.5% of (GDP). According to the value added data for 2010, industrial production was dominated by the following divisions (State Statistical office of the Republic of Macedonia 2013):

- Manufacture of food products (11.7%);
- Electricity, gas, steam and air conditioning supply (14.6%);
- Manufacture of basic metals - steel, lead, zinc, ferro-alloys (9.34%);
- Manufacture of wearing apparel (textiles) (10.2%);
- Manufacture of other non-metallic products (5.9%);
- Manufacture of tobacco products (4.5%); and
- Manufacture of beverages (6.2%).

2.1.11. Agriculture

The agriculture sector, including the value added in the processing industry, contributes 10.2% of the country's GDP and provides employment to 36% of the workforce. The most recent national census recorded 192,675 family farms (in a country of 2.1 million inhabitants). Consequently, given the fact that about 42% of country's population live in rural areas where off farm employment opportunities are rather limited (active workforce unemployment rate in Macedonia is as high as 32%), a more realistic conclusion would be that the agriculture sector is of critical importance for the wellbeing of about half of country's population. Agriculture and natural resource-based rural economies are particularly vulnerable to various anthropogenic stressors, including climatic hazards, variability, and long-term climate change.

2.1.12. Forestry

The Republic of Macedonia's forests cover around 1,095,000 ha of forested land, of which around 940,000 ha is recognized as forests (State Statistical Office 2009). The total wood stock is estimated at around 75,000,000 m^3, and the annual increment is around 1,830,000 m^3.

Regionally, the richest forest region is Southwest Macedonia, with around 180,000 ha, and the poorest is the Skopje region, with around 125,000 ha. Distribution of forest cover throughout the country is uneven in terms of quantity and quality. High forests with good quality are located along state borders, far from the industrial and inhabited places and human influence. Low-quality coppice forests are located in the central parts of the country, and their condition has resulted partly from climate conditions and partly from human activities.

Around 90% of the forests are in state ownership, and state-owned forests with commercial value are managed by the special public enterprise "Makedonski sumi." State-owned protected forests are managed by the national parks (public enterprise) or by local government offices. The remaining 10% of forests are in private or other forms of ownership (e.g. church lands). There are more than 200,000 parcels of forests owned by around 65,000 households, averaging 0.6 ha.

23 For the sake of comparison, in 2011 in Slovenia, the number of passenger cars per 1000 inhabitants was 519, with the average age of the passenger cars of 8.4 years.

24 State Statistical Office (2011), State Statistical Office (2010), State Statistical Office (2009), and State Statistical Office (2008)

In the terms of assignation, around 92% of total forest area has an economical character, and around 8% are protective and protected forests. Annual allowed logging volume, according to approved management plans, is set at around 1,200,000 m^3, and is around 2/3 of the annual increment that is totally acceptable in terms of its sustainability. Most of this cut comes from the state-owned economic forests, and a very small part comes from protective and protected areas. Annual actual logging volume is between 550,000 m^3 and 750,000 m^3, and is mostly firewood (80- 85%), which is used by households. Logs are used mostly by domestic industry, and only a small part is exported.

2.2. Climate change-related institutional and policy framework

The Republic of Macedonia is a party to the United Nations Framework Convention on Climate Change (UNFCCC) as a non-Annex I country and party to the Kyoto Protocol without a quantified emissions limits and reduction commitment (QELRC). However, the country has acceded to the Copenhagen Accord, and it submitted a list of mitigation actions (without quantifying the associated emission reductions) based on these actions.

The **Ministry of Environment and Physical Planning (MOEPP)** is the key governmental body responsible for development of climate change policies. MOEPP has been designated as the National Focal Point to the UNFCCC and as Designated National Authority (DNA) for Kyoto Protocol implementation and is therefore the key governmental body responsible for coordinating implementation of the provisions of the Convention and the Protocol. Other ministries that have responsibilities related to climate change are: Ministry of Agriculture, Forestry and Water Economy, Ministry of Economy, Ministry of Transport and Communication, and Ministry of Finance. Most of these ministries have appointed Climate Change Focal Points, who are responsible for mainstreaming climate change into respective policies, strategies and programmes. In addition, the Ministry of Health established a National Committee for Climate Change and Health in 2009 to serve as the responsible body for surveillance activities and decision-making in that area.

Key ministries in charge of individual policies affecting mitigation are the Ministry of Environment and Physical Planning, the Ministry of Economy which implements many of the policies, activities and projects that directly and indirectly impact climate change mitigation in the energy sector, the Ministry of Agriculture, Forestry and Water Economy who is in charge of the policies and their implementation for the agriculture and forestry sectors vis-à-vis climate change mitigation and adaptation and the Ministry of Transport and Communications. Additionally, the National Climate Change Committee has an information collection and coordinating role for climate change policies.

In January 2000, the **Climate Change Project Office** was set up within MOEPP. In addition, a **National Climate Change Committee** (NCCC) was established by the Government consisting of representatives of all relevant stakeholders: government bodies, academia, private sector and civil society. The NCCC is a participatory platform aimed at providing high-level support and guidance for overall climate change policies in the country. Moreover, a **National Council for Sustainable Development** has also been established to advise on economic affairs.

At the legislative level, climate change issues are incorporated into the Law on Environment, including details on the preparation of GHG emissions inventories as well as an action plan on measures and activities to abate the increase of GHG emissions and to mitigate the adverse impacts of climate change. The **Law on Environment** stipulates that a National Plan for climate change is to be adopted for the purpose of stabilizing GHG concentrations at a level that would prevent any dangerous anthropogenic impact on the climate system within a timeframe sufficient to allow ecosystems to naturally adapt to climate change, in accordance with the principle of international cooperation and the goals of the national social and economic development. In July 2013, changes in the Law on Environment were adopted, and a new article (188) has been added regarding the national system of GHG emissions inventories. This article foresees that a national system of inventories of GHG emissions will be established and that this system will provide a database of relevant information for the preparation of GHG inventories as well as monitoring of the implementation of agreements regarding climate change. This system incorporates collection, processing, assessment, verification and quality assurance and management of uncertainty, as well as storage, use, distribution and presentation of data and information derived from entities holding data for anthropogenic emissions by sources and sinks of greenhouse gases in the atmosphere.

Recognizing the important steps forward in the institutionalization of climate change issues and the mainstreaming of climate change in the national and sectorial development policies, the development of three National Communications to the UNFCCC, supported by GEF and UNDP, has contributed to strengthening these integration processes as well as to informing the international community on the actions

taken by the country to address climate change issues. The First, Second and Third National Communications on Climate Change were published in 2003, 2008 and 2014, respectively.

In the context of its accession process to the European Union (EU) (a high priority for Macedonia), the Republic of Macedonia has already initiated the process of harmonizing its mitigation approach towards EU commitments to the UNFCCC and sections of the EU ***acquis communautaire*** related to climate change. As a member of the EU, Macedonia would be obligated to participate in the EU Emissions Trading System (EU ETS). Additional details related to Macedonia's EU accession process are included below.

2.3. National and regional development priorities and objectives

The driving forces for creation and implementation of environmental policy in the Republic of Macedonia can be grouped into two major categories: national and international, which includes regional cooperation, bilateral activities, and multilateral activities.

2.3.1. National context of climate change policy

At the national level, the Republic of Macedonia focuses on several types of objectives in the areas of environment and climate: strategic, legislative, and institutional/organizational. A cross-cutting priority is accession to the EU, which is at the core of the development goals of Macedonia and a main driving force behind its objectives. The EU integration agenda has generated momentum for political, economic and social reforms and contributed to building consensus on important policy issues across sectors. While EU accession poses great challenges in terms of human capacity at the national and local level and identifying financial means for investments in key sectors, it also provides opportunities for the creation of more integrated, cross-cutting policies and better utilization of available resources.

Climate change is receiving more and more attention in national policy, especially since the finalization of the TNC. Recommendations from the TNC have been included in other strategic documents, studies, and sectoral policies that have been revised/developed, such as:

- The Action plan for the National Strategy for Sustainable Development
- Strategy for Energy Development
- Law on Biofuels
- National Strategy on Health and Environment (currently as a draft version)
- National Strategy for Agriculture and Rural Development for 2014-2020
- Study for Adaptation of Agriculture sector to Climate Change
- Study for Adaptation of Animal Production to Climate Change

Additionally, eight municipalities have developed climate change strategies (a USAID funded project) and the City of Skopje (with UNDP support) will start development of comprehensive climate change strategy in 2015.

At the strategic level, environmental policy (as a component of sustainable development policy and in and of itself) is covered by the National Strategy for Sustainable Development (in which the energy sector and climate change are identified as the main contributors towards national sustainable development, adopted in 2010). An action plan for implementation of the Strategy is being developed (with support from UNDP and USAID), and it should be finalized in February 2015. It will include short-term measures that should be implemented or initiated in the period 2015-2018. The Second National Environmental Action Plan is also a key environmental policy.

In the past decade, a number of relevant laws, regulations and strategies that incorporate climate change considerations have been adopted, such as:

- The Strategy for Energy Development in the Republic of Macedonia for the Period 2008-2020 with a Vision to 2030 (2010) (currently being revised);

- Renewable Energy Sources Strategy of Macedonia till 2020 (2010);
- The National Strategy for Energy Efficiency in the Republic of Macedonia till 2020 (2010);
- National Environmental Investments Strategy (2009);
- National Environmental Approximation Strategy (2008);
- National Health Strategy for Adaptation in Health Sector (2010);
- A National CDM Strategy, 2008-2012 (2007);
- The National Agriculture and Rural Development Strategy 2007-2013; and
- The National Strategy for Climate Change Adaptation in Agriculture (under development).

The Strategy for Energy Development offers a set of ambitious and specific numerical targets for 2020 following the EU climate change policy track, e.g. reducing the energy intensity of the economy by 30% relative to 2006 or increasing the share of renewables (including hydropower and wood heat) to more than 20% of total final energy. The contribution of renewable energy sources (excluding biomass) to total primary energy is expected to grow by 119% over the period 2011 – 2050, primarily due to expected additional wind capacity. However, half of the country's electricity is still projected to come from lignite-fired plants, both in 2020 and in 2030, and the overall total electricity demand is projected to grow by around 52% by 2030.

The Government has also adopted eight Laws on Ratification of five Protocols under the United Nations Economic Commission for Europe (UNECE) Convention on Long-range Transboundary Air Pollution and they are in parliamentary procedure at the moment (National Programme for Adoption of the ***Acquis Communautaire,*** 2012). In previous years, work was aimed at increasing the reliability of data in order to enable a gradual transition to a more sophisticated greenhouse gas inventory with a higher tier of analysis. The differences in terms of data collection have been analysed, and a proposal for a legal solution has been submitted.

2.3.2.International context of climate change policy

The Republic of Macedonia has been a non-Annex I country party to the United Nations Framework Convention on Climate Change (UNFCCC) since 1997 and a signatory to the Kyoto Protocol since 2004. It acceded to the Copenhagen Accord in 2009 and has agreed to take non-binding Nationally Appropriate Mitigation Actions (NAMAs) in the context of sustainable development, supported and enabled by technology, financing and capacity-building.

As previously stated, accession to the European Union is a priority for Macedonia. It was the first country in the region to sign a Stabilization and Association Agreement (SAA) with the EU in April 2001, and in December 2005 the Presidency of the European Council granted Macedonia candidate status for the EU. Legislative and regulatory activities related to the accession process include the Ohrid Framework Agreement, the Law on Local Self-Government, the Action Plan on Accession Partnership, and the National Programme for Adoption of the ***acquis communautaire*** in the environment sector. As a member of the EU, Macedonia would be obligated to participate in the EU Emissions Trading System (EU ETS).

Chapter 3: National GHG Inventory

3.1. Overview

The Republic of Macedonia has conducted a national inventory of anthropogenic emissions by sources and removal by sinks of greenhouse gases (GHGs) emitted to or removed from the atmosphere over a period of time. The inventory includes a database of six direct gases; CO2, CH4, N2O, PFCs, HFCs and SF6, and four indirect gases; CO, NOx, NMVOC and SO2. The purpose of the inventory is to identify the major sources and removals/sinks of greenhouse gases with greater confidence and thus enable more informed policy decisions with respect to appropriate response measures. Reliable GHG inventories are essential both at national and international level for assessing the community's efforts to address climate change and progress towards meeting the ultimate objective of the UNFCCC, for evaluating various mitigation options and calculating long-term emission projections.

The inventory is based upon updated work from Macedonia's Third National Communication on Climate Change (TNC). The GHG inventory under the TNC considered the time frame 2003–2009 and was prepared in accordance with the 1996 Revised IPCC Guidelines for National Greenhouse Gas Inventories and the 2000 IPCC Good Practice Guidance. The inventory has been updated to consider the period 2010 – 2012 and has been developed using the newest IPCC 2006 Inventory Software. The activity data for the year 2012 is taken from the preliminary published national statistical data, since the definitive national statistical data were not published while the FBUR GHG inventory was developed. Additionally, the entire previous series of data from 1990 to 2009 were revised according to the requirements of the 2006 software, thus adding value to the quality of the national greenhouse gas inventory and enabling comparable series of data for the whole inventory period (i.e. 1990-2012)

As part of this inventory, Country Specific Emission Factors for key source categories that contribute more than 95% to the total GHG emissions of the inventory have been updated. Most of the activity data were available from the State Statistical Office (MAKSTAT), Energy Balances, National Reports from the Ministry of Agriculture, Forestry and Water Economy (MAFWE), the Ministry of Environment and Physical Planning (MOEPP) and other relevant institutions. Some data were obtained from industries and from the FAO database. For emission factors, 90% of values are country-specific (CS) and IPCC default values were used taking into account expert judgment.

An uncertainty analysis consisting of running the Monte Carlo algorithm on the inventory data was also performed for each CO_2-emitting category for the whole period 1990 – 2012. The analysis was conducted by using the built-in functionality of the 2006 IPCC software. The overall results showed that the uncertainty in the GHG inventory is 3.13% and the trend uncertainty is 5.41%.

GHG inventory preparation was coordinated by the Ministry of Environment and Physical Planning and managed by a GHG inventory team with support from a national technical advisor and the National Communication Support Programme (NCSP). NCSP provided review from an experienced consultant that highlighted improvements in preparing an extensive, detailed and complete series of emissions data.

The national structure for the development of the National GHG inventory is described and depicted in Figure 3-1 below.

- **The Ministry of Environment and Physical Planning**, responsible for supervising the national inventory process and reporting the emissions to UNFCCC
- **The Project Management Unit**, responsible for managing and coordinating the First Biennial Update Report on climate change
- **The GHG Inventory Team**, composed of experts responsible for preparing the GHG inventory in four different sectors (Energy, IPPU, AFOLU and Waste)
- **A National Technical Advisor**, responsible for training and transfer of knowledge to the GHG inventory team and for supervision and verification of the GHG inventory
- **The Global Support Programme (GSP)**, responsible for supporting and revising the GHG inventory

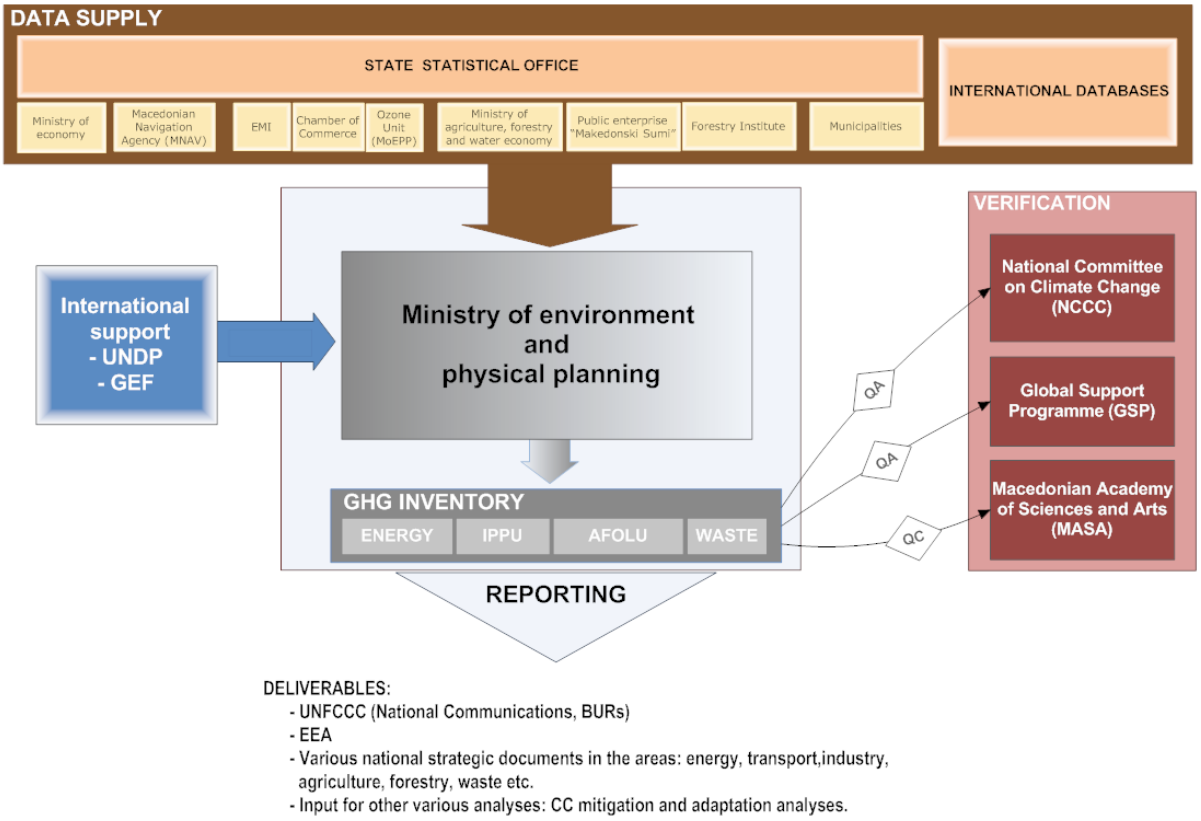


Figure 3-1: MRV Scheme for GHG inventory preparation

The institutional structure shown in Figure 3-1 ensures sustainability in preparing GHG inventories. Additionally, training materials were prepared for each sector, including a step-by-step process for completing inventory tables, explanations of good practices and sources of data and emission factors.

Quality Assurance / Quality Control was ensured through a formalized QA / QC process along with reviews from the National Committee on Climate Change, the Global Support Programme and the Macedonian Academy of Sciences and Arts. QA/QC was provided by ensuring that each Expert inter-checked one or two other sectors to ensure the entered data was of good quality.

Detailed information on the QA / QC procedures is provided in Section 3.7.

3.2. Summary

The five most emitting key source categories in Macedonia are:

- CO_2 emissions from Energy Industries (coal, lignite) (49.5%);
- CH_4 emissions from Solid Waste Disposal Sites (11.7%);
- CO_2 emissions from Mobile Combustion, including Road Vehicles (11.6%);
- Manufacturing industries and construction (8.8%); and
- CH_4 emissions from Enteric Fermentation in Domestic Livestock (3.9%).

The total net emissions in the whole inventory period are experiencing a slight increase of 0.4% compared to the year 1990. The total national emissions of CO_2-eq. [Gg] by sectors for the period 1990-2012 are presented in Table 3-1.

Table 3-1: Total national emissions of CO_2-eq. [Gg] by sectors for the period 1990-2012

Categories	1 - Energy [Gg CO_2-eq]	2 - Industrial Processes [Gg CO_2-eq]	3- AFOLU [Gg CO_2-eq]	4 - Waste [Gg CO_2-eq]	Total National Emissions and Removals [Gg CO_2-eq]
1990	9415,52	827,38	1125,16	849,67	**12217,73**
1991	9215,54	771,04	1114,34	907,39	**12008,31**
1992	9152,00	863,48	1124,48	887,84	**12027,80**
1993	9418,39	681,44	1119,02	941,59	**12160,44**
1994	9152,69	581,24	1098,44	923,21	**11755,58**
1995	9121,20	683,75	1085,35	989,97	**11880,27**
1996	10310,24	787,28	1058,81	982,66	**13138,99**
1997	9202,34	744,88	1021,96	1023,11	**11992,29**
1998	10505,09	782,74	927,24	995,16	**13210,23**
1999	9835,04	683,68	932,10	1054,11	**12504,93**
2000	9983,75	747,13	908,35	1020,70	**12659,93**
2001	9934,96	511,21	894,06	1102,83	**12443,06**
2002	9084,79	827,38	854,17	1088,16	**11854,50**
2003	8886,86	771,04	891,70	1127,17	**11676,77**
2004	8800,59	863,48	921,86	1097,52	**11683,45**
2005	9353,34	681,44	896,42	1186,49	**12117,69**
2006	8456,70	581,24	906,51	1179,57	**11124,02**
2007	8926,39	683,75	893,32	1273,75	**11777,21**
2008	9026,69	787,28	883,57	1318,31	**12015,85**
2009	8650,85	744,88	880,12	1395,29	**11671,14**
2010	8561,21	782,74	912,59	1459,41	**11715,95**
2011	9558,96	683,68	883,83	1538,61	**12665,08**
2012	9132,18	747,13	825,42	1560,30	**12265,03**

Overall, the biggest contributor to the national GHG emissions is the **Energy Sector**, with an average share of 77% of the national GHG emissions in the period 1990 – 2012.[25] The Waste sector is the second sectorial contributor with an average share of 9%, followed by the Agriculture, Forestry and Land Use (AFLOU) share with an average share of 8%. The Industrial Processes sector is the last sectorial contributor with an average share of 6% of the national GHG emissions during the period 1990 – 2012.

25 Increased economic growth in the last decade has led to an increased consumption of energy and consequently an increase in national energy needs.

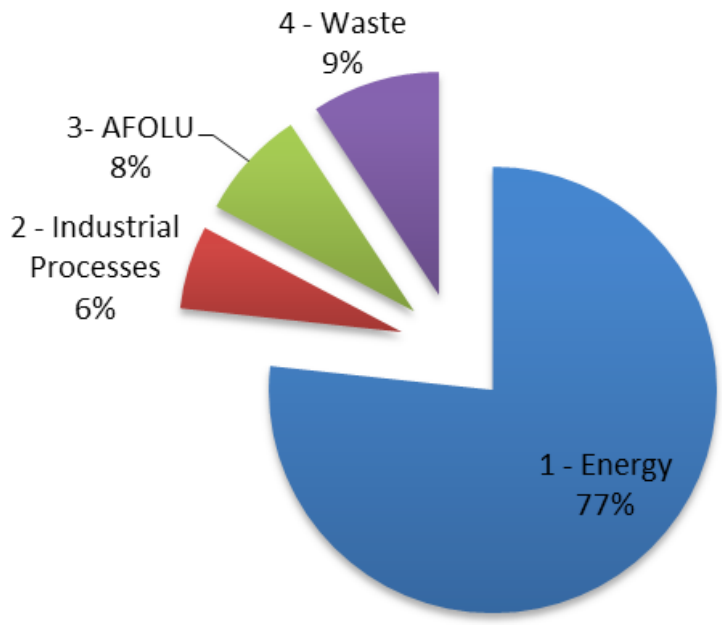


Figure 3-2: Average share of different sectors in total GHG emissions, in %

Concerning the key source assessment by subcategories, the **Energy Industries subsector** is the most dominant emission source in the entire emissions period, with average share of 50.2% in the year 1990, and 49.5% in the 2012.

The **Manufacturing Industries and Construction subsector** was the second national contributor in the year 1990 with an average share of 13.6% in the year 1990. In the last inventory year, 2012, this sector was responsible for 8.82% of the national GHG emissions, and was thereby considered the fourth contributor. The emissions of the Manufacturing subsector thus have a decreasing trend which can be attributed to decreased industrial activity in the country, partly explained by the closure of aluminium, lead and zinc production plants in 2003.

In contrast, emissions of the Road Transport subsector experienced a significant increase of the share of the total national emissions in the period 1990 – 2012; the average share of subsector emissions in the year 1990 was 6.2% of the national totals or 760.85 Gg of CO_2-eq., while in 2012 this subsector was responsible for 11.6% of the total national emissions or 1415.14 Gg of CO_2-eq.

Similarly, the emissions of the Solid Waste Disposal subsector significantly increased during the period 1990 – 2012 due to an increase in the population which has led to more consumption and waste generation.

In the category of Land-Use and Land Use Changes and Forestry (LULUCF) emissions were relatively unchanged, except in 2007, 2008 and 2012 when carbon sinks were significantly reduced due to large-scale forest fires. In the agricultural sector, the biggest part of CH4 emissions (89%) were generated by enteric fermentation from domestic livestock and these emissions have been continuously decreasing in line with the reduction of the livestock population. Manure management emissions account for 8% of GHG emissions, while the remaining emissions come from rice fields and the burning of residues.

The full list of national key emissions sources, by subsectors, for the years 1990 and 2012 are presented in Table 3-2.

Table 3-2: Key emissions sources by Subsectors, year 1990 and 2012, in Gg CO_2-eq.

IPCC Category code	IPCC Category	1990 Year Estimate [Gg CO_2-eq]	Share of the total emissions [%]	2012 Year Estimate [Gg CO_2-eq]	Share of the total emissions [%]
1.A.1	Energy Industries	6205.99	50.19	6050.31	49.50
1.A.2	Manufacturing Industries and Construction	1676.76	13.56	1078.51	8.82
1.A.3.a	Civil Aviation	0.00	0.00	0.14	0.00
1.A.3.b	Road Transportation	760.85	6.15	1415.14	11.58
1.A.3.c	Railways	30.26	0.24	10.94	0.09
1.A.4	Other Sectors	583.99	4.72	207.65	1.70
1.A.5	Non-Specified	0.00	0.00	196.56	1.61
1.B.	Fugitive emissions from fuels	157.67	1.28	172.93	1.41
2.A.	Mineral Industry	286.13	2.31	283.02	2.32
2.B.	Chemical Industry	0.31	0.00	0.01	0.00
2.C.	Metal Industry	655.39	5.30	396.72	3.25
3.A.1	Enteric Fermentation	723.91	5.85	472.50	3.87
3.A.2	Manure Management	166.22	1.34	131.43	1.08
3.C.3	Urea application	3.74	0.03	5.75	0.05
3.C.4	Direct N20 Emissions from managed soils	106.09	0.86	130.31	1.07
3.C.5	Indirect N20 Emissions from managed soils	81.19	0.66	62.47	0.51
3.C.6	Indirect N20 Emissions from manure management	32.85	0.27	25.80	0.21
3.C.7	Rice cultivations	43.91	0.36	22.88	0.19
4.A	Solid Waste Disposal	766.57	6.20	1434.21	11.73
4.C	Incineration and Open Burning of Waste	11.46	0.09	25.20	0.21
4.D	Wastewater Treatment and Discharge	71.64	0.58	100.89	0.83

Details of the most significant sources of GHG emissions in each sector are provided below. Information on less substantial emission sources can be found in the full-length National Inventory Report drafted in September 2014.

3.3. Energy

Energy production in Macedonia is predominantly based on domestic lignite[26], imported fuels, hydro potential and wood, all of which are used for electricity production, heat production, as well as mechanical energy in the transport sector. Electricity production in Macedonia is based mostly on thermal power plants and hydropower plants. The main portion of the electrical energy is produced by thermal power plants. The main energy source used by the energy industries is domestic lignite, followed by residual fuel oil and natural gas[27]. Domestic lignite coal is the dominant electric power resource.

Increased economic growth in the last decade has determined an increased consumption of energy and consequently the national energy needs are increasing each year. To meet the increased energy demand the country is continuously increasing its electricity production capacities, especially in the period 2009 – 2012. Renewable energy sources are still not significant part of the Macedonian energy balance (see Figure 3-3) However, the country is working on accelerated growth of renewable energy sources and facilitation of the development of renewable energy sources facilities. The country recognizes that the use of lignite as fuel for power plants is inefficient in terms of energy delivery, has an extremely negative impact on the environment and is not a sustainable solution for energy production, especially for a country with limited resources of lignite. Renewable energy production is now dominated by biomass followed by hydro energy.

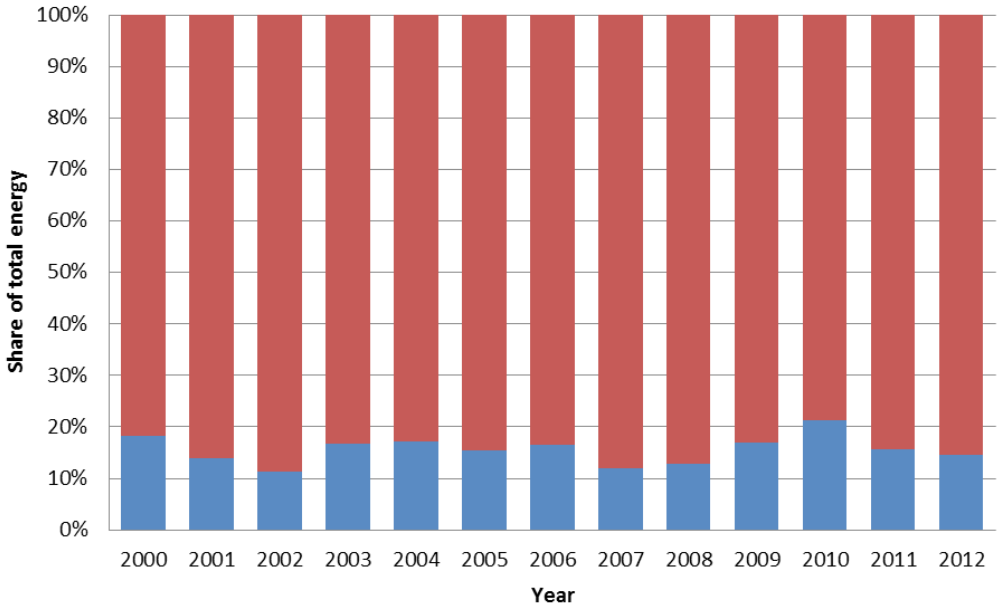


Figure 3-3: Energy share by sources; Renewable Energy vs. Fossil Energy

According to the national energy consumption indicators, the Republic of Macedonia has exceptionally low energy consumption per capita and exceptionally high energy consumption per unit of GDP in all sectors. Macedonia has a favourable downward trend of the national energy intensity indicator[28], indicating that the country is improving the industrial energy efficiency and is slightly moving towards EU trends of effective industrial production.

26 The main consumers of lignite in Macedonia are the main energy industries (power plants) in the country, REK Bitola and REK Oslomej. The data gathered for the calculation of the lignite country-specific emission factor were obtained directly from the power plants.

27 Macedonia imports natural gas of Russian origin. For the calculation of the carbon emission factor of the natural gas used in the country, the carbon content is taken from the Russian Natural Gas specification and the Net Calorific Value is taken from the Adopted Energy Balance of the Republic of Macedonia for the period for 2013–2017.

28 Energy intensity is a measure of how much energy is used to produce a unit of economic output

Most of the greenhouse emissions from the Energy sector are carbon dioxide emissions with an average proportion of 97% of the energy sector emissions. The majority of the CO_2 emissions come from the fuel combustion sector, where in the controlled combustion processes the carbon is almost fully oxidized and converted to CO_2. Methane emissions represent 2% of the total energy sector GHG emissions and nitrous oxide only 1%.

Figure 3-4 represents the average share of the Energy sector emissions by subsectors for the period 1990 – 2012. The main share of the emissions from the energy sector come from the Energy Industries subsector, and represent approximately 69% of the total Energy sector emissions for the period 1990 - 2012. The Transport Sector is second biggest subsector with an average share of 12% for the timeframe 1990 – 2012, and it is followed by the Manufacturing Industries and Construction subsector with an average share of 11% for the time-frame 1990 – 2012. The Other Sectors subsector and Fugitive emissions from fuels subsector have smaller shares compared with the above mention subsectors.

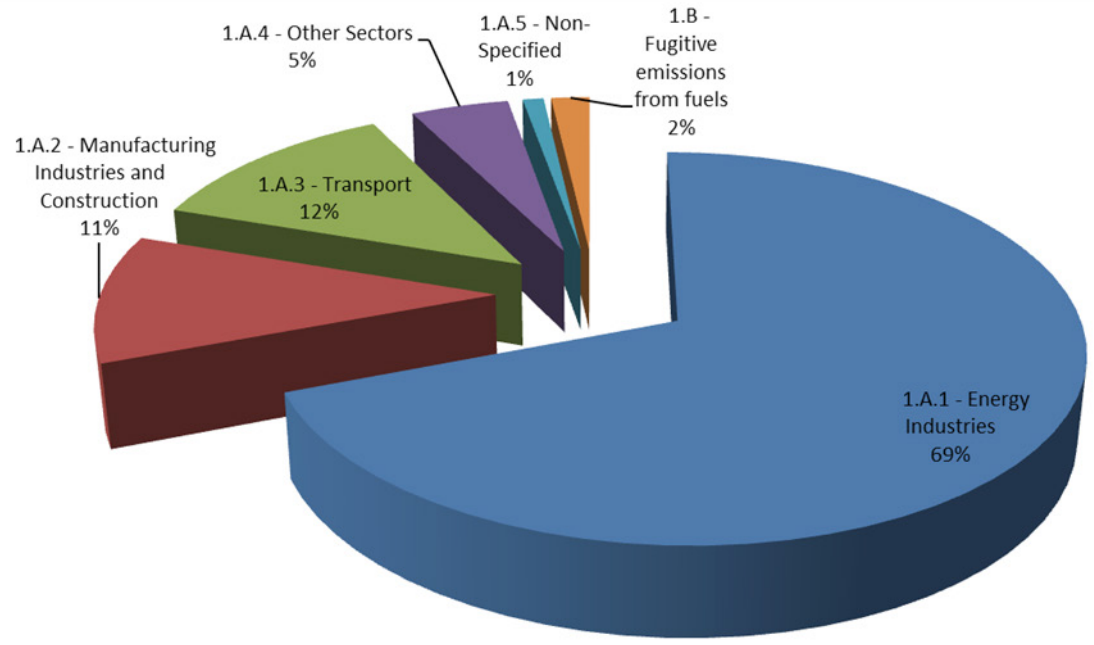


Figure 3-4: Average share of the Energy sector emissions by subsectors for the period 1990 – 2012

3.3.1. Energy-sector specific GHG emissions

3.3.1.1. Energy industries

The Energy Industries subsector is the main contributor to overall emissions from the energy sector, accounting for an average of 69 % of the country's total GHG emissions. The Energy Industries subsector consists of four source categories: i) Electricity Generation[29], ii) Combined Heat and Power (CHP)[30] generation, iii) Heat Plants and iv) Other Energy Industries[31].

29 Emissions from all fuel use for electricity generation from main activity producers except those from combined heat and power plants.

30 Emissions from production of both heat and electrical power from main activity producers for sale to the public, at a single CHP facility are reported under combined heat and Power generation category.

31 Emissions include the combustion emissions arising from the energy-producing industries own (on-site) energy use not mentioned above or for which separate data are not available.

The most GHG intensive category from the Energy Industries is the Electricity Generation category followed by the Heat plants facilities category. The CHP industries and Other Energy Industries are responsible for insignificant portions of Energy Industries GHG emissions (see Figure 3-5).

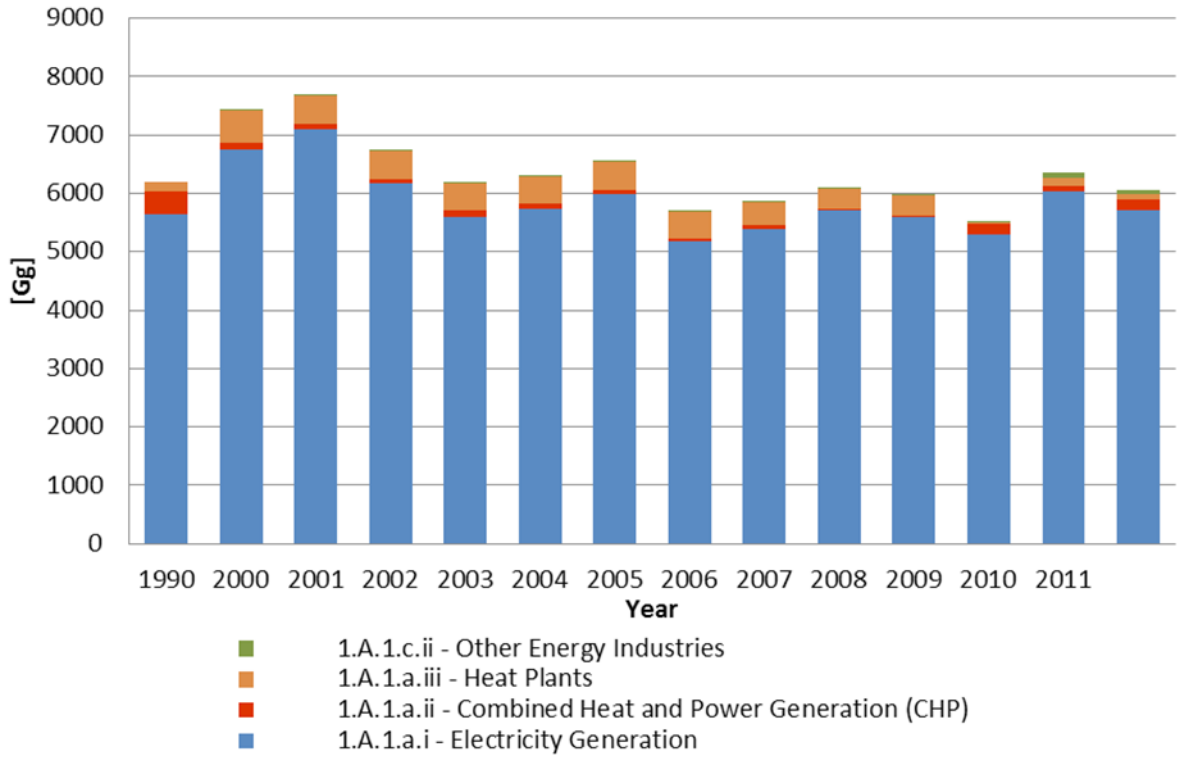


Figure 3-5: GHG emissions from the Energy Industries subsector for the period 1990 – 2012, in Gg CO_2-eq.

The emissions from the Energy Industries are influenced by the amount of electricity produced in the period 1990-2012, as well as from the annual quality of the domestic lignite. The activity data regarding the electricity generation are highly dependable of the annual industrial activities, the economic trends, as well as from the annual meteorological conditions.

3.3.1.2.Manufacturing industries and construction

GHG emissions from the manufacturing industries and construction subsector are dependent on the activity of the Industrial Sector. Types of industries evaluated to determine GHG emissions include iron and steel, chemicals, paper, food processing, machinery, mining and textile. Industrial Production experienced a significant reduction in 2004 and 2009; in 2004 production decreased as a result of the national circumstances while the decrease in 2009 was related to the world economic crisis.

3.3.1.3.Transport

Emissions from fuels combusted in transportation including from national civil aviation[32], road transport and rail transport are second key contributors to the energy section emissions. Transport sector emissions had an average share of 12% of the energy sector emissions during the period 1990 – 2012.

32 Emissions from the Civil Aviation Subsector were calculated using the Tier 2 approach in the framework of the FBUR. International flight emissions (with at least one destination or starting point outside Macedonia) were excluded from the national total emissions and calculated using the Tier 2 method or Tier 1 method if flight data were unavailable.

Road Transport is the main contributor to overall emissions from the transport subsector. In the inventory period 1990 –2012, the road transport subsector was responsible for an average of 99 % of overall emissions from the transport sector. Note that the Tier 2 methodology was unable to be applied to this sector because there is no electronic database of the national vehicle fleet. (See Section 3.8 on Recommendations for further inventory improvements). Rail transport emissions were less than 1% of overall emissions from the transport sector due to the need for large-scale investments to establish new corridors and replace or refurbish inefficient railway vehicles.

Overall, the GHG emissions from the Transport subsector significantly increased during the period 1990 – 2012. The increase was caused by the continuous decrease of vehicles prices in Macedonia related to reduced taxation for imported vehicles as well as increased road transport demand in the country.

3.3.1.4. Other sectors

The other sectors subsector consists of the following emission sources: i) commercial/ Institutional subsector, ii) residential subsector, iii) Agriculture / Forestry / Fishing. This subsector is responsible for approximately 5% of the energy sector GHG emissions for the period 1990 – 2012.

The residential subsector was the most significant contributor to other sectors emissions, with an average of 49% of the total emissions of the subsector for the period 1990 - 2012. An increase in emissions can be attributed to increasing living standards and technology needs. Agriculture / Forestry / Fishing were the second contributors with an average of 30% while the Commercial sector was responsible for 21% of other sectors emissions.

3.3.1.5.Fugitive emissions from fuels

Fugitive emissions from fuels accounted for an average of 2% of overall emissions from the Energy sector. Fugitive emissions in Macedonia originated from coal mining and handling, the production of secondary products of the petroleum industry and from natural gas distribution losses. 99.7 % of the fugitive emissions in Macedonia originate from coal expropriations and coal mining and handling. Direct GHG emissions arising from fugitive emissions from fuels are mainly emissions of CH_4. Emissions from coal mining and handling were estimated using the Tier 1 Global Average Method for Surface Mines. Since domestic lignite is mainly used for electricity production, the fugitive emissions are proportional with the national electricity needs and electricity production capacity. Fugitive emissions from Oil and Natural Gas activities experienced a downward trend to the fact that the national refinery is still working on minimum capacity.

3.3.1.6.CO_2 from Biomass combustion

CO_2 emissions from biomass in Macedonia are represented by the combustion of wood biomass. The general usage of biomass in the country has been increasing in recent years. This is due to a continuous increase in the price of other energy sources and increased energy demand.

3.3.2.Comments on energy sector activity

The Energy sector activity data was mainly gathered from the State Statistical Office Energy Balances, or if not available, data were taken from the International Energy Agency (IEA) database and Ministry of Economy Energy Balances. A country-specific carbon emission factor for domestic lignite combustion and a methane emission factor for coal mining and handling were adopted in light of the significant influence these emissions have on the accuracy of the country's GHG Inventory. In the FBUR inventory, the Tier 2 methodology was applied for the calculation of emissions from the dominant emission sources, i.e. from lignite, natural gas, and residual fuel oil, fugitive emissions from coal mining and handling, as well in the aviation sector which is not classified as a significant source.

The inventory also comprises the emissions resulting from fuel combustion as well as fugitive emissions from extraction, transmission and distribution of solid, liquid and gaseous fuels. These emissions were calculated by two methods: i) Reference approach (top-down) which uses apparent fuel consumption figures to account for the fuel flows into and out of the country and ii) Sectorial approach (bottom up) which accounts for fuel consumption by different sectors. The reporting of GHG emissions was done using the Sectorial Approach, and the Reference approach was used for verification of the reported emissions, taking into account the carbon flow in the country.

Comparison of the two approaches was used to establish the reliability of the intended applications of the Inventory. The assessment of the differences between the Sectorial and the Reference Approach showed that the Energy Inventory estimation methods and data were consistent, accurate and in accordance with the IPCC methodology and Good Practice Guidance for the preparation of GHG Inventories. The estimated difference in the approaches was in the satisfactory range (below 5%), even for an Annex I reporting country.

3.4.Industrial processes and product use (IPPU)

Industry has one of the most important roles to play in the development of the Macedonian economy. Rapid industrial development is one of the most important drivers of economic growth, with the potential to have a transformative effect on socio-economic relationships and standards and manners of living, as well as encouraging, increased interest in technical progress.

In this category, the main emission sources are those industrial processes that chemically or physically transform material. An example includes blast furnacing in the iron and steel industry. During industrial processes, many different greenhouse gases can be produced, including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O).

It was important to distinguish and properly allocate emissions from the use of fossil fuels between the Energy and the IPPU sectors. Emissions from combustion processes were reported in the Energy sector, while emissions from non-energy use of fuels were reported in the IPPU sector.

The greenhouse gas emissions in Macedonia from the industrial sector come from various production industries that can be grouped into the following categories: mineral industry, chemical industry and metal industry. The metal industry is the main contributor to GHG emissions with dominant emissions from the ferroalloy production. This category is followed by the mineral industry where most of the emissions come from cement production. Only a small portion of emissions come from the chemical industry sector as a consequence of the lower development of this sector in the country. The trend of the GHG emissions that comes from the IPPU sector is dependent on peace and stability in the country as well as the level of exports to other countries. The Global Economic crisis that hit Europe in 2009 resulted in reduced emissions from the metal industry due to decreased export.

Most of the greenhouse emissions from the industrial processes sector are carbon dioxide (99%) and the rest are methane. The cement industry contributes the most to overall CO_2 emissions from the industrial processes sector. The emissions from the cement production are influenced by the volume of industrial activity and have followed a generally increasing trend during the period 1990-2012.

Similarly, emissions from lime production were influenced by the volume of industrial activity and followed a sharp downfall trend during the period 1990-1998 and then an increasing trend during the period 1999-2005. There has been no data reporting on the volume of lime production in the country by the State Statistical Office since 2005.

Furthermore, emissions from steel production showed a downfall trend between 1990 and 1999 followed by a stable rise till 2012. Industrial productivity is directly related to political and economic events in the region. The decrease of production beyond 1992 is a result of the depressed economic activity after the independence of the country and separation from Yugoslavia. Similarly, the sharp fall in 2009 is observed as a direct consequence of the Global Economic Crises that highly impacted the export oriented steel industry. (In contrast, emissions from ferroalloy production generally fluctuated).

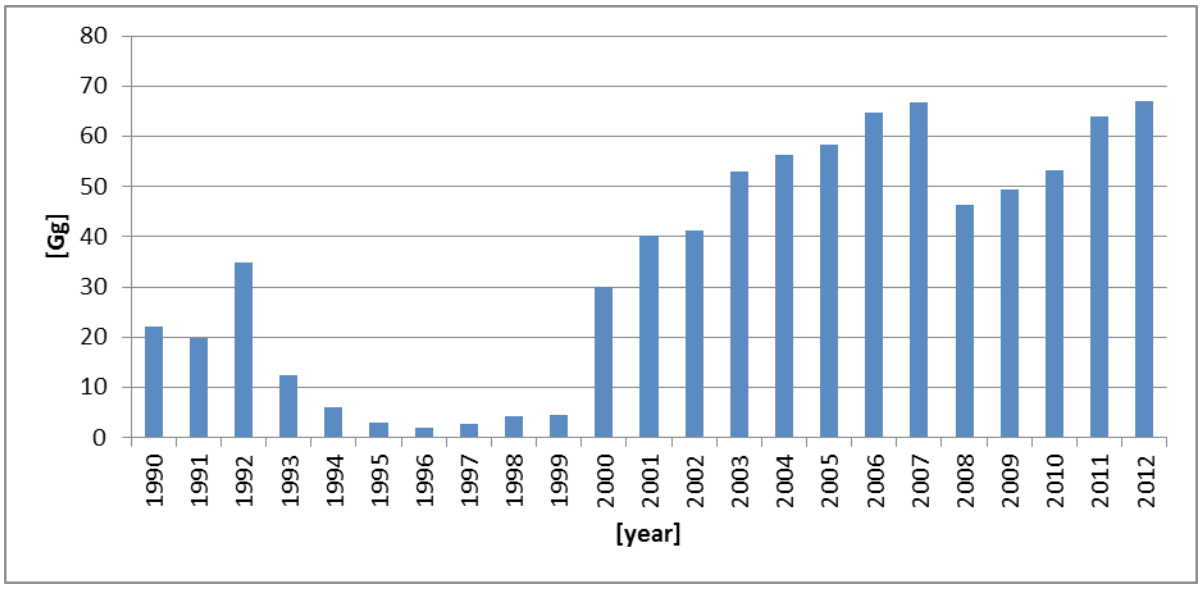


Figure 3-6: CO_2 emissions from steel production during the period 1990-2012, [Gg]

Limestone use was also shown to be tightly related to steel production trends. During industrial applications limestone and dolomite are heated at high temperatures generating CO_2 emissions. Therefore, CO_2 emissions due to limestone use have steadily increased since 2000.

For soda ash production and consumption which results in the release of CO_2, emissions have been steadily increasing. The reasoning behind the increase is that soda ash is used in a variety of production processes such as for paper and other common consumer products. With an increase in the standard of living of the average citizen of Macedonia, more soda ash is being produced to serve the needs of an increasing consumer base.

Contrary to the increasing trends above, in the case of emissions from aluminium and lead production, the trends are drastically different due to halts in production. Emissions from aluminium production became negligible after 2003 when the aluminium company in Skopje became bankrupt and was sold. Similarly, lead and zinc were produced in the MHK Zletovo Smelter until 2003 when there were pollution issues related to releasing heavy metals and sulphur as by-products. Emissions have trended to zero after lead and zinc production halted due to environmental concerns.

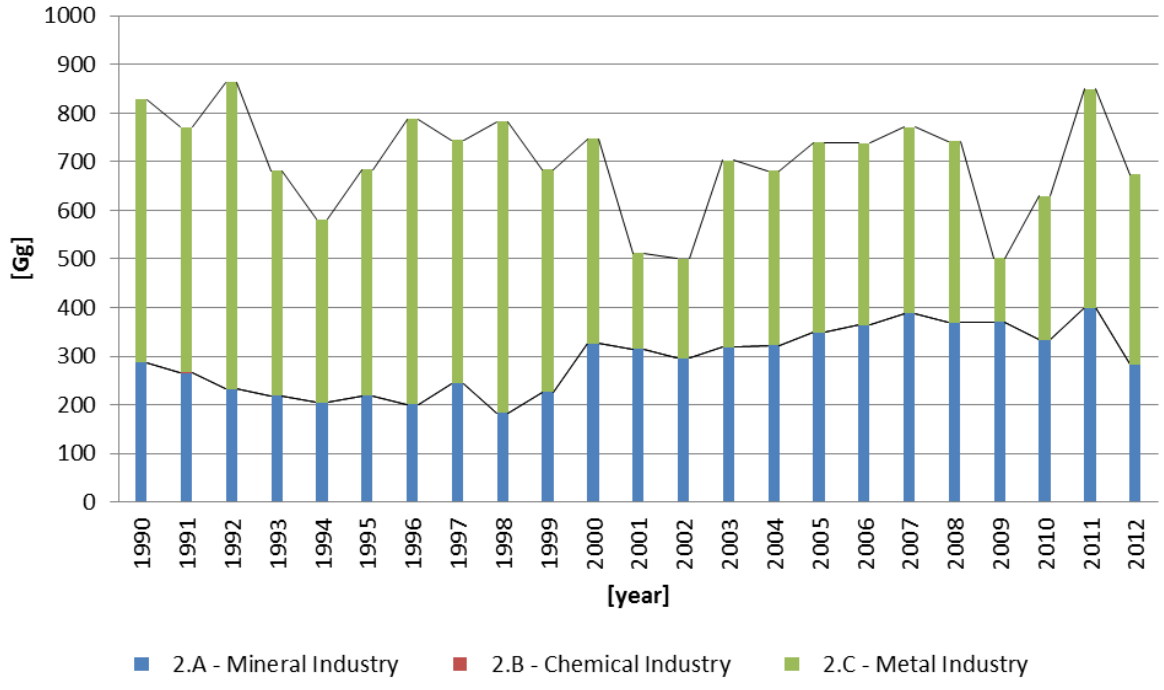


Figure 3-7: Greenhouse emissions from the industrial processes sector, Gg CO_2-eq

3.4.1. Comments on industrial process data

The State Statistical Office gathers data regarding the industrial production in the country. In addition to the data provided by the State Statistical Office, other international data sources were used, such as UN industrial production statistics that give the data (in physical units) by commodity and country for all years and almost all commodities relevant for emission inventories[33] and Eurostat PRODCOM data (Eurostat, 2005) for many European countries. The IPCC Inventory guidelines were used to allocate CO2 emissions released from the combustion of fuel and for the industrial process source category. The Tier 1 method was used to calculate emissions. Emission factors and other parameters with background documentation or technical references were derived from the IPCC Emission Factor Database (EFDB).

National emissions from the IPPU sector will continue to be more detailed and accurate, due to the Emission Monitoring in Industry (EMI) software. This tool for on-line data collection was prototyped for the Ministry of Environment and Physical Planning during preparation of the TNC, and was upgraded and completed within the preparation of this BUR. Its innovative structure enables data collection (on air pollution, greenhouse gas and waste water treatment and discharge emissions) directly from the source- the industrial installation. EMI software harmonizes reporting for air pollution (CORINAIR methodology) and GHG emissions (IPPC methodology) in a centralized data base, but it also customizes reporting forms for different industrial plants depending on the industrial process. The Ministry of Environment and Physical Planning is planning to make EMI a legally binding e-tool for the industry and to further incorporate some of the EU ETS requirements as preparatory phase for introduction of EU ETS in the country. EMI is also one of the components of the National Environmental Information System, proposed in December 2014.

3.5. Agriculture, forestry and other land use (AFOLU)

The greenhouse gases of interest in the Agriculture, Forestry and Other Land Use (AFOLU) sector are CO_2, N_2O, and CH_4. AFOLU GHG emissions are shown by gas in Figure 3-8.

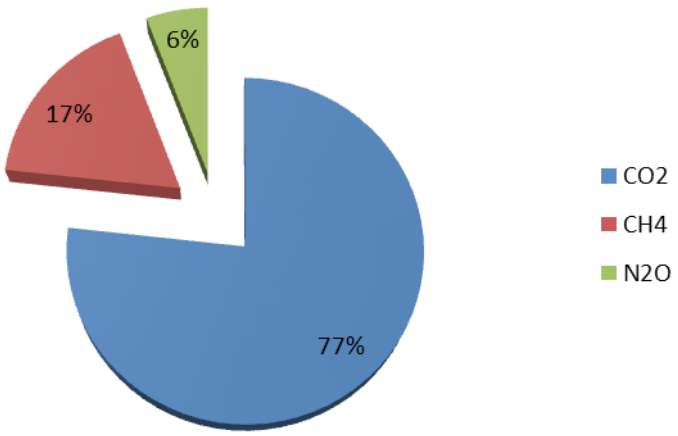


Figure 3-8: GHG emission shares by gas, %

AFOLU GHGs are interchanged between the atmosphere and ecosystems primarily by the uptake through plant photosynthesis and releases via respiration, decomposition and combustion of organic matter. N_2O is primarily emitted from ecosystems as a by-product of nitrification and denitrification, while CH_4 is emitted due to anaerobic processes in soils and manure storage, through enteric fermentation, and during incomplete combustion while burning organic matter.

33 Source http://unstats.un.org/unsd/industry/commoditylist2.asp?Lg=1&S=3.

The emissions from the AFOLU sector excluding the sinks from the land are generally following decreasing trend. This result is primarily driven from the decrease of the livestock population over the year. On the other hand there were several major fluctuations in the time-series of the emissions from the land category. Forest fires that occured in 2007, 2008 and 2012 significantly contributed to increased CO_2 emissions.

3.5.1. Emissions from livestock

The emissions from the AFOLU sector are predominately dominated by carbon dioxide that derives from the land and land use, followed by the emissions from methane mainly from livestock and the manure management. Manure management refers to capture, storage, treatment, and utilization of animal manures. The smallest portion of emissions is nitrous oxide that mainly comes from the management of soils.

In the case of emissions from livestock[34], GHGs are significant due to the relatively large cattle population and the high emission rates due to their digestive systems. In Macedonia, around 80% of the GHG emissions from livestock derive from the enteric fermentations in the form of methane (CH_4). The rest, 20% in the form of CH_4 (14%) and N_2O (6%) are as a result of the manure management practices of livestock manure.[35]

Nitrous oxide emissions from manure management vary significantly between the type of management system used and can also result in indirect emissions due to other forms of nitrogen loss from the system. In Macedonia, only cattle farms have N_2O emissions from anaerobic lagoons.

Overall, emissions from enteric fermentation come predominantly from cattle, around 81.2% while sheep are responsible for 16.3%. In contrast, approximately 72% of the emissions from manure management come from cattle and 24% from swine.

3.5.2. Emissions from land use and land use change

Land-use categories for greenhouse gas inventory reporting include forest, cropland, grassland, wetlands, settlements and other land (e.g., bare rock, soil and ice). The activity data on land use and land use change are gathered form the annual statistical reports published by the State Statistical Office of Republic of Macedonia.

Land use for agriculture in the form of cropland and pastures is substantial in Macedonia and occupies approximately 50% of the surface area of the country. The agricultural sector is prioritized as one of the most important sectors of the Macedonian economy due to its importance for social security and poverty reduction. Forests constitute another 37% and their coverage is growing in Macedonia at the rate of 1.93 m^3/ha. Approximately, 90% of forests are publicly owned.

The emissions from the land and land use underwent several major fluctuations in the time-series due to forest fires that occurred in several years especially in 2007, 2008 and 2012.

3.5.3. Emissions from managed soils

Liming and urea application are conducted on managed soils. Liming is used to reduce soil acidity and improve plant growth in managed systems, particularly agricultural lands and managed forests. Urea is added to soils to act as a fertilizer. Due to the fact that agricultural and forestry practices have not drastically changed, emissions are stable.

Another important source of methane emissions in this sector is the anaerobic decomposition of organic material in flooded rice fields which escapes to the atmosphere. The rice crop is a small crop in Macedonia but it is very important because its production covers domestic needs while the surplus is exported. Currently, production of rice and its emissions are stable.

34 Activity data for the livestock was derived from the Statistical Yearbooks of the State Statistical Office of Republic of Macedonia and the MAKSTAT database

35 Drying and spreading of manure can emit approximately 14% of the methane produced by its equivalent wet weight.

3.5.4. Comments on the AFOLU Inventory

The Tier 1 method was used in AFOLU emissions calculations on enteric fermentation because no allowance could be made for changing livestock productivity. Similarly, the Tier 1 method was used in combination with default IPCC emission factors to estimate emissions from manure management. Due to the fact that manure management practices are temperature dependent, average temperatures were used in calculations. In all calculations for the agriculture sub-sector, data on livestock was collected from agricultural enterprises and cooperatives as well as a Livestock survey by State Statistical Office. Furthermore, in accordance with the 2006 IPCC guidelines, livestock were segregated into categories according to species.

Activity data on land use and land use change were gathered from State Statistical Office annual reports. Data on application of fertilizers and urea were acquired from FAO databases.

3.6.Waste

The Waste sector is one of the key GHG emission sources in Macedonia. Waste management in the country was recently recognized as an issue of concern and a concentrated effort was put forward in order to mitigate its adverse impacts on the environment and society.

The First and Second National Environmental Action Plan, as well as The Law on Waste Management give the general policy directions on waste management and constitute regulation acts that provide general rules applying to main issues on non-hazardous and hazardous waste and on special waste streams. The National Waste Management Strategy is another programme document that defines the fundamental directions in waste management.

Most of the GHG emissions in the Waste sector come from Solid Waste Disposal Sites (SWDS), while emissions from incineration and wastewater handling have an equal importance in total emissions (see Figure 3-9).

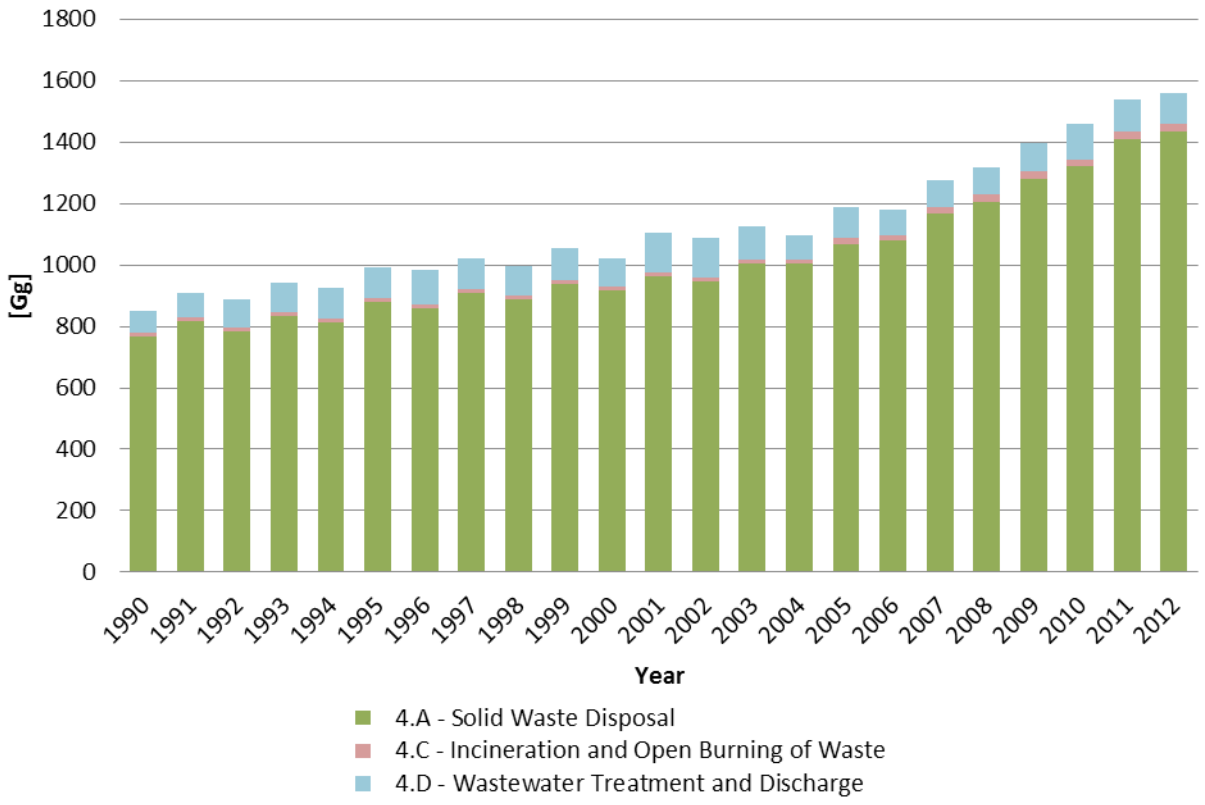


Figure 3-9: Waste Sector GHG emissions, 1990 – 2012 [Gg CO_2-eq.]

Waste sector emissions mainly consisted of CH_4 (methane) emissions (94%). Typically, CH_4 emissions from SWDS were the largest source of greenhouse gas emissions in the Waste Sector. CH_4 emissions from wastewater treatment and discharge were also significant. N_2O emissions were the second biggest source of waste sector GHG emissions. Incineration and open burning of waste containing fossil carbon, e.g., plastics, were the most important sources of CO_2 emissions in the Waste Sector.[36]

3.6.1.General trend for waste

In almost all cases of waste management, there is an upward trend of emissions due to population growth and an improving economy. Higher personal incomes have resulted in a higher waste generation per capita.

3.6.2.Solid waste disposal (SWD)

Solid waste disposal sites (SWDS) produce methane (CH_4), biogenic carbon dioxide (CO_2), non-methane volatile organic compounds (NMVOCs) as well as smaller amounts of nitrous oxide (N_2O), nitrogen oxides (NOx) and carbon monoxide (CO). For the period 1990 – 2012 SWDS were responsible for an average of 89.9% of the overall GHG emissions of the waste sector. Almost 100% of the SWD emissions consisted of CH_4 emissions.

3.6.3.Incineration and open burning of waste

Similar to other types of combustion, incineration and open burning of waste contribute to GHG emissions. Relevant gases emitted from incineration include CO_2, methane (CH_4) and nitrous oxide (N_2O). Normally, emissions of CO_2 from waste incineration are more significant than CH_4 and N_2O emissions. For the period 1990 – 2012 the open burning of waste was responsible for an average of 1.4% of the overall GHG emissions of the waste sector. Approximately 36% of the emissions of this sector consisted of CO_2 emissions, while CH_4 emissions represented 63.5% of the emissions. The share of N_2O emissions was negligible – 0.02%.

3.6.4.Wastewater treatment and discharge

The emissions from the wastewater treatment and discharge originate from Domestic Wastewater Treatment and Discharge and Industrial Wastewater Treatment and Discharge. The emissions of this subsector represented approximately 8.7% of the total waste sector emissions during the period 1990 – 2012. The GHG emissions of this subsector were comprised of two main gases: CH_4 emissions (61.8%) and N_2O emissions (38.2%).

Similar to the other forms of waste, domestic wastewater treatment and discharge emissions have been in line with population growth. In contrast, as described in Section 3.4 on Industrial processes, emissions from the Industrial wastewater treatment and discharge have had a highly fluctuating trend; industrial waste emissions proved to be highly dependent on industrial production rates which were variable between 1990 and 2012.

Future emissions for the Wastewater Treatment and Discharge will be more detailed, since the industry will report directly in the EMI software.

3.6.5.Comments on the waste sector inventory

Waste sector emissions were estimated in accordance with the most recent IPCC 2006 Guidelines and 2006 Inventory Software. The Tier 2 First Order Decay (FOD) methodology was applied for estimation of the waste sector GHG emissions when a long enough time series was available (generally 50 years). If data was missing, the Tier 1 method and a MSW disposal rate of 0.79 kg per capita per day were used. For both Tier 1 and Tier 2 calculations, the FOD methodology was applied by default, as imposed by IPCC 2006 guidelines. Historical data have been taken from official censuses from 1950, 1962, 1971, 1981, 1991, 2002 and current population estimations from the State Statistical Office. Data for the missing years were obtained by extrapolation.

36 Note: All greenhouse gas emissions from waste-to-energy, where waste material is used directly as fuel or converted into a fuel, were reported under the Energy Sector.

Data was also taken from the GHG Inventory for the Second National Communication for 1999–2002 which consisted of the inventory of N_2O emissions from human sewage and methane emissions from sub-sectorial sources, including solid waste disposal sites, domestic/commercial organic wastewater and sludge, and industrial wastewater and sludge. Activity data were taken from State Statistical Office publications, MOEPP reports, FAO statistics and the UN Statistical database.

3.7. Quality Assurance / Quality Control (QA / QC)

Macedonia has implemented Quality Assurance (QA) and Quality Control (QC) procedures to develop national GHG inventories. The process will be repeated for future inventories. The Macedonian approach towards QA/QC introduction in the national GHG inventory process was based on the in-depth analyses of the current practices of the inventory compilation in the country and relevant international best practices.

Personnel involved in QA / QC activities included a Chief Technical Advisor, an Inventory Development Team (IDT) and a QA team (QAT). The QAT verified the adequacy of data, applied methodologies and validated the uncertainty analyses. QC was assured by tabulating activities relative to a list of required QC activities. As a final step, the Chief Technical Advisor checked the National Inventory Report, proposed corrective actions if required and validated the National Inventory Report once the proposed corrective actions were implemented by the IDT members.

The final national inventory of greenhouses gases was additionally reviewed by an expert nominated by the Global Support Programme, who confirmed the significant progress in improvement of the quality of the national GHG inventory.

Training materials on GHG inventory preparation were developed by the GHG inventory team under the Third National Communication. These materials are country-specific and based on personal experiences gathered and lessons learned during the GHG inventory preparations in Macedonia. The training materials are intended to provide clear guidance for personnel active in the GHG inventory process in the future.

3.8. Recommendations for further inventory improvements by sector

3.8.1.Energy sector

Road transport: Fuel-specific and combustion-specific emission factors should be developed. Furthermore, despite the fact that the road transport sector is one of the key sources, improved the Tier 2 methodology was unable to be applied because there is no electronic database of the national vehicle fleet. The development of an electronic database which will serve as a registry of the country's vehicle fleet, by fuel type, specific EURO classification, average consumption and annual average mileage per vehicle is essential for improving the quality of the road transport inventory, especially in terms of estimation of the non-CO_2 emissions.

Railway transportation: fuel-specific and combustion-specific emission factors should be developed. An additional recommendation is the establishment of a database of the average annual mileage per locomotive type and the exact amount of fuel combusted in order to more accurately determine specific emission factors.

3.8.2.Industrial Processes and Product Use sector

For the Third National Communication and the FBUR, a centralized data collection system for industrial plant data was established and updated. The system consists of an online platform called Emission Monitoring in Industry (EMI) which enables industrial plants to report data for calculation of GHG emissions and other pollutants. The data in the EMI portal must be used in the future development of GHG inventories in order to improve the accuracy and completeness of time series.

3.8.3. AFOLU sector

The Tier 2 approach is recommended for estimating methane emissions from enteric fermentation due to the large cattle population in Macedonia. It is also recommended to monitor the amount and type of fertilizers that are used. Furthermore, it is recommended to divide the country by distinct soil types and to develop a new forestry inventory that will determine the area, stock, density, annual growth, tree species, commercial and illegal logging, fires and other disturbances, flooding as well as land development over time. The use of land and the land use change in the land category should be tracked by analysing satellite images.

3.8.4. Waste sector

In the waste sector, a national study should be undertaken on the average composition of waste in order to obtain reliable information on degradable organic content (DOC). Also, more detailed analyses and studies on the wastewater treatment and discharge systems for the domestic wastewaters and industrial wastewater are necessary for improvement of the calculation methodologies of the waste sector inventory. Finally, precise data concerning the incineration of dangerous wastes and the amount of composted wastes are essential for the improvement of the reporting under the Incineration and Open Burning of Waste sector.

Chapter 4: Climate change mitigation and action plan

4.1. Overview

The climate change mitigation analysis for the First Biennial Update Report is a continuation of the analysis carried out in the Third National Communication. Taking into consideration the changes that happened in the interim period, first the baseline scenario was revised which reflects development without implementing mitigation measures, the so called scenario without measures (**WOM scenario**). This scenario is used as a reference scenario upon which the achieved emission reductions and the costs of mitigation are determined.

Using a **bottom-up approach** and starting from specific mitigation measures in **buildings**, **transport** and **energy supply sectors**, a number of potential measures have been modelled individually and their mitigation potential (achievable emissions reduction) and the specific reduction costs have been calculated.

The measures that have a relatively high degree of certainty for implementation (those which have already been started/planned for the near future, which are priority projects/polices in the sectoral strategic and planning documents or which are result of laws that have already been adopted recently or shall be adopted in the near future) are the so-called existing measures which are an integral part of the first mitigation scenario with existing measures (**WEM scenario**). A scenario with additional measures (**WAM scenario**) was developed for the purpose of prioritizing the further mitigation actions and measures and analysing higher levels of ambition.

Despite the fact that Macedonia is not Annex I Party, as an EU Candidate country it is voluntarily trying to incorporate the Annex I UNFCCC reporting principles as much as possible in the framework of the National Communication or Biennial Update Reports. Having in mind that WOM, WEM and WAM scenarios are the main element of reporting for the national mitigation efforts of Annex I countries, including EU member countries, the mitigation analyses within the FBUR was conceptualized for first time in this manner. This exercise has also contributed to capacity building in the country, both, the analytical and the capacities of policy makers and all stakeholders to respond to more demanding reporting requirements.

Prioritization of the mitigation measures and actions has been done for the first time in the country, supporting competent and wise policy making in the field of climate change. Clever choice of proper actions and measures will also result in creation of new economy sectors, increase of employment, beneficial results to regional development, decrease of health costs, tempering the adaptation costs etc. Existing measures (WEM scenario) cannot be prioritized since they are already ongoing. Additional measures (WAM scenario) are the measures that have to be prioritized. Criteria used for prioritization of the proposed mitigation measures and actions are given below[37]:

- Environmental effectiveness (mitigation volume per measure)
- Economic effectiveness (measure specific cost of mitigation)
- Feasibility (measure easiness of implementation)
- Measurability (measurability and verifiability of the measure emissions reductions)
- Co-benefits (health benefits, diversification of income, new jobs, life quality, economic growth potential)

4.2. Scenario Without Measures (WOM Scenario)

The WOM was developed in line with the baseline scenario from the Energy Development Strategy 2015-2035. Taking this into consideration, this scenario contains **specific assumptions on the energy supply side**:

37 More details on prioritization and criteria can be found in the full sectoral report "Climate Change Mitigation in Buildings, Transport and Energy Supply Sectors", on www.klimatskipromeni.mk web site

Use of domestic resources:

- No new large hydro power plants will be built because the investors are not interested and/or there is a resistance of some organizations and the local population.
- The capacity of the power plants with feed-in tariffs is limited to the capacity for which at least a decision for temporary preferential producer has been issued by the Energy Regulatory Commission of the Republic of Macedonia. This capacity is:
    - 65.4 MW for small hydro power plants;
    - 50 MW for wind power plants;
    - 18 MW for solar power plants; and
    - 7 MW for biogas power plants.

Supply technologies:

- Implementation of the Large Combustion Plants Directive
- After revitalization, the Thermal Power Plant (TPP) Oslomej is planned to work on imported high-quality coal.
- A nuclear power plant shall not be built in the analysed period.
- Solar collectors provide for maximum 7% for satisfying the hot water demand in the analysed period.
- The losses in distribution of electricity of about 17%.[38]

Energy imports:

- An interconnection to a new gas pipeline is not considered (taking into account the current situation in the region), which means that there is only the capacity of the existing gas pipe line available.
- The price of imported electricity is the price at the electricity market and in the following three years it is projected to be about 50 EUR/MWh, while in the period after it is projected to increase progressively up to 90 EUR /MWh in 2035, which gives this model a regional component.
- The country is considered to be a closed system, or a country which satisfies more than 95% of its electricity demand from its own capacities and it imports only a small portion of the electricity used.

On the demand side it is assumed that all the new technologies shall have the same efficiency as the existing ones, but there is a possibility for the model to switch from one technology, using one type of fuel to another with a different type of fuel.

Using the MARKAL Model energy demand was analysed in five sectors: residential, industry, commercial and services sector, transport and agriculture. Each of these sectors is further divided into subsectors as follows:

- **The residential sector** is divided into apartments, urban houses and rural houses;
- **The industry sector** is divided into iron and steel industry, non-ferrous metallurgy, chemical industry, ore exploitation industry, food industry, paper and printing industry and other industries;
- **The commercial and services sector** is divided to large and small facilities considering the floor area;
- **The transport sector** is divided into road transport (cars, buses, freight vehicles and motorcycles), rail transport and air transport;

38 According to information obtained from the World Bank team developing the Green Growth Study for the Republic of Macedonia.

- **Agriculture** is not divided into subsectors because it has a relatively low energy demand.

The main drivers in projecting future energy demand in each of these sectors were GDP with an average annual rate of 4.9% (for the period 2012 -2035) and population growth with an average annual rate of -0.09%[39].

In the transport sector there is an expected annual growth of the demand of 4.7% for road transport – or from 6,300 person km (pkm) in 2013 to about 17,800 pkm in 2035. In the freight transport the annual growth is 4.8%, that is from 6,500 tonne km (tkm) in 2013 to about 18,560 tkm in 2035 (Figure 4-1).

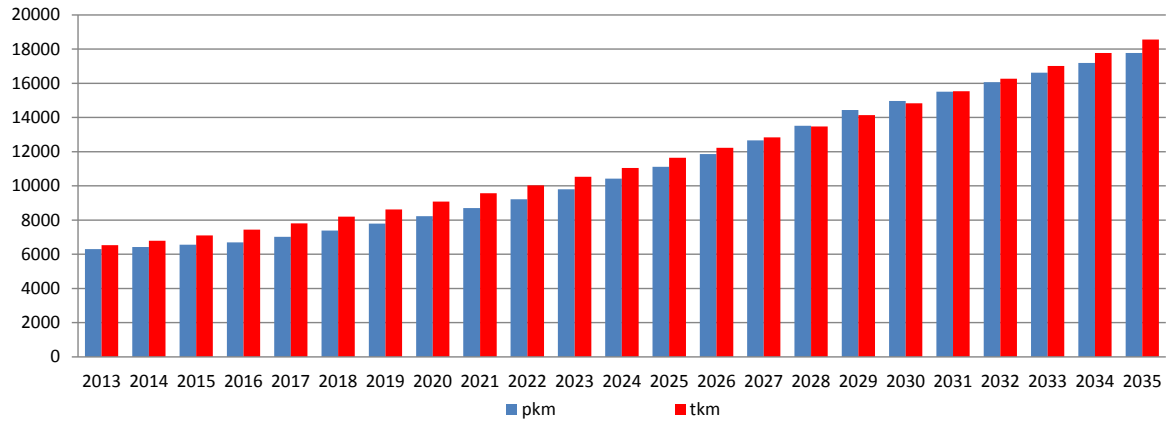


Figure 4-1: Growth of travel demand (in pkm) and freight transport (in tkm) in the WOM scenario

In the WOM scenario, the following are the key characteristics for growth between 2013 and 2035.

On the demand side (see Figure 4-2):

- **The residential sector:** growth of 82% (annual growth of 2.6%) – the lowest percentage growth of any sector).
- **The industry sector:** growth of 84% (annual growth of 2.7%)
- **The commercial and services sector:** growth of 115% (annual growth of 3.4%);
- **The transport sector:** growth of 126% (annual growth of 3.6%) – which is the highest percentage growth of all sectors.
- Final energy consumption would be expected to grow by 97% from 2012 to 2035 (or from 1,767 ktoe to 3,496 ktoe) with an average annual growth of 3%.

39 World Bank, Macedonia Green Growth Study, 2014

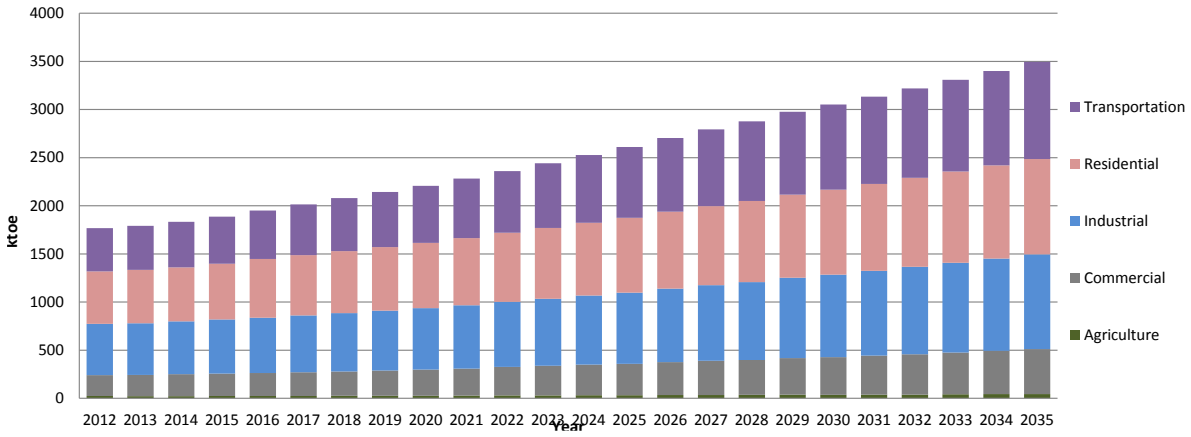


Figure 4-2: Final energy consumption by sectors according the WOM scenario

On the supply side (see Figure 4-3):

- The most dominant fuels in the energy mix would be expected to be electricity and diesel fuel which grow by 100% and 145% (average annual growth of 3%, 4%), respectively.
- Most of the electricity would be generated by coal power plants (increasing from 4,325 GWh in 2012 to 11,977 GWh in 2035 – with annual growth of 4.5% supplying 75% of all power in 2035);
- Combined Heat and Power (CHP) plants based on natural gas would increase from 280 GWh in 2012 to 2,724 GWh – supplying 15% of all power in 2035;
- Hydro power plants would see a small increase from 1,041 GWh in 2012 (a low hydrology year) to 1,613 GWh in 2035 at average hydrology – supplying 10% of all power in 2035;
- Net imports would reduce to a minimum by 2015 and completely avoiding them after 2030;
- The highest growth is evident in gas consumption from 22 ktoe in 2012 to 127 ktoe in 2035.
- Specific growth is also evident in the final consumption of other fuels, but at lower percentage.

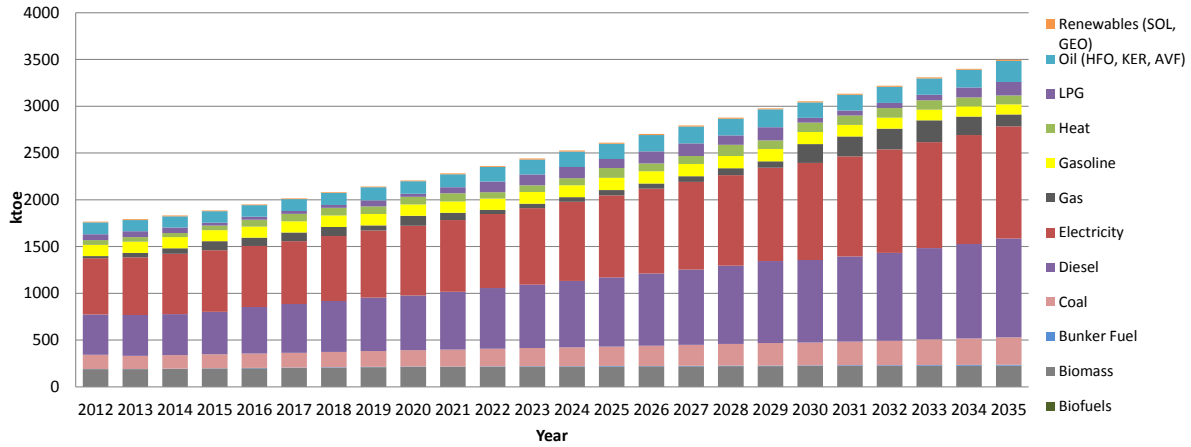


Figure 4-3: Final energy consumption by fuels by 2035 according to the WOM scenario

In order to satisfy growing electricity demand, in addition to existing power plants, new power plants would need to be constructed as follows:

- Coal Thermal Power Plants (TPPs): 2,359 MW (including the overhauled TPPs Bitola and Oslomej[40], two new TPPs of 600 MW each using imported coal, and two new TPPs of 200 MW each using domestic coal);
- Natural Gas TPPs of 700 MW
- Hydro power plants of 92 MW (including HPP Sv. Petka which is already constructed and small hydro power plants with feed-in tariffs),
- Other renewable energy power plants of 71 MW (of which 50 MW are wind power plants, 14 MW are solar power plants and 7 MW are biogas plants).

The total installed capacity would increase 73% from 1,836 MW in 2012 to 3,177 MW in 2035 (Figure 4-4).

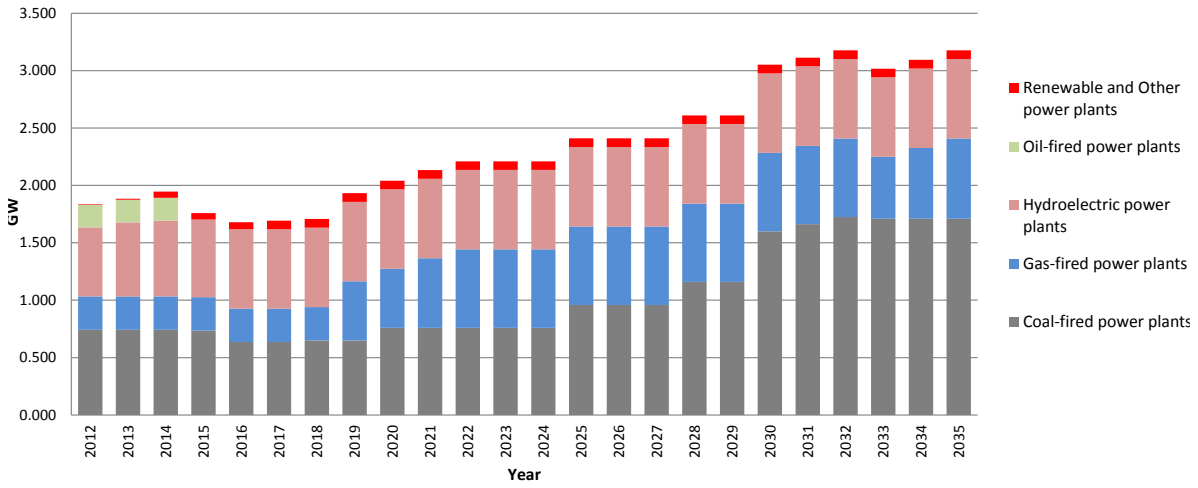


Figure 4-4: Total installed capacity of power plants in the WOM scenario

Under the WOM scenario, the total GHG emissions would increase from 9,030 kt in 2012 to 18,340 kt in 2035, or by 100% (Figure 4-5). This would primarily be due to new coal TPPs commissioned in the period from 2028 to 2032. During this period of time, the most dominant will be emissions from the power sector (60% to 70%). The highest growth of GHG emissions would be in the commercial and sector with an average annual growth of 4.2%, followed by the transport sector with 3.7% and the residential sector with 3.2%

40 The shutdown of old TPPs has been modeled and the revitalized ones were introduced as new TPPs.

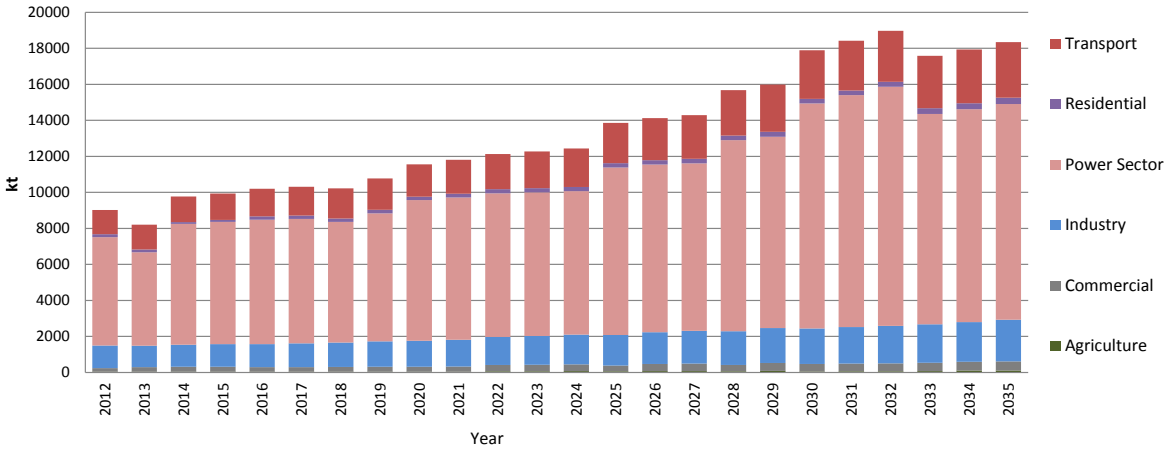


Figure 4-5: GHG emissions in the WOM scenario

The total energy system costs in the Republic of Macedonia for the WOM scenario are estimated to be EUR 43,729 million (using a discount rate of 7.5% and expressed in 2012 EUR).

Compared to 2012 the energy system costs would increase with an average annual rate of 6.2% (or in total for 279%). The highest growth is evident in the investments on the supply side (for electricity generation), from EUR 11 million in 2013 to EUR 521 million in 2035 (or an average annual increase of 19.5%). On the demand side there is also a significant increase in investments in new devices which in 2035 reach EUR 2,173 million.

4.3.Possible Mitigation measures

A total of 18 potential mitigation measures were analysed using bottom-up modelling as part of the preparation for the BUR. These are described below. Additionally, as part of reporting, various measures which are either considered, planned or in progress within the Republic of Macedonia are described in Tabular form in Annex 1. This annex includes a broader range of measures but described in less detail.

4.3.1.Buildings – Labelling of appliances

By labelling appliances, the citizens shall be better informed about their performance and about their energy consumption. This should lead to a reduction in energy demand. The reduction of energy demand applies mainly to the residential sector, but also to the commercial and service sector.

The Rulebook on labelling and standard product information of the consumption of energy and other resources by energy-related products[41] was adopted in 2011, and it was amended in 2012. The implementation of this Rulebook gives an opportunity to the consumers to choose more energy efficient appliances. At the same time, in recent years, higher energy class appliances (class A, B, C) have become present on the market.

It is expected that lower class appliances which are still used in the residential and commercial sectors will be gradually replaced with new ones, which will enable better energy use and reduction of energy demand. It was assumed therefore that by the end of the analysed period:

- In households, the number of higher energy class appliances would increase to 50% of market share;
- In the commercial sector the share of higher class hot water and lighting appliances would increase to 30% of market share, and of heating and cooling appliances to 20%.

41 Official Gazette of the Republic of Macedonia No. 154/2011 and 146/2012

With the increased use of higher energy class devices, as a result of the reduced final energy consumption, the fuel costs shall decrease and at the same time due to lower consumption the investments in the energy sector shall also decrease. The projected CO_2 and cost reductions are described in Table 4-1.

Table 4-1: Economic and environmental assessment of the measure for labelling appliances

Labelling appliances	2020	2030	Cumulative 2020	Cumulative 2030
CO_2 (kt) reduction	21	142	360	1,659
Total cost difference (mil €)	-6	-12	-104	-247
Specific costs (€/t)	-268	-87	-290	-149

4.3.2.Buildings – Public awareness campaigns, EE info centres

This measure is planned in the second Energy Efficiency Action Plan and involves awareness raising campaigns and opening of energy efficiency (EE) info centres. The awareness raising campaigns will contain materials which will make EE information more available to citizens. The info centres will employ energy advisors who give free advice to citizens. This measure would impact the residential and the commercial sector – increasing the use of more advanced appliances (for cooling, heating, sanitary hot water etc.) and reducing energy consumption in these sectors.

It is assumed that the measure would be applied within a period of 5 years (2013-2017) involving EUR 400,000 per year. Although this measure shall be applied for five years, it is expected to have an extended effect, which means to have an increase in the use of more advanced and more efficient appliances even after 2017 as a result of the experience acquired and the good awareness of the citizens.

As can be seen in Table 4-2, the initial costs are projected to be offset by reductions due to fuel cost savings (specifically for the fuel used by appliances in these sectors).

Table 4-2: Economic and environmental assessment for awareness campaigns and for the EE info centres

Awareness campaigns and EE info centers	2020	2030	Cumulative 2020	Cumulative 2030
CO_2 (kt) reduction	1	32	300	967
Total cost difference (mil €)	-2	-5	-89	-156
Specific costs (€/t)	-2,189	-164	-298	-161

4.3.3.Buildings – Rulebook on energy performance of buildings

The Rulebook on energy performance of buildings, adopted in 2013[42], stipulates the minimum requirements for EE and the design and construction conditions for new buildings and retrofit building units. It also stipulates labelling new buildings and building units in accordance with their energy performance (energy certificates). This measure would impact the residential and the commercial sector.

Therefore, the following actions have been analysed:

- **Buildings retrofit in order to reduce heat loss** - improving the building envelope by improvement of outer walls insulation, roof and floors insulation as well as windows and doors. In addition to existing buildings, these interventions would be applied to the new buildings in accordance with the newly stipulated regulations for improved insulation.
- **Energy performance certificates for buildings –** providing information on energy consumption, mainly for cooling and heating purposes. This assumes that building users, knowing the energy performance of buildings, will commit to improving the energy class of the building by using more efficient technologies/appliances and will improve the insulation of buildings.

Since these two actions are complementary, the impact is shown together in Table 4-3.

42 Official Gazette of the Republic of Macedonia 94/2013

Table 4-3: Economic and environmental analysis of the measures contained in the Rulebook on energy performance of buildings

Rulebook on energy performance of buildings	2020	2030	Cumulative 2020	Cumulative 2030
CO_2 (kt) reduction	833	2,343	3,622	16,578
Total cost difference (mil €)	-68	-70	-394	-1,223
Specific costs (€/t)	-81	-30	-109	-74

4.3.4.Buildings – Phasing out of incandescent light bulbs

This measure would involve the adoption of rules that forbid production, import and sales of incandescent lights bulbs in 2016. It is assumed that the phasing out period would be 1 to 2 years, and after this period of time only efficient lights will be used (CFL, LED). A number of countries around the world, including EU member countries[43], have already adopted such decisions. By applying this measure, the consumption of electricity for lighting and associated costs and CO_2 emissions would be reduced as described in Table 4-4.

Table 4-4: Economic and environmental analysis of the measure for phasing out incandescent lights

Phasing out incandescent lights	2020	2030	Cumulative 2020	Cumulative 2030
CO_2 (kt) reduction	66	153	361	1,864
Total cost difference (mil €)	-13	-12	-98	-277
Specific costs (€/t)	-193	-78	-273	-149

4.3.5.Buildings – Phasing out of resistive heating devices

This measure assumes that as of 2017 a ban would be introduced on selling heating devices with resistive heaters, such as electric heat stoves, electric heaters etc. in households. It is assumed that the phasing out period for these technologies would be 10 years, being that a large number of households still use these types of devices and their life expectancy is longer compared to incandescent lights. By applying this measure, the consumption of electricity for lighting and associated costs and CO_2 emissions would be reduced as described in Table 4-5.

Table 4-5: Economic and environmental assessment of phasing out of resistive heating devices

Phasing out of resistive heating devices	2020	2030	Cumulatively 2020	Cumulatively 2030
CO_2 (kt) reduction	55	401	154	2,594
Total cost difference (mil €)	-8	-17	-50	-270
Specific costs (€/t)	-152	-43	-322	-104

4.3.6.Transport – Increased use of railway

This measure involves influencing the mode of transport for passengers and for freight by improving the conditions of railway travel.

To improve railway passenger transport, the Government has ordered six compositions consisting of a locomotive and passenger wagons, each of them providing transport for 1200 passengers with an investment of ~EUR 24 million. With improved conditions, it is expected that people that usually use individual cars for longer distances will travel using railway. Additionally, there would be people who would decide to use trains instead of buses. The transport of passengers by train is projected to increase by an average of 0.1% per year, with the changes as follows:

- 2011: 145 mpkm (million passenger km)

43 REGULATION (EU) C(2012)4641/F1 of 12.7.2012 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to energy labelling of electrical lamps and luminaires (http://ec.europa.eu/transparency/regdoc/rep/3/2012/EN/3-2012-4641-EN-F1-1.Pdf)

- 2012: 99 mpkm (having fallen from the previous year)
- 2035: 270 mpkm with an additional 11 mpkm using a train instead of bus.

To significantly improve freight transport, the Government (with the assistance of the European Bank for Reconstruction and Development) has already ordered 150 freight cars with an investment of EUR 13 million. The change of transport of goods is projected as follows:

- 2007: 778 mtkm (million tonne km),
- 2012: 423 mtkm (having fallen during the previous 5-year period)
- 2035: 1000 mtkm, with a reduction in freight transport by trucks of equivalent amount.

Since these two actions are complementary, the impact is shown together in Table 4-6.

Table 4-6: Economic and environmental assessment of increased use of railway

Increased use of railway	2020	2030	Cumulative 2020	Cumulative 2030
CO_2 (kt) reduction	26	56	96	525
Total cost difference (mil €)	-7	-9	-30	-113
Specific costs (€/t)	-275	-162	-310	-214

4.3.7.Transport – Extension of railway to Bulgaria

This measure involves the extension of the railway to Bulgaria – which traditionally is one of the biggest trading partners of the Republic of Macedonia. In 2005 about 875 kt of goods were transported of which 190 kt were exported and 675 kt were imported.[44] Assuming that half of these goods were transported with Macedonian trucks, and that each truck travelled 400 km in average, it means that they all have travelled 175 mtkm in total.

Extension of the railway is projected to result in half of this transport carried out by rail – increasing over time. The Government estimates that the extension would require an investment of EUR 600 million be complete by 2022. Taking into consideration that the implementation of this measure will start after 2020, the comparisons with the WOM scenario were made only for 2030 and cumulatively until 2030. Given this time delay on any savings achieved from fuel reductions, the specific costs relatively high (246 EUR/t CO_2 reduced), which makes this measure one of the costlier measures analysed (see Table 4-7). However, it is important to underline that this measure would also generate many other benefits.

Table 4-7: Economic and environmental assessment of the extension of the railway to Bulgaria

Railway to Bulgaria	2030	Cumulative 2030
CO_2 (kt) reduction	27	229
Total costs difference (mil €)	4	56
Specific costs (€/t)	168	246

4.3.8.Transport – Increased use of bicycles, walking and introduction of parking policy

The introduction of appropriate parking policy would reduce the use of cars in the urban areas, and would increase the use of bicycles. As a part of this measure, it is also assumed that people, especially in smaller towns where very often they use individual cars for shorter distances (about 2 km), they would start use bicycles more often or they would walk.

44 According to the data from the State Statistical Office

It is very difficult to generalize the investment in new bicycle trails or walking trails because it depends on the terrain on which it is being built. Also it is very complicated to determine how many people would use them. According to the data of the City of Skopje, for the construction of the trail of 7.5 km on the Vardar River, they spent about MKD 22 million (~EUR 364,000 or 48,500 per km). On the other hand in Dojran, EUR 53 million (EUR 330,000 per km) were invested for the construction of a trail of 2.6 km. Therefore, the construction of new trails was not analysed but rather it was assumed that people would use the existing trails.

This measure is mostly aimed at smaller towns where there is not much traffic, and where there is room for walking or cycling. Therefore, only the investment in new bicycles was taken into consideration. From the use of individual cars for short distances (in pkms), it is assumed that 0.1% annually would start using a bicycle and 0.01% would start walking.

The economic and environmental benefits are described in Table 4-8. The high negative specific costs are a result of the small investment (bicycle) or no investment (walking), and with this measure people replace individual cars which require an investment and have maintenance and fuel costs.

Table 4-8: Economic and environmental analysis of the measure for increased use of bicycles and walking

Cycling, walking	2020	2030	Cumulative 2020	Cumulative 2030
CO_2 (kt) reduction	2	5	6	38
Total cost difference (mil €)	-1	-2	-6	-24
Specific costs (€/t)	-702	-494	-910	-647

4.3.9.Transport – Renewal of the vehicle fleet

One of the EE measures in the transport sector is to replace the old and inefficient vehicle fleet. In order to see the benefits of this measure, in the WOM scenario only the use of old vehicles (but not older than 8 years) was modelled. It is assumed that the old vehicle fleet is renewed based on the lowest price, so the old vehicles are replaced with vehicles having internal combustion engines. These vehicles are cheaper compared to the others, such as hybrid vehicles, Plug-in Hybrid Electric Vehicles (PHEV) 10[45], PHEV 40[46], electrical vehicles etc.

Table 4-9 shows the results of the economic and environmental analysis of the measure. According to the analysis, the replacement of the old vehicle fleet during the whole period will have negative specific costs.

Table 4-9: Economic and environmental assessment of the measure for renewing the vehicle fleet

Renewal of the vehicle fleet	2020	2030	Cumulative 2020	Cumulative 2030
CO_2 (kt) reduction	20	140	240	1,345
Total cost difference (mil €)	-2	-13	-49	-217
Specific costs (€/t)	-93	-93	-203	-161

4.3.10.Transport – Improving vehicle efficiency, tax exemption for hybrid and electric vehicles

For the previous measure (renewal of the vehicle fleet) the model selected vehicles with internal combustion engines. The other technologies available to the model have not been selected because the total levelized cost of investment (including on-going costs) are higher than those for internal combustion vehicles. The levelized cost of investment of vehicles in this type of analysis depends on the realistic initial price of investment for the vehicle, the ongoing costs (including fuel, maintenance, taxes and fees), but also on the discount rate. The discount rate can vary and it depends on whether people believe more in one or another technology.[47] Certain surveys show that people

45 Vehicles that can travel at least 10 miles without consuming any gasoline

46 Vehicles that can travel at least 40 miles without consuming any gasoline

47 The discount rate can vary depending on the perception of the value of future savings which also reflects the consumer's trust in the technology being purchased. A higher discount rate (in % terms) implies a reduced present value put on future cash flow – which implies a lack of trust that the future improved cash flows (or savings) will be realized. Conversely, a lower discount rate (in % terms) implies a higher present value put on future cash flow – which implies a higher degree of trust.

still do not trust hybrid vehicles. As a result of this, these vehicles in the model have a higher discount rate (8%) put on future savings in ongoing costs (fuel and maintenance) compared to the internal combustion vehicles (6%), while electrical vehicles, PHEV 10 and PHEV 40 vehicles have a 10% discount rate.

Although the total cost for initial purchase, maintenance, and use of hybrid vehicles is typically slightly higher compared to the internal combustion vehicles, for persons who travel more than 20,000 km per year the savings in fuel costs mean that the levelized cost of investment become lower for hybrid vehicles than internal combustion vehicles. Some of the hybrid vehicles have three times higher efficiency. However, high investments costs prevent their selection by the model.

An analysis was conducted by equalizing the discount rates (6%) (that is by increasing the trust in hybrid type of vehicles). With equal discount rates, the hybrid vehicles in the beginning of the analyzed period become more cost-effective compared to internal combustion vehicles. However, after some time expected future increases in efficiency of internal combustion vehicles reduce the relative economic efficiency of hybrid vehicles and makes them less attractive/chosen less. In order to increase the attractiveness of these vehicles it is planned to exempt their owners from paying annual registration tax to an amount which is not higher than EUR 100. At the same time it is assumed that the penetration of these vehicles would reach a maximum 10% by 2035. This measure would enable the penetration of HEV vehicles which together with the internal combustion vehicles contribute to the renewal of the car fleet. The costs for introducing hybrid vehicles would increase by EUR 6 million, and the marginal costs of abatement would be 44 EUR/tonne CO_2eq, but seen in total, this measure still has negative costs of 145 EUR/tonne (see Table 4-10).

Table 4-10: Economic and environmental assessment of the measure for improving of vehicle efficiency and tax exemption

Improving vehicle efficiency, tax exemption	2020	2030	Cumulative 2020	Cumulative 2030
CO_2 (kt) reduction	24	158	257	1,476
Total cost difference (mil €)	-1	-13	-47	-213
Specific costs (€/t)	-56	-83	-184	-145

The introduction of subsidies for buying electrical vehicles was also analysed. In some European states the Government subsidizes electrical vehicles and the subsidies amount to EUR 5,000 in Romania, Portugal and Iceland, EUR 15,000 in Amsterdam and EUR 29,300 in Denmark. In the analysis for this report, subsidies of EUR 5,000 were used but this intervention still did not make electrical vehicles effective investments, so they were not taken into consideration.

Concerning PHEV 10 vehicles, it would be necessary the Government to introduce annual subsidies in the amount of EUR 450 to make them investment worthy – but only after 2030. These vehicles would still remain a luxury and would not penetrate much on the market. Thus, it can be concluded that the only technology which can realistically be subsidized in order to contribute to emissions reduction in Macedonia and which would not overburden the budget are the hybrid vehicles.

4.3.11.Electricity – Higher number of preferential producers

This measure assumes the number of preferential producers to increase above the maximum which has been set out by a Governmental decision for feed-in tariffs as follows:

- **Wind:** Increasing from 50 MW by 2016 (as set out in the decision) to 100 MW by 2020 and 150 MW by 2025;
- **PV:** The quota for 18 MW of PV to benefit from feed-in tariffs as established in the Governmental decision is exhausted. For this measure, it is assumed that an additional 22 MW of PV would benefit from feed-in tariffs – bringing the total to 40 MW.
- **Small hydro:** The Government decision does not determine the total power for small hydropower plants, so it was assumed that in on top of the existing 65 MW already planned in the WOM scenario,[48] an additional 100 MW would benefit from feed-in tariffs.
- **Geothermal energy:** 10 MW.

48 17MW have already built but only 6 MW in the baseline year (2012). The rest were built in 2013 and 2014.

For the scenario developed in this way, containing all the technologies and the same assumptions as the WOM scenario, but with additional capacity benefiting from feed in tariffs, the cumulative and discounted cost for the period until 2035 amounts to EUR 43,437 million (EUR 392 million less than the WOM costs). This reduction above all is due to the high price of natural gas in the WOM scenario. The introduction of additional technologies with feed-in tariffs first replaces the natural gas PPs from the system because they have more expensive production from the non-preferential producers and – because they are the most flexible sources resulting in a very low number of annual working hours – they are not as economically efficient. The projected CO_2 and cost reductions are described in Table 4-11.

Table 4-11: Economic and environmental assessment of higher number of preferential producers

Higher number of preferential producers	2020	2030	Cumulative 2020	Cumulative 2030
CO_2 (kt) reduction	82	214	224	2,338
Total cost difference (mil €)	-3	-5	-19	-136
Specific costs (€/t)	-34	-23	-83	-58

4.3.12.Electricity – Distribution losses reduction

The losses in distribution of electricity in the Republic of Macedonia are about 17%.[49] In the coming 20 years, it is expected that the distribution company will make investments in order to reduce the loss to 11%. Annual investments range from EUR 25 to 30 million. The projected CO_2 and cost reductions due to this measure are described in Table 4-12.

Table 4-12: Economic and environmental assessment of distribution losses reduction

Distribution losses reduction	2020	2030	Cumulative 2020	Cumulative 2030
CO_2 (kt) reduction	146	401	448	3,261
Total cost difference (mil €)	-13	-12	-70	-290
Specific costs (€/t)	-90	-30	-156	-89

4.3.13.Electricity – Electricity import (market)

In the WOM scenario, the Republic of Macedonia is considered to only import a small amount of electricity. This measure envisages electricity import if the price of electricity on the market is lower than the price of electricity produced by domestic production capacities. The following assumptions are made for this projection:

- The wholesale price of electricity on the European market (which has significantly dropped in recent years) continues at relatively low prices for the coming several years (up to 2020), after which a specific increase is expected.
- The bigger part of the imported electricity will be from renewable sources since the electricity from RES has the lowest price on the wholesale market so consequently this will cause a GHG emission reduction.
- The introduction of this measure contributes to emissions reduction in other sectors as well. This reduction is a result of the lower electricity price and the use of certain electrical appliances becomes less expensive compared to others which use fuel with higher emission factors.
- The introduction of electricity imports, as a result of the lowered price, would result in a shutdown of the gas PPs which are present in the WOM scenario. It should be noted that the price of natural gas – which currently is high for Macedonia – would in a period of 3 to 4 years be reduced to the European market price.

49 According to information obtained from the World Bank team developing the Green Growth Study for the Republic of Macedonia.

Table 4-13 shows the projected CO_2 and cost reductions. In 2030 due to the intensified operation of the coal PPs there it is projected that there would be a slight increase in the emissions and this takes place only in this year.

Table 4-13: Economic and environmental assessment of electricity import (market) measure

Electricity import (market)	2020	Cumulative 2020	Cumulative 2030
CO_2 (kt) reduction	1,005	4,655	12,024
Total cost difference (mil €)	-20	-125	-344
Specific costs (€/t)	-20	-27	-29

Sensitivity analysis was conducted in case the price of electricity stays on the current level of about 40-50 EUR/MWh. This would cause the shutdown of existing coal power plants and no construction of new coal PPs which are projected in the WOM scenario. This would also cause a significant reduction in the GHG emissions, because the coal PPs are those that emit the most CO_2 emissions.

4.3.14.Electricity – Introduction of CO_2 tax and electricity import (market)

This measure involves the implementation of the EU Emissions Trading Directive (2003/87/EC) which stipulates the introduction of a CO_2 tax for electricity generated from fossil fuels. At the same time, the measure provides a possibility for the import of electricity, which means that the domestic production of fossil fuels would be burdened with a CO_2 tax which would increase the production price. If this price is higher than the electricity import price, than there would be import instead of domestic production of electricity.

For this measure, the CO_2 tax is set at 20 EUR/tonne in 2020, increased to 25 EUR/tonne in 2025 and to 30 EUR/tonne in 2030. At this price of CO_2 domestic coal PPs (on domestic and imported coal) can still operate and they are competitive on the market. The commissioning of new PPs would be postponed for two to three years. When there is not sufficient production of electricity by the domestic coal power plants it would be supplemented by imported electricity or by domestic natural gas PPs, which at the specified CO_2 price in certain periods are even more competitive than the coal PPs.

This measure causes cumulative CO_2 reductions and cumulative negative costs of EUR 189 (See Table 4-14) although for a certain period of time there are positive costs, as in 2020. The specific costs are far closer to positive than in the previously analysed measures, but are still.

Table 4-14: Economic and environmental assessment of the measure for introducing CO_2 tax + electricity import (market)

Electricity import (market) +CO_2	2020	2030	Cumulative 2020	Cumulative 2030
CO_2 (kt) reduction	1,370	2,358	3,945	17,988
Total cost difference (mil €)	9	-2	-37	-189
Specific costs (€/t)	7	-1	-9	-10

4.3.15.Electricity – Increased utilization of renewable energy sources

This measure involves the utilization of large hydro PP (Boshkov Most, Lukovo Pole, Chebren, Galishte, Gradec and Veles) in addition to the preferential producers. It also involves the second phase of revitalization of existing hydro power plants and revitalization of HPP Shpilje. Additionally, the construction of PV and wind PP without feed-in tariffs is possible. Roof-top PV systems have also been included. The projected CO_2 and cost reductions are described in Table 4-15 – assuming all of the above mentioned technologies are constructed.

Table 4-15: Economic and environmental assessment of the measure for increased utilization of RES

More RES + FT	2020	2030	Cumulative 2020	Cumulative 2030
CO_2 (kt) reduction	248	1,025	605	5,648
Total costs difference (mil €)	-6	-4	-39	-192
Specific costs (€/t)	-24	-4	-65	-34

4.3.16.Heat – Higher penetration of solar collectors

There is currently a subsidy programme for the implementation of solar collectors (see Annex 1). This measure involves the wider application of solar collectors beyond the 7% envisioned in the WOM scenario. Wider application of solar collectors means that their participation would be increased to 30% during the analysed period. In 2020 and 2030 there would be a very small increase in the electricity production which brings an increase in the GHG emissions. Due to this reason Table 4-16 does not show the specific costs – only cumulative emission reductions by 2030 the specific costs are negative. This means that the introduction of solar collectors is a cost-effective option. However it is preferable to continue with the subsidizing policy because this additionally increases market penetration. It is recommended to subsidize more socially vulnerable families.

Table 4-16: Economic and environmental assessment of the measure for wider application of solar collectors

Wider application of solar collectors	Cumulative 2030
CO_2 (kt) reduction	550
Total cost difference (mil €)	-91
Specific costs (€/t)	-165

4.3.17.Transport – 10% Biofuels

The EU's Biofuels Directive (2003/30/EC) stipulates that by 2020 there should be 10% participation of biofuels in the final energy consumption in the transport sector. The EU's Renewable Energy Sources Directive (2009/28/EC) also stipulates a certain percentage of final energy consumption to be supplied by renewable sources. In 2020 the final energy consumption in the transport sector is projected to be 593 ktoe, which means that the consumption of biofuels would need to be 59 ktoe to meet the EU Biofuels Directive target. It is assumed that the percentage of biofuels by 2020 would change similarly to what is shown in Figure 4-6:

- In 2015 – 0.5%
- In 2016 – 1.25%
- In 2020 – 10%
- After 2020 remaining at 10%

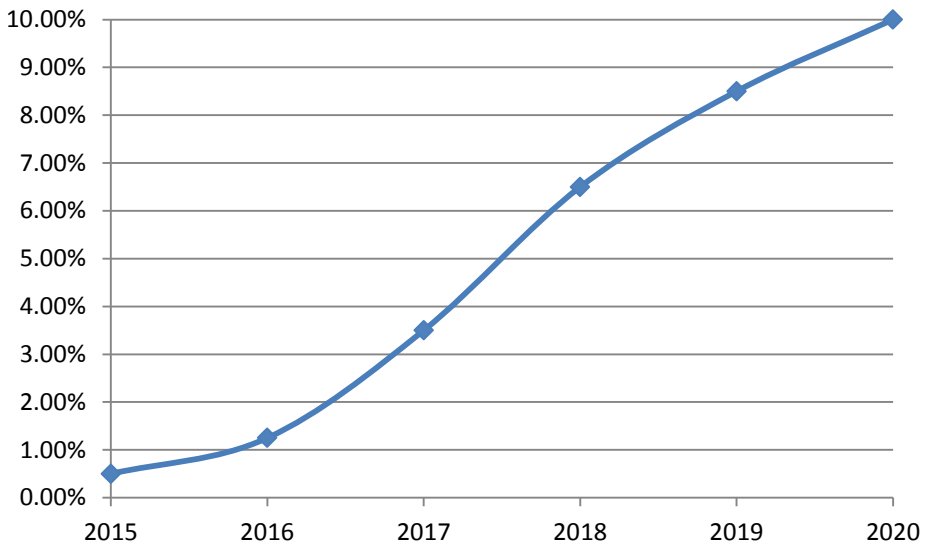


Figure 4-6: Participation of biofuels until 2020

This would entail an increase in costs compared to the WOM scenario (see Table 4-17).

Table 4-17: Economic and environmental assessment of the measure for 10% biofuels

10% biofuels	2020	2030	Cumulative 2020	Cumulative 2030
CO_2 (kt) reduction	175	265	504	2,747
Total cost difference (mil €)	4	1	12	29
Specific costs (€/t)	21	4	24	11

4.3.18.Transport – Biofuels – delay until 2025

This measure plans for 5-year delay in the implementation of the Biofuels Directive as a result of the financial implications of biofuels on the state budget. It is assumed that the percentage of biofuels would develop as follows:

- 2016 – 0.5%
- 2020 – 5%
- 2025 – 10%
- After 2025 – remaining at 10%

The projected CO_2 and costs are described in Table 4-18. The costs are higher compared to the WOM scenario. The specific costs throughout the whole period are positive, but decrease over time.

Table 4-18: Economic and environmental assessment of the biofuels measure – voluntarily

Biofuels voluntarily	2020	2030	Cumulative 2020	Cumulative 2030
CO_2 (kt) reduction	89	265	211	2,307
Total cost difference (mil €)	1.6	1.0	4	19
Specific costs (€/t)	18	4	21	8

4.4.Marginal Abatement Cost Curve

In regard to the specific costs per tonne of CO_2 abatement, out of 18 measures analysed, 15 are "win-win" measures, which means that besides generating CO_2 savings, they also provide for financial benefits, which actually means that investing in them would reduce costs compared to the reference option. Increased use of bicycles, walking and introduction of parking policy has lowest specific costs (-647 EUR/t CO_2). The only measures with positive costs are the biofuels – delay until 2025 (8 EUR/t CO_2), 10% biofuels (11 EUR/t CO_2) and extension of railway to Bulgaria (246 EUR/t CO_2).

The results obtained concerning specific costs and quantity of emissions reduced for each of the measures are presented visually on a Marginal Abatement Cost Curve (MAC) in Figure 4-7). On this curve, the x-axis presents CO_2 emission reductions, while the y-axis presents specific costs. From this it is easy to see what measures achieve highest savings of CO_2 at what specific cost and whether a measure is a "win-win" measure. Additionally, this curve shows the total quantity of emissions reduced – a cumulative amount of 75 Mt over the course of the time analysed. It is important to note that this curve is an indicative one, because there are some measures overlapping, such as electricity import and electricity import and introduction of CO_2 tax. In a real situation the emission reduction of 75 Mt cannot be reached.

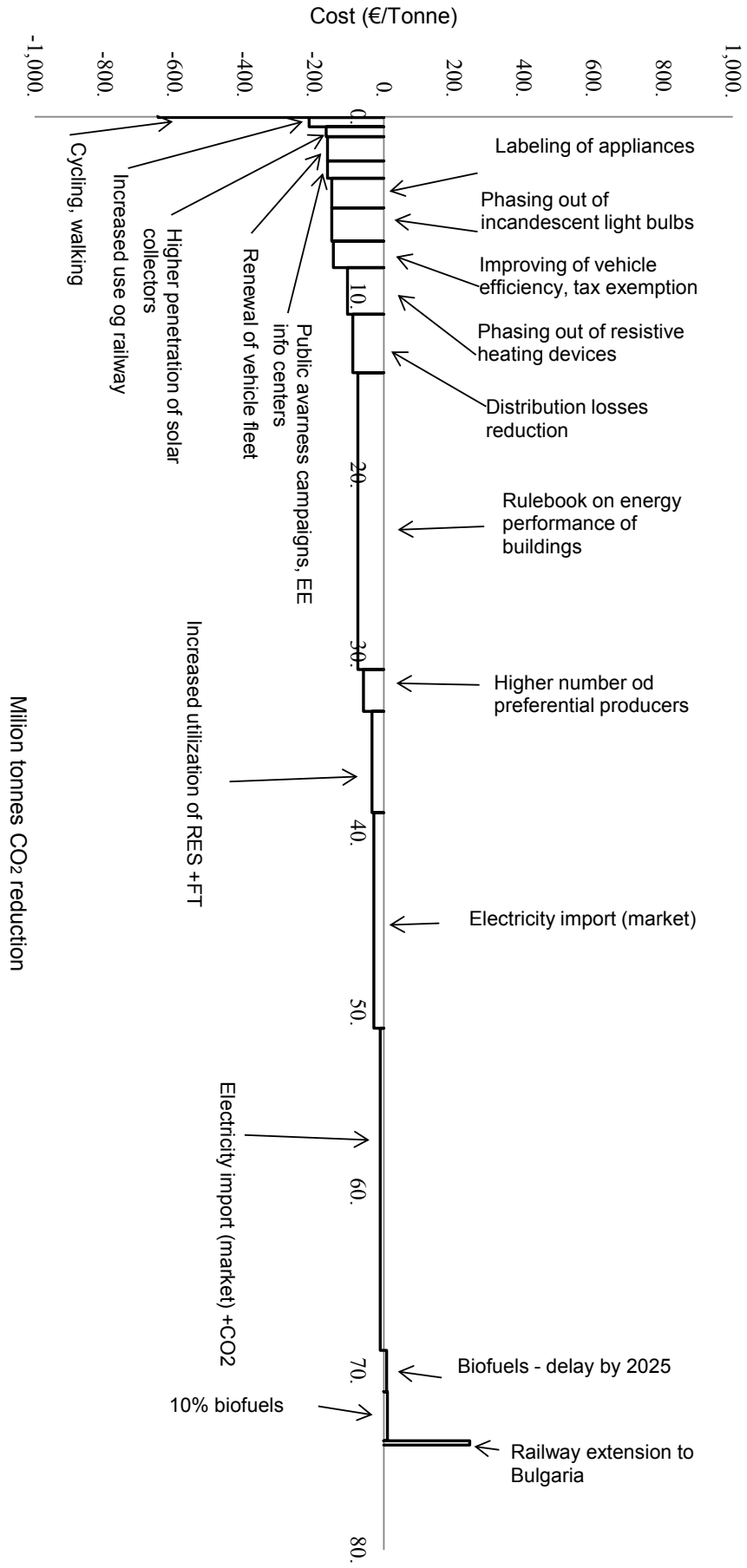


Figure 4-7: Marginal Abatement Costs Curve based on cumulative reductions and costs by 2030

4.5.Scenario With Existing Measures (WEM Scenario)

The WEM scenario was developed based on analysing a portfolio of mitigation measures that already have been initiated or were assessed as highly probable for implementation. These measures were examined using a bottom-up modelling exercise. In addition to intensive analytical work, the mitigation analysis also includes an approach based on participation of several key stakeholders, especially for evaluation and prioritization of the measures given in the mitigation Action Plan, as well as for capacity building and knowledge transfer, implemented by a key technical advisor and international mitigation expert.

In the **scenario with existing measures (WEM)**, out of the 18 measures previously described the following measures were included:

1. Labelling of appliances
2. Public awareness campaigns and energy efficiency info centres
3. Rulebook on energy performance of buildings
4. Increased use of railway
5. Increased use of bicycles, walking and introduction of parking policy
6. Renewal of vehicle fleet
7. Distribution losses reduction
8. Electricity import (market)
9. Increased utilization of renewable energy sources
10. Biofuels – delay until 2025
11. Higher penetration of solar collectors

Their annual and cumulative impact on emissions reductions are provided in Figure 4-8 and Figure 4-9.

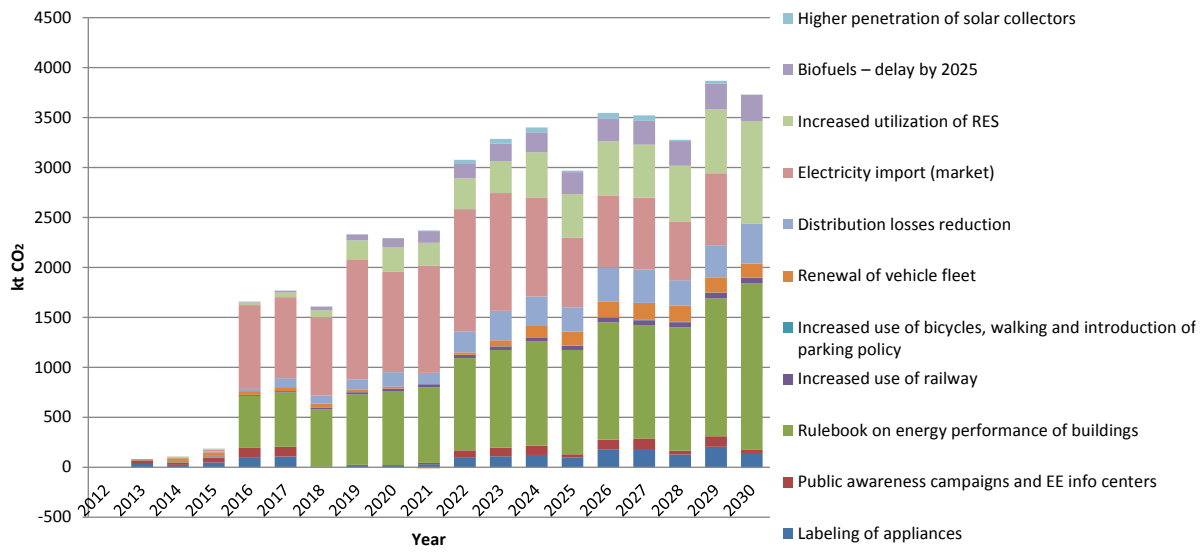


Figure 4-8: Annual emissions reduction in the WEM scenario

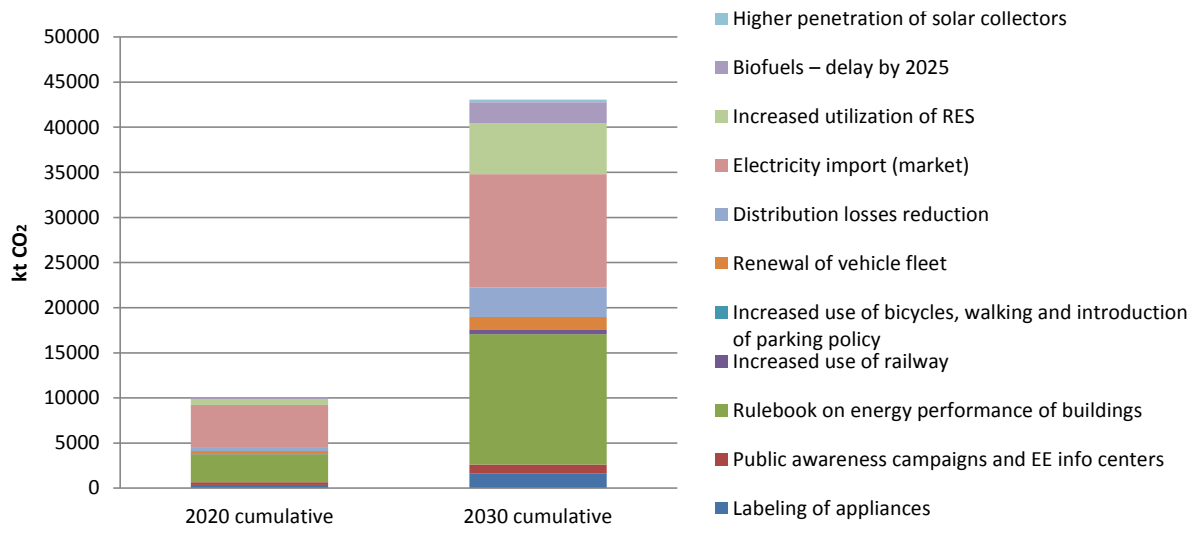


Figure 4-9: Cumulative savings by 2020 and 2030 in the WAM scenario

With these measures it is possible to achieve maximum emission reduction of about 4,000 kt CO_2 in 2029, which compared with the WOM scenario generates a reduction of 24% in that year. The highest cumulative emission reductions are projected to be achieved by the following measures:

1. The Rulebook on energy performance of buildings – 35% of the total cumulative emissions reduction;
2. Electricity import (market) – 28% of the total cumulative emissions reduction;
3. Increased utilization of renewable energy sources – 13% of the total cumulative emissions reduction;
4. Distribution losses reduction – 7% of the total cumulative emissions reduction.

The measure for import of electricity provides for highest savings in the period 2016-2023, however as the price of imported electricity grows the domestic production of electricity becomes more competitive which in the end results in a lower import and lower CO_2 emissions savings.

Cumulative CO_2 emission reductions below the WOM scenario are:

- By 2020 - 10,000 kt – an 11% reduction cumulatively
- By 2030 - 43,000 kt – an 18% reduction cumulatively.

4.6.Scenario With Additional Measures (WAM Scenario)

The scenario **With Additional Measures** (WAM) includes 14 measures, which are as follows:

WEM measures

1. Labeling of appliances
2. Public awareness campaigns and EE info centers
3. Rulebook on energy performance of buildings

4. Increased use of railway
5. Increased use of bicycles, walking and introduction of parking policy
6. Distribution losses reduction
7. Increased utilization of RES
8. Higher penetration of solar collectors

Improved WEM measures

9. Improving vehicles efficiency, tax exemption for hybrid and electrical vehicles
10. Introduction of a CO2 tax and electricity import (market)
11. 10% Biofuels

Additional measures

12. Phasing out of incandescent lights
13. Phasing out of resistive heating devices
14. Railway extension to Bulgaria

With these measures a maximum emissions reduction of more than 7,000 kt in 2030 is projected to be achievable (Figure 4-10), which compared to the WOM scenario presents a reduction of about 40%, in that year.

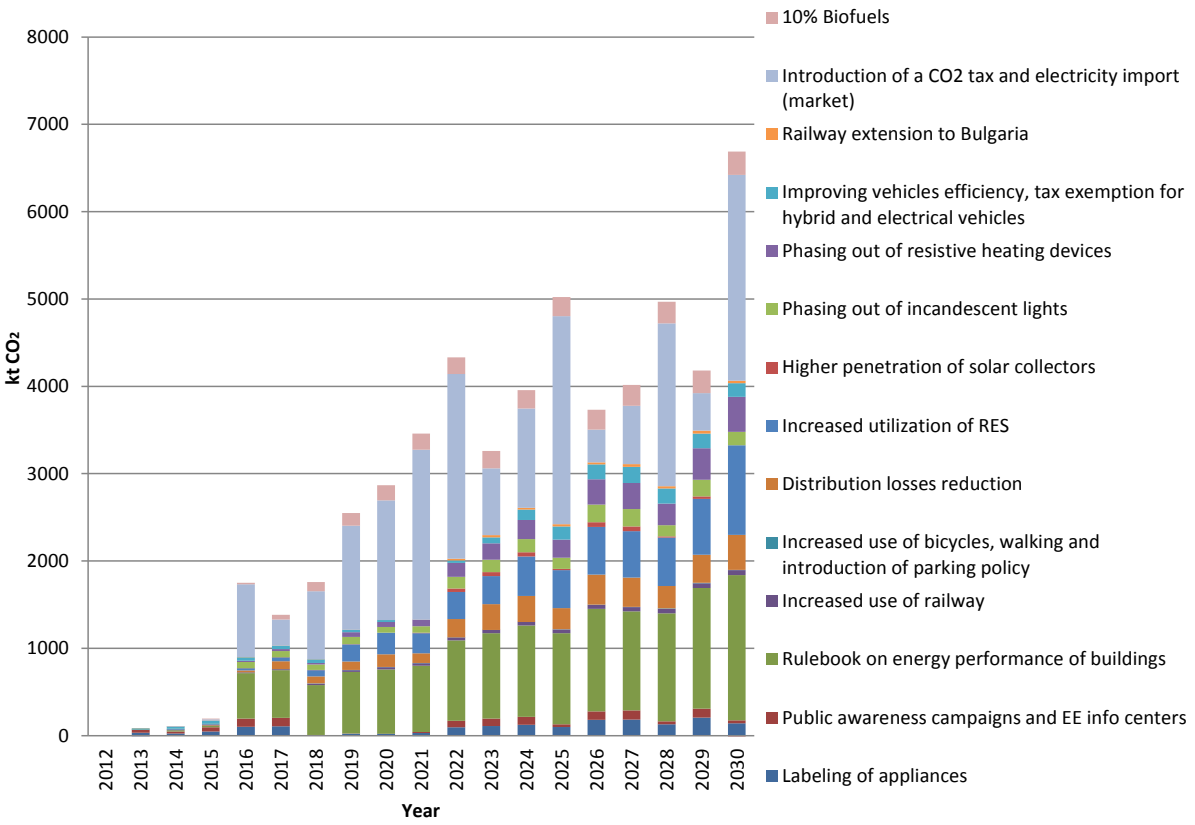


Figure 4-10: Annual emissions reduction in the WAM scenario

Cumulative CO_2 emission reductions below the WOM scenario are (see Figure 4-11):

- By 2020 - 11,000 kt – an 12% reduction cumulatively
- By 2030 - 55,000 kt – a 22% reduction cumulatively.

The highest cumulative emission reductions are projected to be achieved by the following measures:

- Introduction of a CO_2 tax and electricity import – 34% of the total cumulative emissions reduction[50]
- Rulebook on Energy Performance of Buildings – 27% of the total cumulative emissions reduction
- Higher participation of RES – 10% of the total cumulative emissions reduction
- Decreasing losses in distribution - 6% of the total cumulative emissions reduction

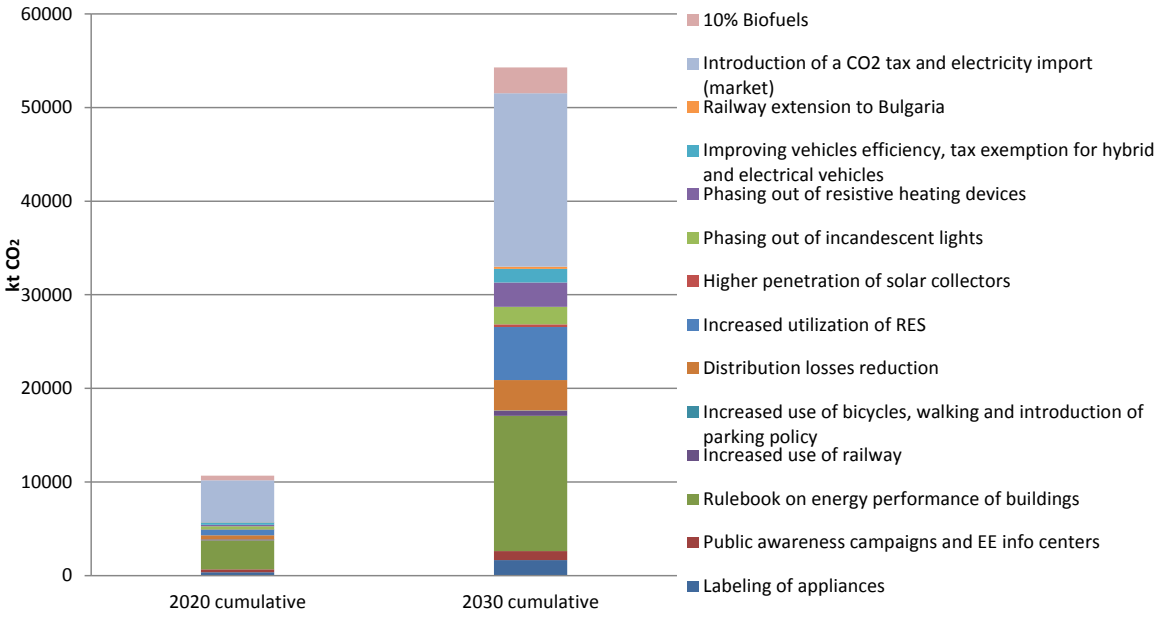


Figure 4-11: Cumulative savings by 2020 and 2030 in the WAM scenario

50 It is noteworthy that there are projected to be high oscillations in the emissions reduction resulting from this measure because they are mainly connected to higher production of gas PPs in the WOM scenario, or to changing the year when new coal PPs would be built (domestic or imported).

4.7.Conclusion

Cumulative emissions in the WOM, WEM, and WAM scenarios to 2030 are shown in Table 4-19). By comparing CO_2 emissions in all scenarios (Figure 4-12) it can be concluded that measures with a relatively high probability of implementation (WEM scenario) significantly contribute to CO_2 emission reduction. Their introduction is very important in order to achieve specific national targets. The influence of additional measures is also important, especially in the period after 2020, when greater reductions of CO_2 emissions are visible.

Table 4-19: Summary CO_2 emission results in 2020, 2030 and cumulatively by 2020 and 2030 in WOM, WEM and WAM scenarios

	WOM	WEM	WAM
CO_2 emissions in 2020 (kt)	11,561	9,269	8,694
CO_2 emissions in 2030 (kt)	17,891	12,124	11,214
Cumulative CO_2 emissions by 2020 (kt)	90,033	80,007	79,348
Cumulative CO_2 emissions by 2030 (kt)	212,634	173,301	165,032
Reduction compared to WOM (CO_2 emissions in 2020)		20%	25%
Reduction compared to WOM (CO_2 emissions in 2030)		32%	37%
Reduction compared to WOM (cumulative CO_2 emissions by 2020)		11%	12%
Reduction compared to WOM (cumulative CO_2 emissions by 2030)		18%	22%

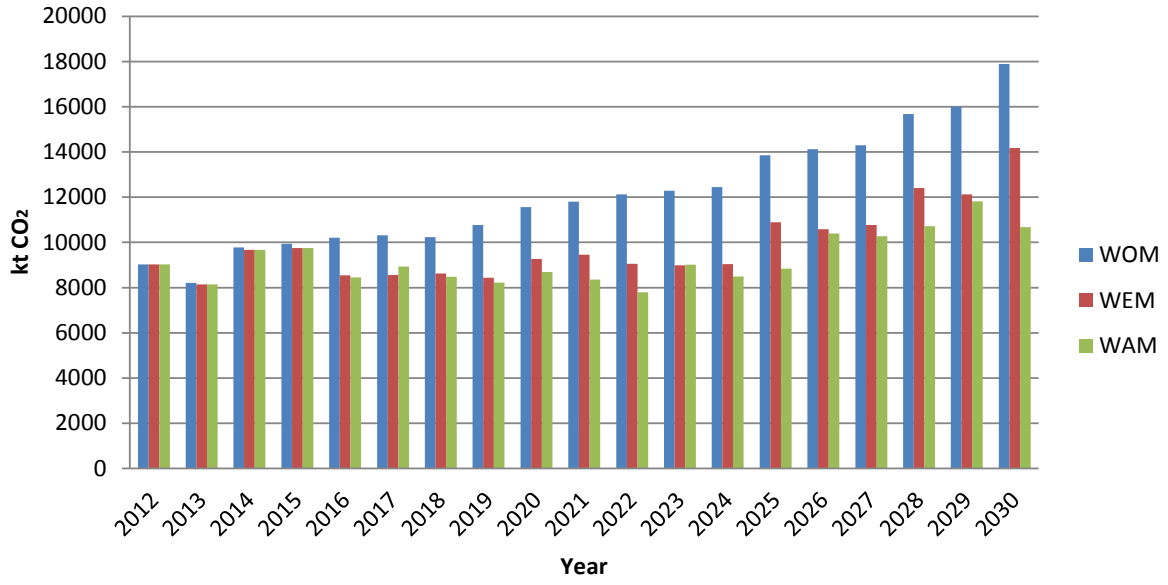


Figure 4-12: Comparison of GHG emissions in the WOM, WEM and WAM scenarios

It should be noted that the WEM and WAM scenarios can be improved, there are other measures in these sectors, and other measures in other sectors as well which could be incorporated into analysis (as part of the WEM and WAM scenarios). Therefore, it should be underlined that the results of the study are indicative but can be used for defining national contributions in the global GHG emission reduction efforts (intended Nationally Determined Contributions – iNDC). An action plan for these measures is described in Annex 3.

Finally, a tabular form of the various mitigation actions which Macedonia is currently implementing and considers or intends to implement in the coming decade is presented in Annex1 which also takes into account the mitigations analyses conducted under the Third National Communication and the Second National Energy Efficiency Action Plan. For those which it is currently implementing, information on the steps taken to date is included.

The types of mitigation actions include:

- The promotion of end-user energy efficiency;
- Increasing the level of renewable energy in electricity and heat production;
- Improvement of transport systems and the vehicle fleet;
- Encouraging the switch from high-carbon fuels to low-carbon fuels;
- Improvement of waste management;
- Improvement of agricultural management through a variety of cost-effective methods.

The results from this mitigation assessment served as input for an indicative policy paper for determination of potential national GHG emissions limitation/reduction targets in sectors: buildings, transport and energy supply sectors. Nevertheless, these sectors cover most of the GHG emissions in the Republic of Macedonia, and also those are sectors in which policies and measures may achieve quick and easy results, and in which, the already implemented measures are even now achieving results. The policy paper also contains recommendations for follow-up actions which will help setting the mitigation contributions reflective of the national circumstances. This paper serve as starting point to the process of determination of potential national greenhouse gas (GHG) emission limitation/reduction targets, in preparation for the United Nations Framework Convention on Climate Change (UNFCCC) 21st Conference of Parties (COP 21), that will be held in Paris in 2015.

The available options and necessary decision to be made by the Government can be more or less ambitious, depending of the pledge type QELRC or deviation from Business as Usual (see Annex 5 for more details).

The analyses for refining the mitigation scenarios have shown that transport sector has significant potential for mitigation. One of the proposed measures with biggest potential for GHG reduction on short term is new passenger car excise tax, based on vehicle CO_2 emission per km, exhaust emission level standard, engine size and vehicle value. The model is open to fine-tuning. It may later be easily extended to motorcycles and light duty commercial vehicles.

Basing excise tax on CO_2 emissions is more environmentally and socially sensitive, since it does place higher tax on stronger cars which pollute more even if the best technology is employed[51].

51 More details on prioritization and criteria can be found in the full sectoral report "Climate Change Mitigation in Buildings, Transport and Energy Supply Sectors", on www.klimatskipromeni.mk web site

Chapter 5: Constraints and Gaps, and Related Financial, Technical and Capacity Needs

5.1.Capacity Reinforcement

Macedonia has received significant capacity building to assist with FBUR preparation between September 2013 and December 2014. Details of the trainings are described below by theme.

5.1.1.Mitigation and GHG inventory

Regional Capacity Building Activity on Measurement of Inland Transport C02 Emissions and Mitigation Policies – Technical Workshop (Geneva, Switzerland – 8-10 October 2013): The training informed Stakeholders on the project "For Future Inland Transport Systems (ForFITS)" which supports a global monitoring and assessment tool to help decision makers to assess activity, energy use and CO_2 emissions from transport, as well as the impact of related policy measures. The main objective of the project is to enhance international cooperation and planning for sustainable transport policies.

Energy Efficiency in Industry (Skopje – December 2013): This training was carried out by the Regional Environmental Centre (REC) – Office in Macedonia jointly with USAID and focused on promoting energy efficiency in industry, with particular reference to using the ISO 50001 standard. 45 companies were trained, and another 25 companies will have been trained by the end of 2014.

Mapping LEDS elements in the national strategic planning (Skopje – November 2013): As part of the USAID Clean Energy Investment Project, two workshops focused on the inclusion and implementation of the Low Emission Development Strategy (LEDS) approach in the Government of Macedonia's strategic planning and recommendations for integration of LEDS into the national sustainable development planning. It was attended by National Committee for sustainable development – technical working group

Regional workshop for the Asia-Pacific regions on NAMAs (Vientianne, Laos – 22-25 April 2014): This workshop facilitated sharing of experiences, lessons learned and good practices in the process of preparation and implementation of Nationally Appropriate Mitigation Actions (NAMAs). The workshop brought together experts from Asia Pacific and Eastern Europe regions, as well as representatives from international organizations. Further bilateral and multilateral agencies present at the workshop provided participants with information on their NAMA support programmes.

ECRAN Workshop on Regional Capacity for Developing Low Emission Strategies and Modeling (LAUNCH WORKSHOP) (Zagreb, Croatia – 23 January 2014): The Workshop was the launch of the ECRAN Regional Exercise on the development of climate policies converging with the EU acquis in the ECRAN beneficiaries. This Regional Exercise's objective is to promote and establish an enabling environment for further development of national climate policies converging with EU climate acquis. In the framework of this Exercise the beneficiaries were familiarized with the 2030 framework for EU Climate change and energy policies.

1st ECRAN Monitoring Mechanism Regulation (MMR) workshop (Zagreb, Plomin & Koromacno Croatia – 5-7 March 2014): This was a regional training on GHG Inventory development process with a focus on the energy sector. It included field training for beneficiaries' staff compiling the National Inventories and National Communications. The purpose of the field training was to fill gaps and check the quality of implemented emission factors and reported Activity Data for fuel combustion activities and fugitive emissions from fuels.

ECRAN Regional Training on inclusion of aviation into the EU Emission Trading Scheme (Istanbul, Turkey – 10-11 April 2014): The objective of the meeting was to improve technical understanding of the ETS implementing provisions in relation to monitoring, reporting, verification and accreditation in the beneficiary countries among the target group aircraft operators, as well as competent authorities and potential verifiers. In addition, information was provided on the requirements of the Monitoring and Reporting Regulation (MRR) and Accreditation and Verification Regulation (AVR) and the guidance and templates that have been developed to support a harmonized implementation and compliance with EU ETS.

ECRAN Regional Training on Ozone Depleting Substance (**ODS) and F Gases (Tirana, Albania – 27-28 May 2014):** The objective of this training was to familiarize the beneficiaries with the F-gases and the ODS regulations, with a particular emphasis on the planning and preparation, certification, verifications and training schemes, labelling, responsibilities for commercial, industrial and public sector organizations, as well as reporting requirements in the transposition and implementation of F-gases regulations.

2nd ECRAN MMR Workshop, (Podgorica, Montenegro – 8-9 July 2014): This workshop provided the essential elements for the establishment and contributions to a fully functioning monitoring mechanism of GHGs for ECRAN members, in line with the EU Monitoring Mechanism Regulation and UNFCCC requirements.

ECRAN Regional Training Seminar on assessment of GHG Inventories in the Energy and Industrial Processes sectors (Zagreb, Croatia – 28-29 October 2014): The aim of this training seminar was to gradually improve/increase technical knowledge and institutional and procedural capacities of the ECRAN countries to prepare submissions of the National Inventory Reports according to the requirements of the MMR.

ECRAN LEAP modelling: training Module 1 (Skopje – 4-7 November 2014): This training increased Macedonia's technical capacity to carry out modelling of emission scenarios, with the purpose of enabling them to carry out emission scenario modelling work. Modelling aided scenarios will support Macedonia to meet their future EU and UNFCCC reporting requirements and to form a rational position on national efforts contributing to the EU 2050 roadmap and the 2030 Framework.

Study visit in Freiburg organized for the Network of capital Cities (Freiburg, Germany – October 2014): This visit was organized by GIZ and the City of Freiburg for increasing capacity for the Network of Energy Efficiency Capital Cities (including Skopje, Zagreb, Sarajevo, Podgorica, Tirana, and Freiburg). The City of Freiburg is a model city for the Network. The Network was also presented at the International Conference on sustainable development of Cities.

10th Centralized review (Bonn, Germany – 29 October – 4 November 2014): At COP 9 Parties adopted a code of practice with decision 12/CP.9 for the treatment of confidential information in the technical review of GHG inventories from Parties included in Annex I to the Convention. Procedures developed cover submission, processing and handling by the Secretariat of any information designated as confidential by an Annex I Party, and the granting of access by expert reviewers to this information. This year an expert from the Macedonia national GHG inventory team was in the role of Industrial Processes expert for the centralized review which was conducted and conducted in Bonn, Germany. The Parties under review were: European Union, Japan and Slovenia.

Study visit for exchange of experiences and technical review of the ongoing national GHG inventory preparation of the Republic of Serbia (Belgrade, Serbia – 27-28 February 2014): This visit involved an exchange of experiences between the national inventory experts of Macedonia and Serbia (including the Serbian Environmental Protection Agency), Belgrade and technical review of the ongoing national GHG inventory preparations of Serbia.

Emission Monitoring in Industry (EMI) training: Training was provided on the EMI online platform to improve how industrial plants report data for calculation of GHG emissions and other pollutants. The training was conducted for the industrial plant users and the MOEPP experts who are able to inspect the data and automatically produce annual reports grouped by the type of industrial activities.

COPERT Training Workshop (Copenhagen, Denmark – 27-28 March 2014): The expert workshop was dedicated to the usage of the COPERT model for calculating GHG and air pollutant emissions from the road transport sector. The workshop was primarily aimed at users and interested potential users of the COPERT software. In addition to an introduction to the technical methodologies used within COPERT, there will also be hands-on training sessions using the software itself.

First workshop for designing of the work packages for Energy Efficiency at Municipal Association Project (Podgorica, Montenegro – December 2014): The aim of the workshop was the development of the first draft of the Guidelines for Municipalities from South East Europe for development of Sustainable Energy Action Plans. Additionally, a review of the National Stakeholders Maps was conducted. Various Municipal Associations from South East Europe attended.

5.1.2. MRV

The **USAID Association of Energy Engineers Training (Tirana, Albania – 4-8 November 2013):** provided training on the International Performance Measurement and Verification Protocol (IPMVP) and training on how to verify the results of energy efficiency activities, including emission trading, energy statistics calculations and indicators. Training was provided to energy engineers and analysts, utility engineers, project managers and federal/state/local government energy staff.

Workshop on "International Climate Policies - Implications for Low Emission Development opportunities for BiH" (Bosnia and Herzegovina – 16 September 2014): UNDP Macedonia presented a conceptual framework for the establishment of Monitoring, Reporting and Verification scheme for Climate Change Mitigation.

Training of the Monitoring and Verification Platform for National Energy Efficiency Plans (Vienna, Austria – February 2014): This training was developed by the Energy Community Secretariat for the members of the Coordination Group for Energy Efficiency. The platform will be used by the national ministries for collecting data on implemented projects and assessment of the fulfilment of the national and regional action plans for energy efficiency.

Training of the Monitoring and Verification Platform for National Stakeholders in Macedonia (Skopje – April 2014): This training was organized by GIZ for the Ministry of Economy, Energy Agency and Union of the Local Self-Governments (ZELS) and was related to the similar training carried out in Vienna, Austria by the Energy Community Secretariat (see above).

Training of the Monitoring and Verification Platform for municipalities in Macedonia (Skopje – May 2014): This training was organized by ZELS for the Energy Agency and local municipalities. It was related to a similar training carried out for other national stakeholders and to the training in Vienna, Austria by the Energy Community Secretariat (see above).

5.1.3.Technical training

Introduction of Remote Sensing (RS) and Geographic Information System (GIS) techniques for monitoring forestry changes (Skopje – December 2013): As part of the USAID Clean Energy Investment Project, this event included a presentation and training for new platforms, techniques and software for image procession, interpretation and technical requirements for implementation of Remote Sensing into forest-change monitoring. Representatives from relevant national institutions and the GHG inventory team also participated.

Training workshop for National Designated Entities (NDEs) concerning the Climate Technology Centre Network (CTCN) services (Vienna, Austria – 17-19 June 2014): This workshop hosted by UNIDO and UNEP presented the CTCN and its services including processes for processing and responding to country requests and the CTCN Knowledge Management System; presented roles and responsibilities of NDEs as climate technology champions at the national level fostering; identified NDEs' needs and priorities to enable them to effectively perform their role and enable their countries to benefit from CTCN services.

GEF Small grants programme (throughout Macedonia, November 2013 – November 2014): Within this programme, 11 climate change related workshops/trainings have been organized on energy efficiency and/or renewables in various municipalities (energy savings - public buildings, street lighting, EE in public buildings, replacing oil with biomass). At the local level, approximately 450 people participated.

Service design and building organizational culture in co-designing with beneficiaries (Skopje – 14 – 16 April 2014): This training sponsored by UNDP and delivered by Dominic Campbell, Founder of FutureGov, Expert in Service design aimed to enhance knowledge in approaches and tools for service design and incorporation of the prototyping into the project cycle for two target groups: UNDP project staff in the country and national counterparts and relevant ministries.

Crowdfunding for development (Skopje – 30 June – 2 July 2014): This UNDP sponsored training was given by Toshi Nakamura, Co-founder of Kopernik and Global Innovator. The goal of the training was to familiarize UNDP project staff with the crowdfunding approach and how/whether at all can be used for UNDP development projects.

"Foresight – theory and successful examples" (Skopje – 16 October 2014): This workshop was delivered by John Sweeny, Consulting Futurist and Deputy Director of the Center for Postnormal Policies and Future Studies, Chicago, USA. It focused on sharing knowledge with UNDP staff on the theory and concept.

5.1.4.Climate policies

Global Training Workshop on the Preparation of Biennial Update Reports (Bonn Germany – 16-18 September 2013): This workshop provided technical support to non-Annex I Parties on how to report information in their BURs pursuant to the Annex III decision 2/CP.17. Training included using training materials developed by the Consultative Group of Experts (CGE) and providing feedback on the training materials, including its design and technical content, with a view to ensuring that these training materials respond effectively to the technical assistance needs of non-Annex I Parties.

The Climate Change Conference (Tetovo – 30-31 May 2014): The goal of this event is to gather relevant representatives from the region in South East Europe such as Local and National Authorities, Civil Society Organizations, Scientific Institutions, International Organizations and other guests to promote the project results at an international level, using the Green Agenda Methodology for development of municipal strategies for climate changes and to establish and promote regional cooperation for join activities for combating climate change.

Signing of MoU with the Network of Political Schools of South East Europe under the auspices of the Council of Europe (Sarajevo, BiH – December 2014): GIZ organized this signing of a new phase in mutual implementation of projects with the Network of Political Schools from South East Europe. The cooperation will be based on increasing the transparency in creation of policies related to energy efficiency. One parliamentary hearing will be held in each country in this phase. Additionally, cooperation will take place with the Baltic Environmental Fund – providing training on climate change for NGOs from South East Europe.

Asia-Pacific and Eastern Europe technical dialog on Intended Nationally Determined Contributions to the 2015 Agreement under the UNFCCC (Hanoi, Vietnam – 9-11 July 2014): This training took place with a representative of MANU as a participant. The MANU representative gave a country presentation titled "Macedonia: Towards post-2020 climate change regime: Comparative assessment of various scenarios and Intended Nationally Determined Contributions for a non-Annex I country".

USAID project on municipal climate change strategies: This project was implemented by Milieukontakt Macedonia and involved training for municipalities on the development of municipal GHG inventories and climate change strategies. Strategies were developed in 8 municipalities.

ECRAN Workshop on Contributions to the Global Climate Agreement in 2015, (Brussels, Belgium, 28-29 October 2014): The objective of the workshop was to strengthen regional cooperation between the EU candidate countries and potential candidates in the fields of climate action and to assist them on their way towards the transposition and implementation of the EU climate policies and instruments which is a key precondition for EU accession. The workshop focused on promoting and establishing an enabling environment for further development of national climate policies converging with EU climate ***acquis*** and providing support for beneficiaries preparing their intended nationally determined contributions to the 2015 Global Climate Agreement.

5.1.5.Climate finance

Webinar: The Global Innovation Lab for Climate Finance (7 October 2014): The webinar discussed the Global Innovation Lab for Climate Finance's goals, the initial set of ideas and instruments it has identified for analysis and further testing, and its next steps. The half hour presentation by CPI, The Lab's Secretariat, was followed by an opportunity for participants to ask questions.

Second Annual Conference of the Economics of Green growth Peer-Assisted learning (EGGPAL) Network (Istanbul, Turkey – 14-16 May 2014): This conference covered various issues of green growth including:

- Carbon pricing; energy subsidies; green investment schemes; feed-in tariffs and subsidies for renewables and other green technologies; climate change public expenditure reviews;
- Macroeconomic modeling of low carbon actions, resilience, and greening and the impact on growth, employment, and trade patterns over the long term; how to integrate sectorial models into macroeconomic analysis; carbon leakage and competitiveness;
- Marginal costs of mitigation (the construction of MAC curves), the economic impact of emerging new technologies in mitigation (shale gas as a bridge fuel, innovations in energy efficiency and renewable energy sources);

- Public investment choices under uncertainty; the economic costs of adaptation to a changing climate both within key sectors (energy, agriculture, transport, water) and economy-wide;
- Green jobs, green exports, and green innovation;
- Country experiences with low carbon development planning and green growth strategies.

5.1.6.Climate change adaptation

ECRAN First Regional Conference and Seminar on Climate Change Adaptation, (Skopje – 2-3 July 2013): The event aimed to plant the seeds for development of national institutional structures and to start a process of increased interest for adaptation among the local and regional authorities in the ECRAN countries, eventually resulting in adaptation planning and action.

6th Crop Growth Monitoring System (CGMS) Expert Meeting (Ispra, Italy – 12-13 November 2013): The objective of the meeting was to present the current state of the MARS Crop Yield Forecasting System at JRC, to exchange on the latest developments in crop monitoring, forecasting, and crop modeling, and to identify the scientific and technical challenges related to the use of crop models and their implementation in monitoring systems. The meeting allowed the exchanging of experiences between participants, sharing of questions and opinions in the fields of crop monitoring and modelling. The representative from Macedonia was invited to present the experience and views on the subjects of using BioMA in Macedonia as best practise for other countries.

Workshop on climate change adaptation (Strumica, Macedonia – 2-6 September 2014): This workshop was carried out by Milieukontact Macedonia and USAID and involved an advanced training on climate change adaptation.

Adaptation to Climate Change in Agriculture Project (throughout Macedonia – November 2013 – November 2014): This series of workshops carried out by the Rural Development Network of Macedonia and funded by USAID included an informative workshop for journalists, climate change workshops/trainings for Rural Development Network members throughout the country, results dissemination workshops, a Climate Change Public Awareness stand and workshop, as well as on-site demonstrations and trainings on different project-promoted agricultural adaptive practices for farmers and NEA advisors.

The following workshops were led by the World Health Organization (WHO).

1) WHO workgroup on health and climate change – third meeting (Bonn Germany – 2 July 2014): attended by representatives from the Ministry of Health.
2) **WHO Training of Trainers (Geneva, Switzerland – 3-4 July 2014):** which was used to strengthen capacities on health and climate change for WHO member countries – attended by representatives from the Ministry of Health
3) **WHO Conference on health and climate (Geneva, Switzerland – 27-29 August 2014):** Good practices from Macedonia were presented and Macedonia was promoted as of the most successful countries in the process of adaptation of health sector to climate change – attended by representatives from the Ministry of Health.

Also, in 2014 the **Institute for Public Health, Red Cross** provided public awareness activities and flyer distribution on prevention of negative effects from cold weather and heat weaves to improve health.

5.2.Capacity Gaps

In order to fulfil the obligations arising from the Cancun and Durban Conference of Parties (COP) decisions related to the submission of national communications and biennial update reports, further support is needed to continue to develop and consolidate existing technical and institutional capacities and to continue the efforts of integrating climate change into national policies, plans and programs.

The GHG inventory team noted that there is not enough technical support to ensure full sustainability and quality control of the national GHG inventory process into the future. A permanent administrative and financial support is needed in order to guarantee continuity and

integrity, specified, for example, in a governmental program for support of the process. This program should identify the financing mechanisms, and if found appropriate, open up a possibility for outsourcing.

Other than one training focused on climate finance, Macedonia also requires capacity reinforcement on how to access the growing networks of private and public climate change financing. Climate financing must incorporate both gender mainstreaming into existing mechanisms and also target women and women's sectors.

Along these lines, to ensure that the Measurement, Reporting and Verification (MRV) of mitigation actions is gender-sensitive, focal points responsible for MRV should receive training in gender mainstreaming and gender issues relating to climate change mitigation. This can be done in the form of an online training course, in-person capacity building workshops, and intra-departmental networks of focal points for climate change and gender. Additionally, for gender auditing purposes, more sex-disaggregated data needs to be collected and connected to climate change impacts and mitigation strategies.

Chapter 6: Level of Support Received for the FBUR

To assist the Republic of Macedonia in the preparation of its First Biennial Update Report (FBUR) for the fulfilment of the obligations under the United Nations Framework Convention on Climate Change (UNFCCC), the GEF provided a project grant of USD 321,461.

Between the period of September 2013 and December 2014, trainings have been hosted by various international organizations and regional consortiums. ECRAN has provided significant training sessions to improve Macedonia's national inventory development process. They have supported the country to include aviation into the EU emission trading scheme and to report on F-gases. They have also provided technical training on the LEAP software. The UNFCCC and UNDP have complemented these trainings by focusing on facilitating the BUR and NAMA processes as well as supported Macedonia to update policies. USAID has also provided a range of technical support on IPMVP, Geographic Information Systems and energy efficiency (ISO standards). Finally, during this period UNEP has shared expertise on how to benefit from CTCN services and WHO has provided several trainings linking climate and health.

With support from the UNDP Innovation Fund, UNDP is promoting innovation and the Skopje Green Route as an example of best practice to address climate change and transport.[52] The Skopje Green Route is an application which detects the most ecological and efficient movement trajectories through the city of Skopje. It also details CO_2 data for vehicles and possibilities for emission reduction. The application aims to bring together local authorities, the private sector (e.g., taxi companies) and citizens to work together to find the most efficient means of travel and to promote change to Macedonia's urban mobility culture. The application takes into account specific needs of drivers and promotes public health with bicycling and walking as zero-emission travel options. The ultimate aim is to enhance policy development and to create partnerships between communities, the private sector and local authorities. Thus far, the application has gained a vast user-base[53] and has been publicized in the EU for its success. The app was presented on the UN Climate Summit in New York 2014 – the biggest ever gathering of world leaders on climate change and was honoured as one of the top seven "projects to watch" in a global contest organized by the UN Global Pulse to harness big data to fight climate change. It was the top story on the EU Commission website and the REC website and has involved a vast array of diverse Stakeholders.

USAID is also supporting Macedonia to improve GHG emission reduction and to implement recommended actions proposed by Macedonia's TNC. Through the Milieukontact Macedonia project financed by USAID, 8 municipalities in the country have developed GHG inventories on the local level. The City of Skopje will also develop its GHG inventory next year through the support of UNDP.

Regional cooperation is continuously improving. In 2012, there were a series of coordinated activities performed with bilateral support from Republic of Bulgaria which informed stakeholders how to develop a roadmap for implementation of the Directive on Emissions Trading and EU decision for monitoring, reporting and verification (MRV). Macedonian good practices from BUR preparation were presented in Bosnia and Hercegovina (on MRV), with Serbia (on the GHG inventory preparation process). Regular cooperation and exchange of experience is also sustained with Montenegro and Albania.

In total, thanks to the support of international organizations and knowledge exchange with other countries, Macedonia has managed or is in the process of managing 422 climate change related projects since January 2005.[54] In order to analyse expenditure, the projects were lumped into 11 categories. The percentage of total projects in relevant sectors to the FBUR include: water resources (16.4%), waste (2.8%), agriculture (3.8%), energy (19.7%), forestry (0.2%), transport (4.7%) and health (1.2%). Total expenditure for these sectors is the following: water resources (EUR 70m), waste (EUR 3m), agriculture (EUR 16m), energy (EUR 80m), forestry (EUR 268k), transport (EUR 4.5m) and health (EUR 6m). Beneficiaries of most of these projects have been the municipal and local governments.

Of the 83 projects under the energy sector, the main goal of most projects has been the promotion of energy efficiency in: the residential sector, public institutions, SMEs, and with street lighting. Also, renewable energy sources usage (solar, wind, small hydro power plants, geothermal, biomass) is included in many projects. The other areas which are covered are climate change mitigation; sustainable energy; energy policy and administrative management. In the Waste sector there are 12 projects which refer to waste management; solid waste management; industrial waste management; biodegradable waste management; waste oil management; and recycling and collection

52 http://www.mobilityweek.eu/ http://www.rec.org/new.php?id=974

53 #SkopjeGreenRoute is the second most trending hashtag on twitter in Macedonia

54 UNFCCC, UNDP, Proaktiva.org, Skopje Oct 2014. ***Analysis of projects from the central area Climate Change 2005 – 2014 in the Republic of Macedonia***.

of waste. Sixteen projects are part of the agricultural sector for which a majority supports usage of renewable energy sources and energy efficiency. In the Transport sector a total of 20 projects have been or are being implemented related to sustainable urban transport; cycling; road infrastructure and railways.

Overall, the European Union and their programs provided the highest amount of donations or 34.4% of finances needed for project realization. The United Nations with their programs and organizations contributed 11.1% to the total financing, and the GEF contributed 9% to project financing.

The number of projects related to climate change is probably larger than was found in the analysis. Due to lack of budget information for most of the projects, it is not possible to summarize the cofinancing from Macedonia (cash or in-kind). This cofinancing is not negligible.

Overall, based on all 422 projects analysed, the following conclusions can be reached:

- Institution are more and more concerned about the dangers of climate change and climate change is on the top of the local and national government agenda.
- The total number of completed projects, directly or in directly connected to the fight against climate change is large enough.
- There is a variety of international sources for donations to address climate change.
- Cross-border projects are being implemented more and more often.
- The best results can be achieved only with cooperation amongst all stakeholders.

Case studies of projects with a municipality as a beneficiary demonstrate that in the future, local government, public institutions and organizations will have to pay more attention to energy efficiency; wider use of renewable energy; alternative transport; climate change adaptation and mitigation and similar activities. This is especially the case related to buildings and installations which are under their control. Additionally, local citizens should be stimulated through workshops, educational materials, application of incentives, etc.

Additional conclusions and recommendations include the following:

- There are sources for investment (other than own budgetary resources) such as donations and grants from national and international institutions, low interest loans etc. At the same time, it is necessary to have separate budgets for financing and co-financing climate change projects, which will provide more options to joint projects on local, national and cross-border levels.
- For the preparation and implementation of projects, organizations can find support and consultation at organizations and institutions that have been involved in previous projects.
- Better results for national-level implemented projects are especially important in the following sectors: Waste; Biodiversity; Forestry, Transport and Health, though other sectors should not be neglected – allowing previously completed projects to be replicated and upgraded.
- It's important to incorporate a model for investment of savings from previous projects, contributing to sustainability.
- Development of criteria to collect info on climate change projects implemented in the country and explore possibilities for establishment of system for regular collection of data related to climate finance (form international donors and budget allocations)
- Registration of projects, detail-oriented in a central database will improve the promotion of projects.
- Climate change should be described as a separate sector, considering its importance in the present and especially in the future.
- National cofinancing should be noted in the database of projects.
- The database should also include results (products) for better insight of the project's effects.

Chapter 7: Domestic Measurement Reporting and Verification Systems

To report on the progress of mitigation actions, Macedonia has begun developing a Measurement, Reporting and Verification (MRV) system. MRV of mitigation actions is an important management tool for Macedonia to track their progress in moving to a low-emission development path and in achieving sustainable development goals. Under new UNFCCC agreements an MRV system will be required for the first time for non-Annex I countries.

As an EU candidate state and a Contracting Party to the European Energy Community, Macedonia will need to report on all of its mitigation actions that reflect these commitments. Most relevant, these reporting requirements include savings from energy efficiency programmes, the share of renewable energy, and emissions levels from large industries/combustion plants. Macedonia has to report to the EU using common reporting format that the EU normally uses, which not only complies with UNFCC reporting standards, but goes in many instances much further than UNFCCC. These reporting requirements are already beyond the requirements of other non-Annex I countries.

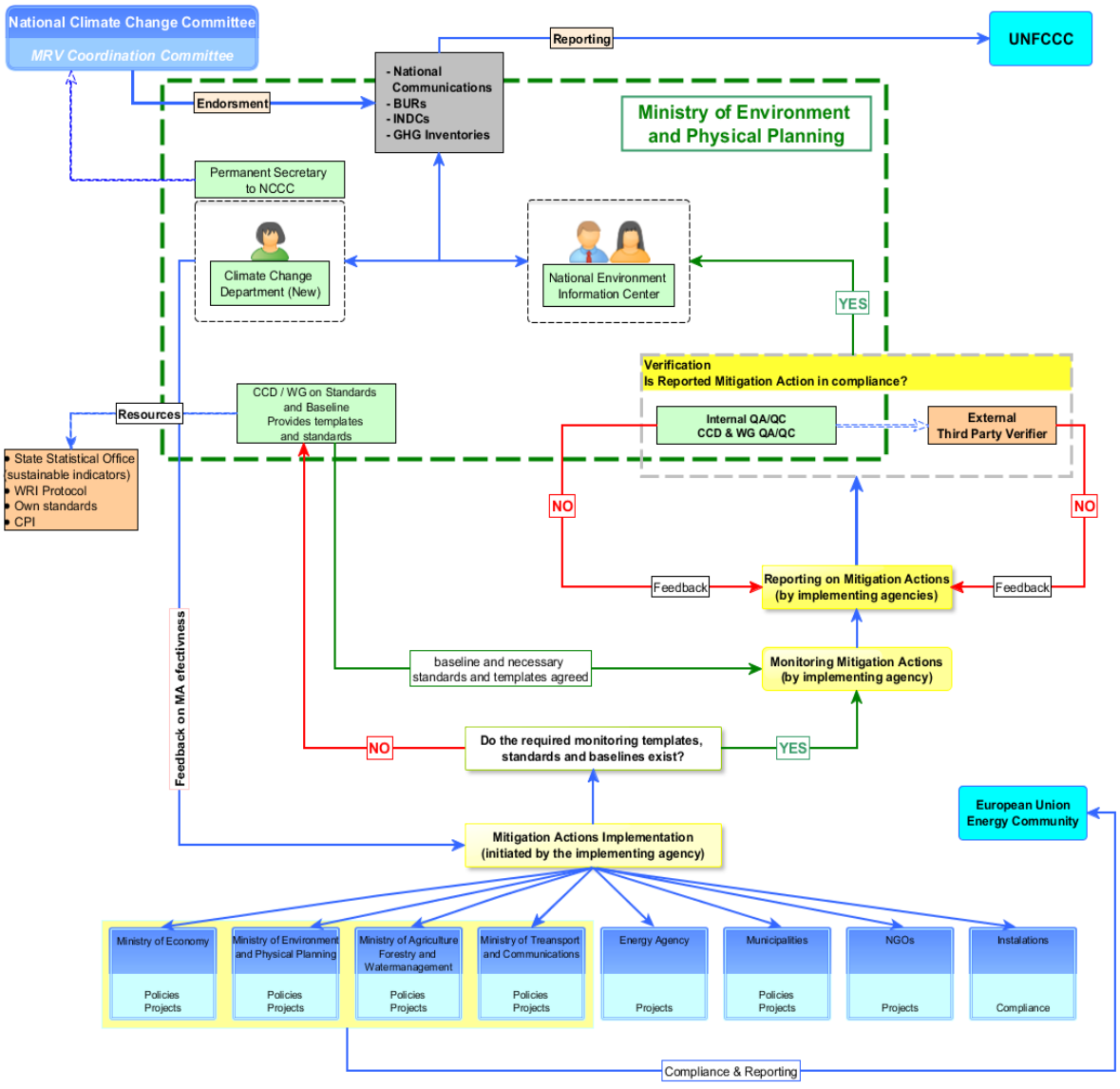


Figure 7-1: Proposed Institutional Arrangement and Processes for MRV for mitigation actions in Macedonia

The current institutional arrangement and process of developing the Greenhouse Gas Inventory is described in Figure 3-1. The proposed arrangement for MRV for Climate Change mitigation actions in Macedonia has been developed for first time in the country, as part of the requirements of the FBUR and is presented in the following figure.

Additionally, Macedonia has two sets of its own separate "in-house" indicators that could be used in developing a mitigation action MRV system in the country. First, the Ministry of Environment and Physical Planning developed a set of environmental indicators in 2012. Second, and probably more relevant, the State Statistical Office established sustainable development indicators in 2014.[55] Either of these sets of indicators could be adapted to include social inclusion and social development indicators by the State Statistical Office. These indicators are more or less general, measuring progress on macro level, and may not be usable to measure progress at smaller-scale mitigation action.

All such aforementioned indicators are more or less general, measuring progress on macro level, and may not be usable to measure progress at smaller-scale mitigation action. Therefore, as part of the preparation of the FBUR, the first potential comprehensive list of indicators proposed in the "Conceptual Framework and Pathway for Monitoring, Reporting and Verification (MRV) of Climate Change Mitigation Actions in Macedonia",[56] will enable the country to improve the current MRV system and be able to measure progress at smaller-scales (e.g., individual projects with disaggregated metrics). These indicators can be used for measuring non-GHG benefits of mitigation actions, specifically of NAMAs[57], but also to support sustainable development and to increase domestic political support for sectoral and economy-wide actions. Table 7-1 shows the list of measures included in the mitigation analysis of the BUR and how the indicators could be developed both in a quantitative and qualitative way.

55 http://www.stat.gov.mk/Publikacii/Odrzliv_Razvoj_2014.pdf

56 Kolar, S. and M. Dimovski, Nov. 2014. ***Conceptual Framework for Monitoring, Reporting and Verification (MRV) of Climate Change Mitigation Actions in Macedonia.***

57 Center for Clean Air Policy: „MRV of NAMAs: Guidance for Selecting Sustainable Development Indicators", October 2012, Washington, DC, USA

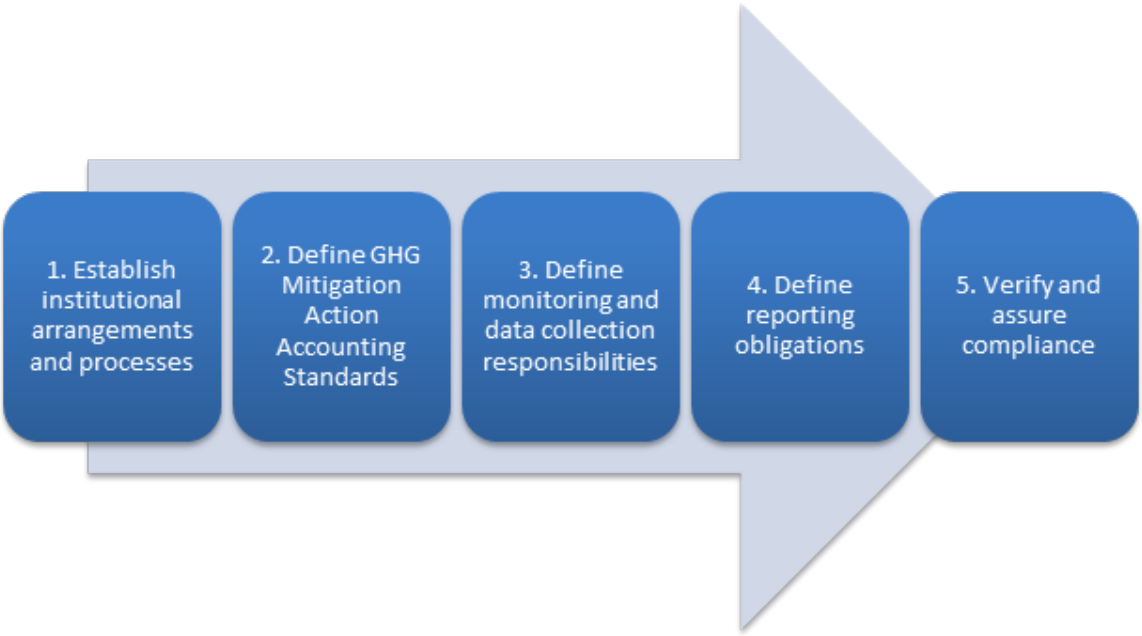
Table 7-1: Macedonian mitigation actions analysed as part of the BUR report and a potential template for MRV quality-indicators

GHG MRV Quality Indicators								
Mitigation Action	Metric*	Non-GHG Co-benefits	Transparency	Comparability	Reliability	Usefulness	Timeliness	Completeness
DEMAND SIDE			(example scoring)					
Buildings								
Rulebook on energy performance in buildings	Sectoral energy consumption	Action/ policy specific	1 very	2 fairly	3 some-what	4 not very	5 not at all	1 very
Retrofit measures	Sectoral energy consumption							
Labeling electric appliances	No. of appliances sold by efficiency label							
Information campaigns, EE info centres	No. of centres, No. of campaigns							
New buildings directive – nearly zero energy buildings	Sectoral energy consumption							
Energy efficiency directive – 3% yearly rate of public buildings retrofit	Sectoral energy consumption							
Energy certificates for buildings required when selling	Sectoral energy consumption							
Phase out of incandescent bulbs	Sectoral energy consumption							
Phase out of resistive heating	Sectoral energy consumption							
Transport								
Railway extension to Bulgaria	Project specific							
More bicycle and walking paths	Length of paths							
Increased use of railways	Person km, freight km by rail							
Fuel economy improvements by vehicle replacement	Old vehicles retired							
Renewal of vehicle fleet	Replacement rate							
Improvement fuel economy and no tax for registration of hybrid and electric cars	Penetration rate							
SUPPLY SIDE								
Electricity								
The National Renewable Energy Action Plan describing the policies and measures aiming to achieve RES target in 2020	RE share in energy consumption							
Feed in Tariffs	kWh RE electricity generated							
Large Combustion Plant Directive (LCPD) implementation	GHG emissions, conventional emissions							
Decreasing losses in distribution	GJ energy saved							
Market	Efficiency of generation, transmission , distribution							
CO_2 + market	GHG emissions							
More renewables	RE share in energy consumption							
Heat								
More heat pumps	Penetration rate, sectoral consumption							
More district heating	Penetration rate, sectoral consumption							
More solar collectors	Penetration rate, sectoral consumption							
Transport								
Bio fuels – voluntary	Penetration rate, sectoral consumption							
10% Bio fuels	Penetration rate, sectoral consumption							

* Specific metric may change depending on data availability

The pathway for establishing a MRV framework in Macedonia lies in taking the five broad steps. Each of the steps has been planned to facilitate mitigation prioritization, policy coherence and tracking of lessons learned. Some of the steps will be directly determined by results of further analysis. The five steps are:

Figure 7-2: Proposed pathway for establishing an enhanced MRV in Macedonia



7.1. Step 1: Establish Institutional Arrangements and Processes

As a first step, Macedonia is identifying institutional responsibilities for policymaking, data collection, data analysis, reporting, and quality control and quality assurance (QC&QA) in order to assure quality of data collection, monitoring of mitigation policy and action, and reporting. Institutions have been identified to i) design the overall climate change mitigation policy, ii) implement each mitigation policy / action, iii) developing accounting standards, iv) inform the respective policy maker about policy progress success and v) conduct QA / QC.

Although policy coordination and advisory roles exists within the Ministry of Environment and Physical Planning, the real **political responsibility** rests with the Office of the Prime Minister and the Macedonian government as a whole. There is no single Ministry that has overall coordination role for climate change mitigation policy, because such policy is being carried out by several ministries at once.

The proposed institutional arrangement for MRV of the mitigation actions is shown in Figure 7-1.

The main precondition of this institutional arrangement is the existence of appropriate legal regulation that will establish a) rights of institutions to require monitoring of and reporting on the policies and actions, and b) obligations of others institutions to provide such data and information. In this respect, in separate report within the FBUR specific recommendation for legal amendments of the Law on Environment are developed. However, as the MOEPP is planning to draft completely new legislation that will deal with climate change (the working title is the Law on Climate Action), it is strongly recommended that all MRV aspects be included in this law.

7.2. Step 2: Define GHG Mitigation Action Accounting Standards

As Step 2, Macedonia plans to refine its GHG Mitigation Action accounting standards. The country should develop its own unique mitigation action accounting standards for low impact policies alongside using World Resource Institute's (WRI's) Policy and Action Standard and its Mitigation Goals Standards[58] to monitor large impact actions. The use WRI standards will facilitate tracking changes over time of significant policies and measures with large impacts on GHGs such as energy policies. Such a system provides precise monitoring for "big ticket" items while giving the flexibility to monitor lower impact policies more flexibly and with lower costs.

58 Developed by the World Resources Institute

7.3.Step 3: Define Monitoring and Data Collection Responsibilities

As step 3, to maintain consistency in data quality, all implementing agencies of mitigation actions should develop standardized templates for tracking individual mitigation actions, policies, and projects. This will aid in defining clear monitoring and data collection responsibilities. At the same time, it will clarify roles for the multiple agencies and ministries who are simultaneously responsible for a particular mitigation policy or project. The templates and manuals should be developed by the Climate Change Department (CCD) of the MOEPP who is recommended to set up a special Working Group on Data Standards and Baselines. This Working Group will include as a minimum, representatives of the individual agencies and ministries responsible for monitoring their respective mitigation actions.

The following table presents the types of mitigation actions that are recommended to be monitored, and subsequently reported.

Table 7-2: General Mitigation Action Scope for Monitoring with an Enhanced MRV

Level of Action	Example
Target	National goal (such as reduction of GHG emissions compared to 1990)
Policy (also as NAMA)	Energy efficiency policy RES policy
Project (also as NAMA)	Feed-in-tariff scheme to install XX MW in renewable capacity
Corporate level	Emissions within boundary of a company
Facility level	Facility level emissions
Product level	Product level carbon footprint

7.4.Step 4: Establish Reporting Processes and Obligations

In Step 4, reporting of mitigation actions will involve using measurable, reportable and verifiable nationally appropriate mitigation commitments or actions, including quantified emissions limitation and reduction objectives. Such an approach will facilitate the comparability of efforts among countries reporting to the UNFCC.

Macedonia, as an EU candidate state and signatory of the UNFCCC, will report, at a minimum, the following types of information: i) policy or action, ii) GHG assessment boundary, iii) baseline emissions estimates, iv) GHG effects ex-ante, v) performance over time of GHG reductions and goals and vi) uncertainty.

In the context of the country's obligations to the UNFCCC, the Climate Change Department (CCD) in MOEPP will be responsible for standardizing all reporting. Additionally, the National Environment Information Centre will be responsible for managing and publishing the GHG inventory. The CCD will provide the agencies that are implementing mitigation policies and actions with the feedback information on the effectiveness of their mitigation. This two-way type of communication will provide more effective and more detailed feedback to the implementers.

7.5.Step 5: Ensure Verification, Data Analysis and Quality Assurance

Step 5 will be a verification process used to check that the information reported meets the requirements and that the methods and assumptions used are reasonable. Verification will be a cooperative, iterative process that provides feedback, allowing users to improve accounting practices. MOEPP will have the authority and responsibility to verify the GHG assessment results and to provide feedback to users.

To assist with data analysis, Macedonia is developing two types of verification / quality control (QC) processes: i) full third party verification of a few policy instruments with significant impacts on GHG emissions and ii) in-house Quality Control / Quality Assurance for lower impact

mitigation actions. MOEPP will be tasked with establishing accreditation standards for third party verifiers and developing criteria for domestic verifiers. "In-house" QA/QC is planned to be performed by the Climate Change Department using standard protocols and quality assurance guidelines (e.g., the WRI Policy and Action Standard).

Preconditions

As mentioned during the discussion on the institutional arrangements, for establishing an enhanced MRV framework a first precondition is that institution's roles must be formalized through the establishment of formal, legal agreements. Such agreements must mandate the appropriate institutions to fulfil monitoring and reporting activities.

A second precondition for the MRV process is that institutions must be provided with an online and systemized platform to facilitate monitoring for both the UNFCCC and the EU. The platform must be user-friendly with a clear instruction manual. Furthermore, the technical and financial capacities of required personnel for MRV must be continually reinforced to provide long-term stability to the monitoring, reporting and verification process for mitigation.

Macedonia is in the process of satisfying these preconditions in order to develop its enhanced MRV system. The first is expected to be addressed by amending the Law on the Environment. The second precondition is planned to be addressed by ensuring government budget lines and donors provide the necessary financing to support and target MRV development.

Chapter 8: Other relevant information

8.1. Mainstreaming Gender in Climate Change

The IPCC identifies gender as one of the socio-economic factors that influence "the capacity to adapt to changing environmental and economic conditions". Climate change impacts will affect women and men and members of differing socioeconomic and ethnic groups differently.[59]

Gender-based differences exist in the Republic of Macedonia in daily activities and household responsibilities, access to assets and credit, income, participation in decision making at the household level, and employment. The gendered factors and trends affect the ability of women and girls to respond to the impacts of climate change and to implement mitigation strategies. They also impact the ways in which women contribute to greenhouse gas emissions, in terms of types and amounts of consumption as well as purposes for consumption.

Overall findings on gender issues in Macedonia from the Gender and Climate Change in Macedonia Report compiled in 2014[60] include the following:

- There is a substantial gender gap in earnings and productivity. This affects the ability of women to make choices, invest resources and influence decisions.
- Women make up only 39.6% of the formal labour force. At the same time they contribute a substantial amount of unpaid family labour. Their work on- and off-farm tends to consist of manual labour-based activities, while male activities tend to be more supported by technologies and work in formal employment.
- Women and men in rural areas face challenges in accessing all levels of policy and decision-making processes. They are less represented as Mayors of municipalities and municipal administrations have 30% or less women representation. (However they are close to equally represented in civil services.) Their decision making power within the household is very low, particularly in rural areas. As a result they are less able to influence policies, programmes and decisions that impact their lives.
- Socio-cultural norms and the gender division of labour – which restrict women to the household to care for children and manage domestic tasks – limits women from acquiring information and interacting with institutions and services outside of the household.

8.1.1. Macedonia's gender equality policies

Gender and climate change was analysed for first time in the country as a part of the preparation of the BUR. This field of analysis is also new for the region since most of the similar analysis has been done in Africa, and the results are not comparable with European countries. Relative to other developing countries, Macedonia has made significant progress in advancing gender equality. Equality is mentioned in the Preamble of the Constitution of Macedonia. Article 9 states that citizens have equal rights and freedoms regardless of sex. Also, the National Strategy for Equality and Non-discrimination aims to improve the status of the most vulnerable groups in Macedonian society, and to promote equality and non-discrimination.

The National Strategy for Gender Equality 2013-2020 has furthermore been adopted in order to enhance equal opportunities for men and women in the period 2013-2020. The strategy is however not funded; it was decided to be executed with annual operational plans, which received criticism in the Committee on the Elimination of Discrimination against Women (CEDAW) 2013 recommendations. The fact that there is limited capacity to measure gender and environment in Macedonia has adversely impacted the implementation of this Strategy. Although the previous National Strategy for Gender Equality included gender and environment, due to limited capacity to deal with gender and environment, environment was removed in this 2013-2020 strategy. It is strongly recommended to include environment and climate change in the next strategy, or any revision of the existing one.

59 UNFCCC (2014); UNDP (2011); UNFCCC (2007)

60 Huyer, S. and M. Risteska (2014) ***Gender and Climate Change in Macedonia: Applying a Gender Lens to the Third National Communication on Climate Change*** http://www.unfccc.org.mk/content/Documents/Publications/GCC-Macedonia-pdf.pdf

The Law on Equal Opportunities for Women and Men (LEO), adopted in 2006, regulates the basic and specific measures for establishing equal opportunities between men and women in the country. The LEO aligns Macedonian legislation with the EU and regulates an institutional network which has been established to support the Law. It encompasses

- The Department on Equal Opportunities (DEO) that was established within the Ministry of Labour and Social Policy in March 2007;
- Gender Focal Points (GFP) in all line ministries and municipalities, also called Coordinators on Equal Opportunities ;
- The Parliamentary Commission on Equal Opportunities of Men and Women which is tasked with monitoring legal regulation proposed by the government and implementing the National Strategy for Gender Equality;
- Commissions on Equal Opportunities on Women and Men (EOC) within the local government units that develop and adopt local action plans on gender equality.

Additionally, the Republic of Macedonia started to promote the concept of Gender Responsive Budgeting (GRB) in 2008. Several pilot activities were implemented aimed at its application and raising the awareness among the relevant stakeholders on the importance and benefits of this concept. In accordance with Article 11 of the Law on Equal Opportunities for Women and Men: "The state administration bodies are obliged to incorporate the principle of equal opportunities for women and men within their strategic plans and budgets; to monitor the effect and impact of their programs on women and men and to report (this information) within their annual reports". Based on the lessons learned in this phase, the GRB initiative will be expanded to other central level institutions. Currently UNWomen is implementing a project on introducing GRB in local level government, in 10 case study municipalities[61].

In 2012 the Government of Republic of Macedonia adopted a Strategy of Gender Responsible Budgeting for 2012-2017 which included the state in global gender budgeting initiatives. This obliges the government to mainstream a gender perspective through creating and implementing policies and budgets which will take into consideration the different position of women and men and different obstacles they face. On the basis of the activities and measures included in the Strategy, the Ministry of Finance made some changes in a Budgetary Circular and obligated the Ministry of Labour and Social Policy, Employment Service Agency, Ministry of Agriculture and Water Management and Ministry of Health to develop gender indicators to measure results.

Finally, Macedonian law does not discriminate against women's access to or ownership of land, or the right to own property other than land. However, women experience limited opportunities to acquire and manage land and other forms of property because property is usually registered in the husband or a male relative's name.

8.1.2. Political representation of women in Macedonia

In Macedonia the representation of women in the national and local government systems is related to a change in the election law which introduced gender quotas (in 2002 and subsequent amendments). The implementation of the law led to a significant increase in the representation of women in these bodies overall – women represent 35% of Parliament members and 30% in these bodies overall.

Women in Macedonia play a significant role in climate change decision making at the national level. Climate change policy is developed by the Ministry of Environment and Physical Planning (MOEPP), which was until recently headed by a female State Secretary. The National Climate Change Committee (NCCC) is headed by a woman and has 32 members, of which 16 are men and 16 are women (50%). Macedonia fares well in this area in comparison with EU countries, with a 33.9% average of women in high-level positions relevant to climate change in the environmental sector.

61 The local component of the project "Promoting Gender Responsive Policies in South East Europe and the Republic of Moldova" (2013-2016) supported by the Austrian Development Agency and the Swiss Agency for Development and Cooperation, aims to replicate the central level interventions for gender mainstreaming policies and gender responsive budgeting with local governments. Ten pilot municipalities, will become case study municipalities for gender assessment of decentralization and budgeting processes at the local level, in order to identify entry points for gender mainstreaming within the decentralization, policy planning and budgeting processes.

8.1.3. Climate change and mainstreaming gender

In spite of a solid framework for gender equality, gender differences in work inside and outside of the home affect the ability of Macedonia women to mitigate the impacts of climate change. Women who work in the home have lower levels of resources to change behaviour or to deal with disasters when they arise. Also, women in Macedonia are limited in their means to take on new information (such as transfer technologies) and training for mitigation activities.

Based on the key areas identified in the Third National Communication on Climate Change (Ministry of Environment and Physical Planning, 2014), interviews with ministry personnel and the situational analysis of women and men in Macedonia in the previous section, critical impact points of climate change and leverage points for mitigation in the country are identified in the following sectors: Energy and Transportation, Agriculture, Water and irrigation, Disaster and Risk Reduction and Tourism

Important leverage points to ensure both women and men are reached by climate change-related information and participate in decision making include access to information and communication on climate change in all sectors, as well as participation in decision making bodies at local, national and regional levels.

8.1.4. Energy and transportation and gender

Due to earning lower salaries in general, single women and single-headed households will be less able to absorb increasing energy costs for heating, cooling and transportation. In Macedonia, a large proportion of women do not work outside of the home and will therefore depend on domestic heating – cost and type of fuel – to a greater extent. Covering such costs becomes difficult at times of climate extremes (flooding, heatwaves, cold periods).

Furthermore, as a result of transformation from a market economy and the need to update energy infrastructure, Macedonia experienced a major increase in energy prices, causing many households to switch to fuelwood. The use of fuelwood for heating and cooking purposes is usually fairly inefficient and not clean-burning, a result of the use of old stoves and scavenged wood materials.[62] As noted by the IEA, the use of inefficient wood stoves has a negative impact on the health of households using fuelwood. Women and children face the greatest disease burden from wood fuel use for these purposes because of the time spent in the household in general, and cooking duties in particular. Solid fuel use is most firmly associated with acute lower respiratory infections (including pneumonia) in young children, and chronic obstructive pulmonary disease and lung cancer in women (and to a lesser degree in men).[63]

Studies in Europe show that women tend to use public transport more than cars. Studies across the region show that men tend to own and use cars more than women. A close geographical example, in Romania, sees slightly less than 5% of single female households own a car compared to 16.5% of single male households.

Research on gendered transport use in Europe has found that women make shorter work trips, make greater use of public transport, make more trips for the purpose of serving others' needs and drive fewer miles per year than men. These findings are supported by existing data in Macedonia. While these mobility patterns of women lead to less intensive energy use, they can change as women enter the workforce in greater numbers and their salaries increase in relation to men's. These differences in transportation-based energy consumption need to be taken into account in developing and reaching energy reduction targets.

Targeting women to use public transport can potentially achieve great benefits since they are more receptive to public transport. Similarly, women in Macedonia may be more receptive to using cleaner public transport due to the environmental and health benefits.

Fortunately, women would be direct beneficiaries of the emission reduction recommendations outlined in the Third National Communication. Emission reduction recommendations include[64]:

- making homes more energy efficient;
- encouraging the use of more cleaner-burning wood fuel stoves;

62 Stojilovska (2013); IEA (2008)
63 Desai et al (2004)
64 MOEPP (2014)

- expanding the electricity grid;
- providing subsidies for fuel and clean energy sources.

All of these actions will benefit women as well as men, in reducing energy costs for heating and cooling. They will also improve air quality in communities. Providing subsidies for fuel will improve household finance. Due to rural women's increase vulnerability to household energy, subsidies and support for cleaner energy sources, such as solar, should target women specifically, at either the household or farm level.

8.1.5. Agriculture and gender

As discussed in the Third National Communication, some of the main climate change induced concerns for the agricultural sector include increasing temperatures and drought, and increased natural disasters such as flooding and excessive rainfall, resulting in reduced crop yields. With regards to women, farming is not normally a paid activity for them. Women tend to be responsible for the agricultural activities near the house, and for feeding and milking of livestock. Nonetheless, official statistics for Macedonia indicate that in 2012, women made up 40% of workers in agricultural enterprises.

Women's participation in agriculture in the country is also characterized by lack of land ownership, little input into agricultural decision making, and lack of control over their time and labour. According to the FAO,[65] approximately 16% of land in the country is owned by women.

Risteska et al (2012) have noted that limited agricultural education, extension and training has limited opportunities for women to (1) gain new technological knowledge in their areas of production, (2) occupy positions as agricultural researchers and extensions, and (3) express their needs for research, training, and other kinds of support, including technology, policy, and financing. Women in the Republic of Macedonia tend to have lower levels of access to technologies as well as to information and training about appropriate technologies and their use. As in other countries, women lack the same access to inputs, services and technology in agriculture as men, limiting their production as well as their ability to respond to stresses and shocks caused by climate change. This is exacerbated by the fact that women in rural areas tend to have primary education only.

Women's poor participation and limited role in decision-making in agriculture should be addressed because knowledge garnered from women could make a substantial contribution in addressing and managing harmful emissions generated by agriculture (such as by manure management). Similarly, considering their role on the family farm, it should be ensured that women farmers and members of farming households are trained in cultivation techniques of organic agriculture and soils with high humus content.

8.1.6. Progress of using tools to address gender issues relevant to climate change

A range of tools is proposed to address the gender dimensions of climate change in national and local level policy. Some are focused on gender equality and women's empowerment, and others, if used in tandem with gendered assessments, planning and monitoring, will achieve results which benefit women and men.

Policy tools and approaches which can be improved if implemented through a gender lens are:

- Participation of women in climate change decision making at all levels, from project level to municipal all the way to international. This has been implemented at the national level.
- Communications strategies which take into account and target different sectors of the population, according to sex, age, ethnicity, economic status, and geographic location. This has been introduced to a certain extent in the country.
- Climate financing instruments which incorporate both gender mainstreaming into existing mechanisms and also target women and women's sectors. These have not yet been introduced. Recommendations to support Macedonia to access the growing networks of private and public climate change financing include:
    - Use of a mixed system of market- and non-market mechanisms: Mitigation measures that take advantage of both market and non-market mechanisms will yield a range of high-impact gender equality benefits. Investments and financial

65 FAO (2014)

support should increase women's access to resources, enable both women and men to scale up their entrepreneurial activities and promote local and household infrastructure.

- Integrate gender-based priorities into private-sector regulations and policy frameworks: Mechanisms and processes need to be developed to ensure that gender-specific priorities and concerns are integrated into policies, programmes and incentive mechanisms that influence private-sector finance activities.
- Ensure that information and analysis for decision makers account for gender differences: Financing should be based on differentiated estimates (that incorporate the values, contributions and time spent by women and groups whose productive and reproductive activities are not reflected in traditional markets indicators), so that the livelihood costs and consequences are understood through a gender, age and ethnic lens.[66]
- Develop gender audits of financing projects, gender impact assessments, and progress towards the development of gender-sensitive climate change financing indicators.

Gender tools include:

- **Technology transfer:** approaches to assess the needs and uses of women and men relating to technology often differs, with preferences, priorities and access closely related to their different roles. Gender assessments of technology transfer and development are being developed by GenderInSITE – Gender in Science, innovation, technology and engineering – an international coalition addressing these issues in the context of climate change and sustainable development[67].
- **Gender-sensitive criteria and indicators:** Indicators for assessment, participation, progress monitoring and evaluation of results will need to be developed, and can build on existing work in agriculture and food security, environmental management, transport, energy and technology transfer. While sex-disaggregated data is collected in some sectors, it is not complete and needs to be more clearly connected to climate change impacts and mitigation strategies. Full list of needed sex-disaggregated data can be found in the full report on gender and climate change[68].

Internal government actions:

- Gender budgeting: gender analysis of applicable budget lines and financial instruments to determine the differentiated impact on women and men of the budget with subsequent reallocation of resources, if necessary. This process has been initiated as a pilot in selected national ministries. The next step would be to expand it throughout the federal level of government and into municipal levels.
- Gender focal points in Ministries should receive training on climate change while focal points on climate change should receive training in gender mainstreaming and gender issues relating to climate change mitigation. This can be done in the form of an online training course, in-person capacity building workshops, and intra-departmental networks of focal points for climate change and gender.

8.1.7. Macedonia's progress with gender indicators

In its 2010 gender budget analysis the Ministry of Labour and Social Protection noted that overall policy planning and implementation processes, strategies and analyses, as well as instruments for monitoring and evaluation, must not be gender neutral. They should include a gender breakdown of statistical data and data cross-referenced to various parameters, including gender analytical information that clarify statistical differences. It is also critical to implicate both men and women in policy-making and to promote gender-sensitive policy development. In this approach, statistical data should become a routine part of each governmental initiative.

Recommended indicators to measure gender trends and effects in climate change have been proposed in Macedonia for first time as part of this report. Such indicators would be disaggregated by sex and would allow programme planners and implementers to tailor their preven-

66 UNDP (2011)
67 See www.genderInsite.org
68 See www.klimatskipromeni.mk

tion and response strategies most effectively according to the socio-economic, physiological and resource characteristics of the vulnerable group. The comprehensive list can be found in the first "Gender and Climate Change in Macedonia" report, prepared within the FBUR project.

Gender-sensitive data already collected by the State Statistical Office include:

- Participation of women and men in climate-change related sectors of employment;
- Disciplines in which students have completed upper secondary education;
- Participation of women and men in agriculture;
- Users /recipients of energy subsidies;
- Proportion of women in climate change decision-making bodies at the national level; and
- Users of public transportation, by age and gender; access to public transportation by geographic location; car owners / drivers by gender.

Using such indicators and monitoring data, Macedonia is expected to close the gender data gap and improve knowledge on how to advance all members of society towards addressing climate change challenges. A detailed action plan was developed as part of the preparation of this BUR and is included in Annex 4. A number of the activities involve main-streaming gender considerations into existing plans and actions.

8.2.Public perceptions on climate change and awareness raising activities

8.2.1.Public perceptions on climate change

UNDP and the MOEPP conducted an online survey in November 2014 to gather information on the public perception and the public administration employees of climate change in order to provide insights to the FBUR. The survey aimed to identify key incentives for and challenges to environmental and climate conscious behaviour.

The online questionnaire was distributed through professional mailing lists and was promoted through social media, such as Facebook and Twitter. A total of 473 completed surveys were collected with participants from Skopje (66%) and 48 smaller municipalities. The sample included participants with an equal gender distribution, belonging to various age groups (45% belonged to the age group 25-39) and working for governmental institutions and the private sector.

Climate change was indicated to be the most serious threat to Macedonia, followed by poverty and lack of clean water. The principle reason why the participants want to take action to combat climate change is to be able to live in a healthy and clean environment.

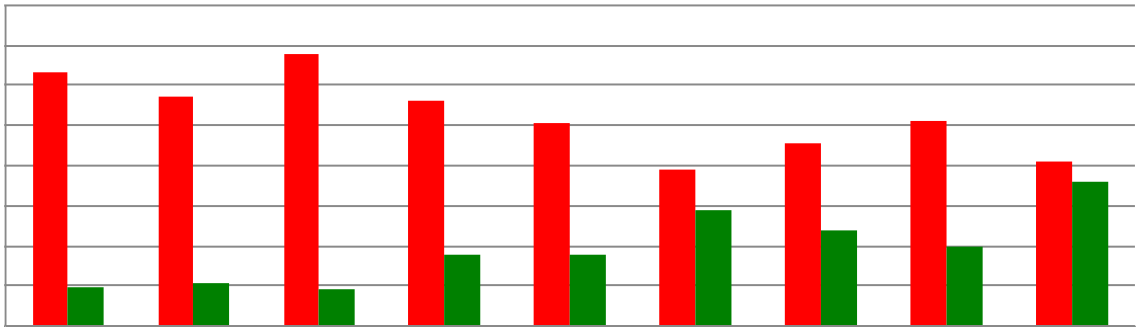


Figure 8-1: Responses as to the most and least serious threats to the society

Public administration respondents considered that environmental groups/NGOs, international organisations (such as UNDP and USAID) as well as the EU were doing enough related to climate change – at least to some extent. They believe the national Government and Regional Authorities have conducted the work only to some extent, and that neither corporations and industries, nor citizens do enough for climate change.

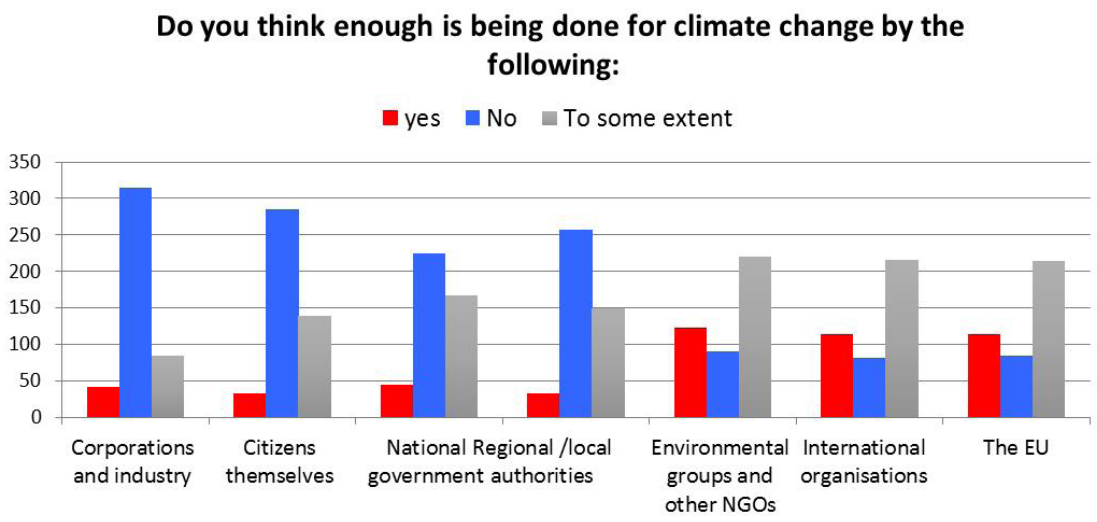


Figure 8-2: Different actors' engagement with climate change according to general respondents

Participants in the survey were also asked if they had noticed changes in the environment or climate in the past 10 years. The responses are outlined in Figure 8-3. It is noteworthy that well over 50% of participants had noticed changes in their environment.

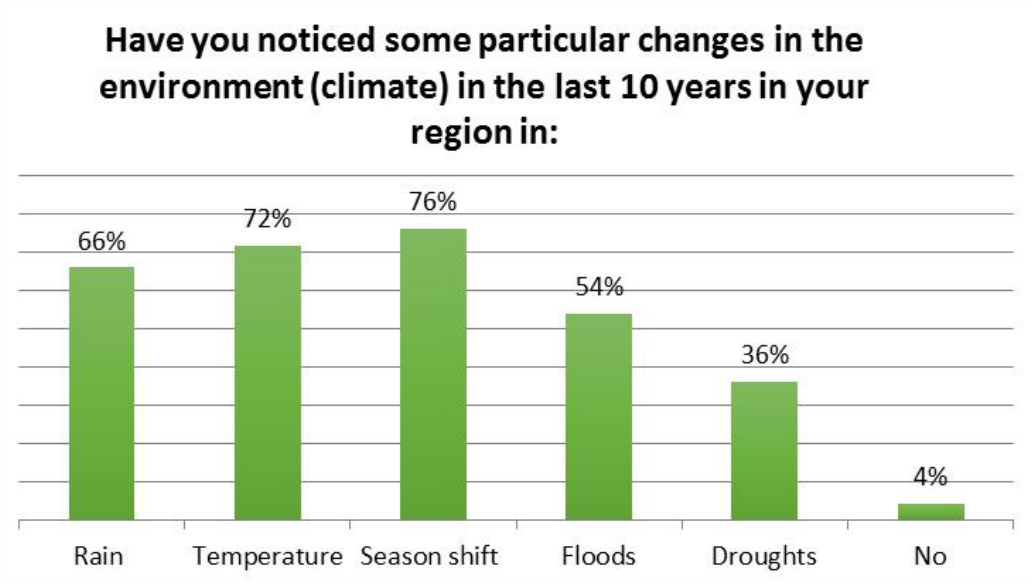


Figure 8-3: Environmental (climate) aspects in which participants noticed changes in past 10 years

Participants were also asked about their about more expensive energy coming from low carbon or renewable resources and their willingness to pay. It is noteworthy that 85% expressed a willingness to pay some additional amount for low emission sources.

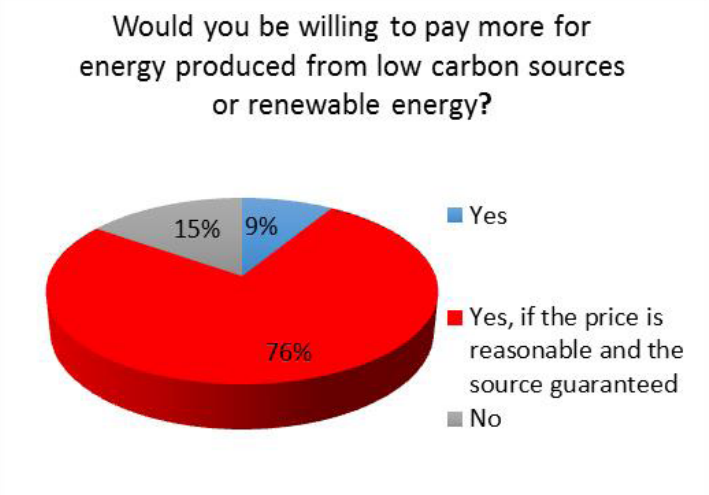


Figure 8-4: Payment for alternative energy resources

Possible barriers to environmental and climate friendly behaviour include that most of the participants consider that it is not their duty, rather the obligation of the Government, companies and industries to address climate change. Participants voiced concern that corporations and industries, as well as citizens themselves have made insufficient efforts. Unsatisfactory efforts by the public administration, particularly on the local and regional level were also perceived. In contrast, MOEPP was recognized by 70% of participants as a leading institution in conducting climate change related projects throughout Macedonia.

The principle media sources for information on climate change amongst participants include the internet followed closely by television (Figure 8-5). In spite of successful awareness campaigns on recycling and tree planting, almost 35% of participants reported that they do not know how to address climate change as they lack information and hesitate about what can be done to promote climate friendly practices. Between 21% and 42% of the participants are not aware of the causes, consequences and ways to mitigate climate change.

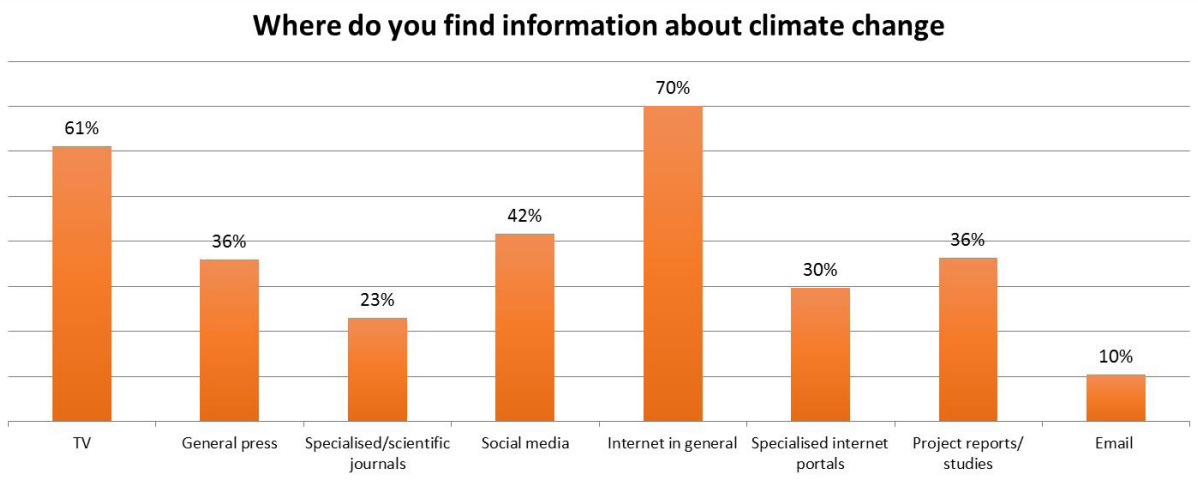


Figure 8-5: Responses on where participants find information about climate change

When making daily decisions, Macedonian are aware of efforts such as saving energy and water, using alternative transport modes, waste recycling and insulating a home to combat climate change. The participants are most willing to reduce energy (72%) and water consumption (60%) and use alternative transport modes (59%). Macedonians are less likely to make long-term decisions such as installing renewable energy equipment and purchasing fuel-efficient cars.

A comparative analysis of responses by survey participants in Skopje versus smaller urban or rural surroundings found that smaller areas are more likely to install renewable energy equipment and are more willing to pay higher prices for energy produced from low carbon sources or renewable energy. Also, analysis of the sub-group of the youngest participants, age 25 or less, demonstrated that they are the most worried about climate change.

The results of this survey will help in better designing and communicating future activities which aim to combat climate change. The surveys have indicated that special attention should be paid in designing climate change campaigns so that they are comprehensible and share useful information which instigates action. The ultimate goal in applying findings of this analysis is to promote climate change policies and enhance climate change governance in Macedonia.

8.2.2.Perceptions amongst public administrators on climate change

The survey also had a specific sub-group of 79 participants that work in governmental institutions and local administration. Climate change clearly stands out as the most serious threat for the society for the participants of this group (Figure 8-6).

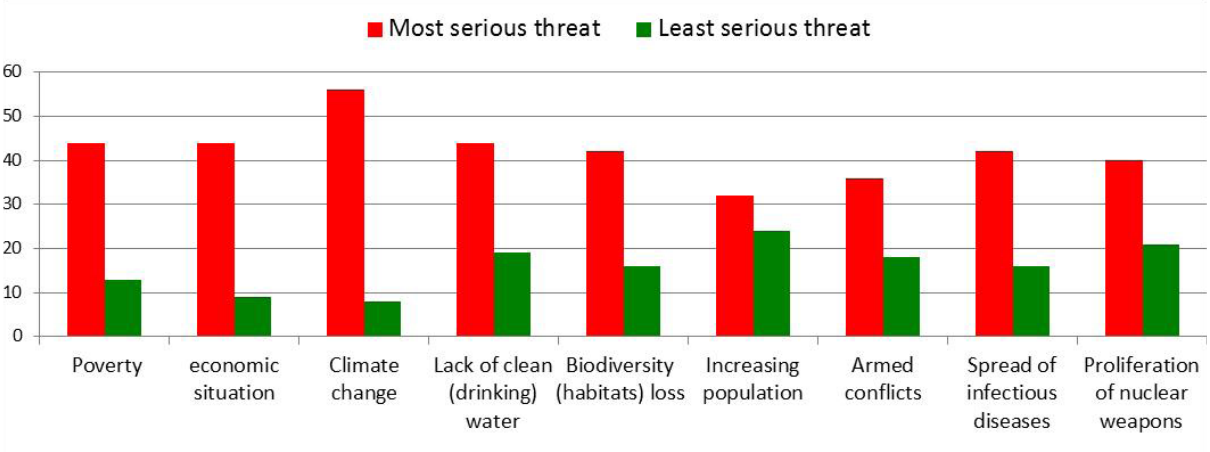


Figure 8-6: Most and least serious threats to the society according to Public Administration respondents

Public administration respondents considered that international organisations, such as UNDP and USAID as well as by the EU were doing enough related to climate change – at least to some extent. They believe that the national Government has conducted the work only to some extent, and that the regional and local authorities have done even less. Finally, this group considers that neither corporations and industries, nor citizens do enough for climate change.

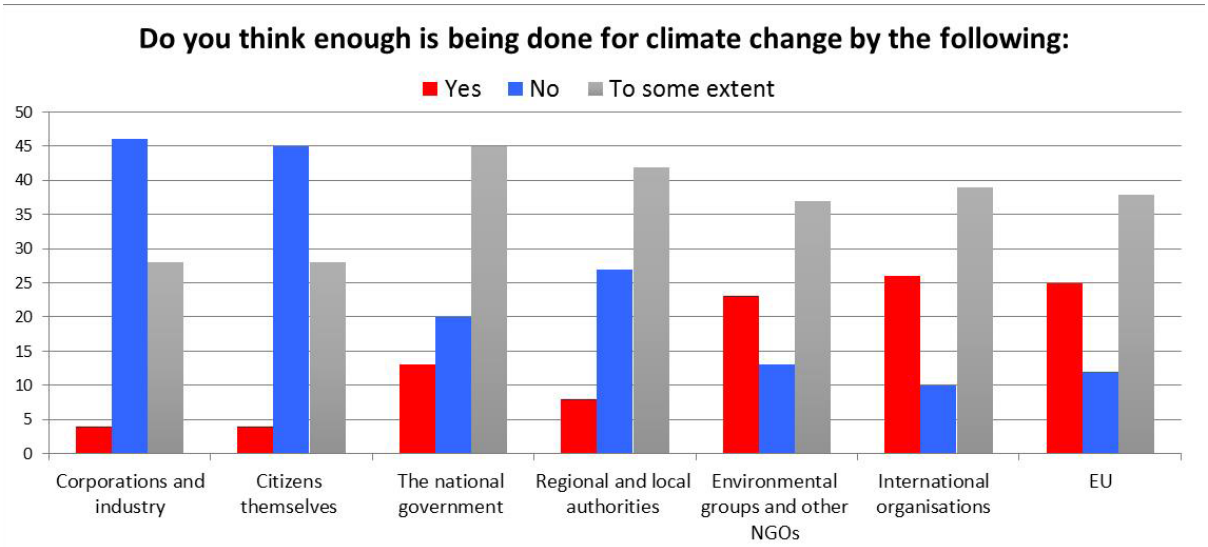


Figure 8-7: Different actors' engagement with climate change according to Public Administration respondents

A significant portion (84%) of the group think that they are informed, at least to some extent, about ways in which they may address climate change (Figure 8-8). Participants from this group are least informed about the adaption options.

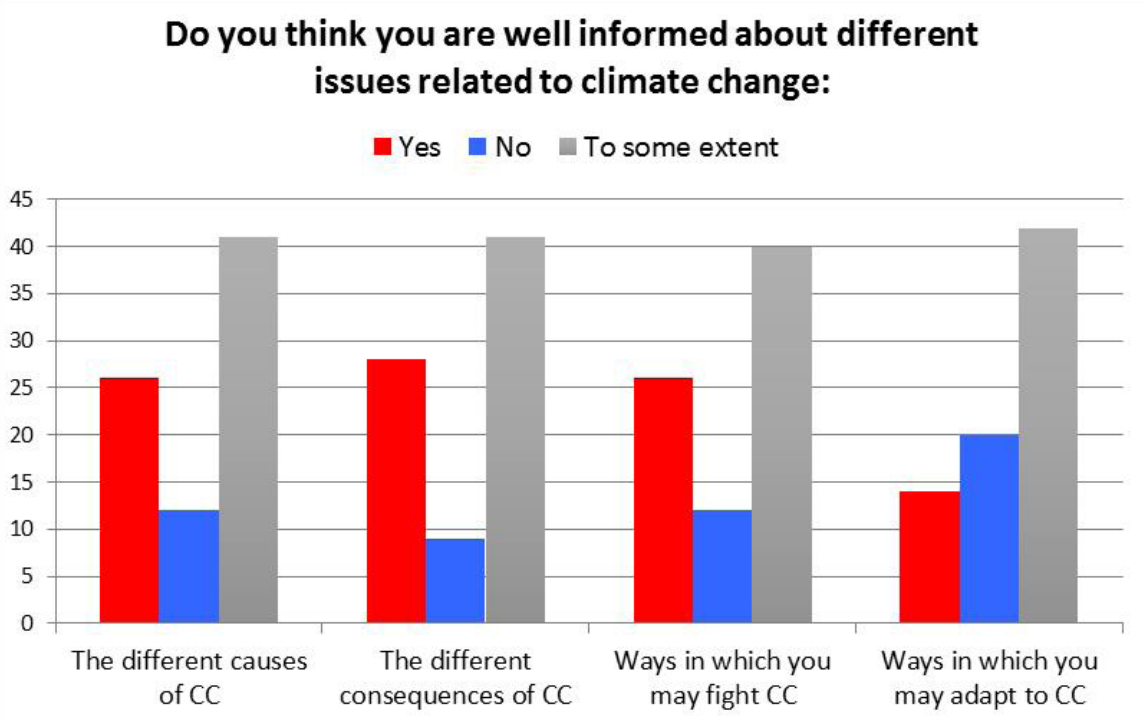


Figure 8-8: Familiarity with different climate change topics

This group uses traditional media, such as TV and general press, but also the Internet for searching for climate change related information (Figure 8-9). Project reports and even social media are also frequently used by this group.

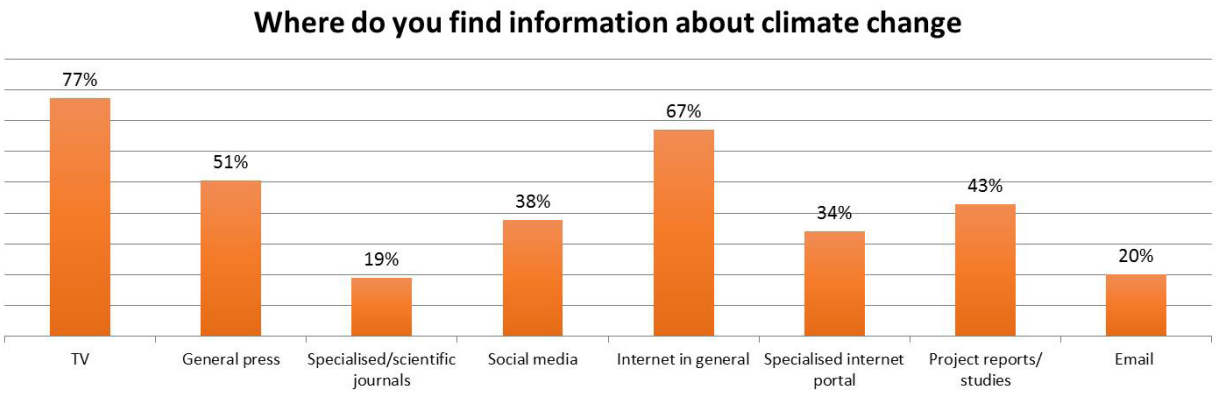


Figure 8-9: Responses on where public administration respondents find information about climate change

This group recognises the MOEPP and UNDP as the main institutions involved with climate change related projects (Figure 8-10).

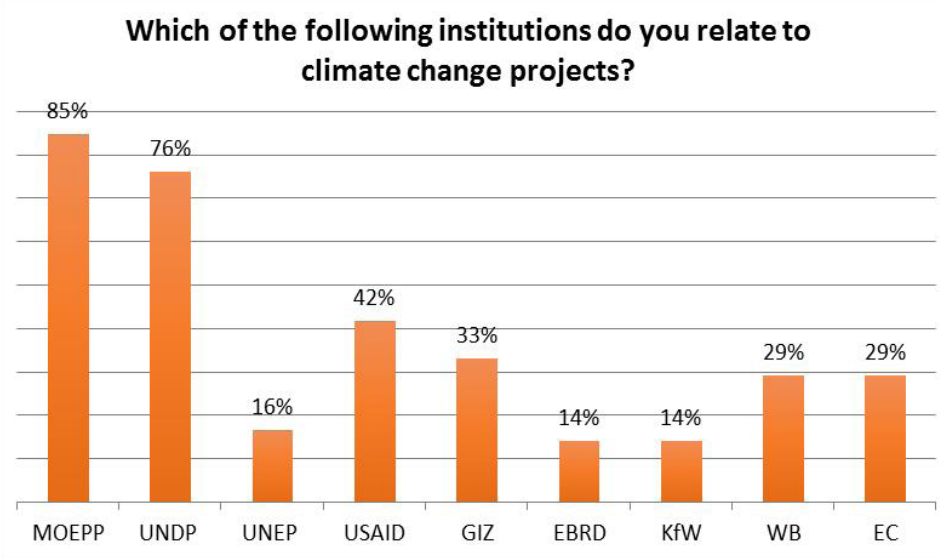


Figure 8-10: Responses from public administration respondents on which institutions are related to climate change projects.

8.2.3.Communications and awareness raising activities

As part of the preparation activities for the BUR, a number of additional communications and awareness raising activities have been carried out for the general public and stakeholders. These include:

- Update of the climate change glossary (it is on the www.klimatskipromeni.mk web site);
- Development of a climate change newsletter (the first should be sent early in 2015);
- Development of e-library for the MOEPP (an all areas covered by the MOEPP, not only climate change). The software has been developed and it is in process of being filled with data. It should be deployed and functional early in 2015;

- Public awareness activities by the Institute for public health and Red Cross on prevention of negative effects from cold weather and heat weaves to health of the population in the country (flyers). These targeted the general public, doctors, and workers;
- "Energy Efficiency days of the City of Skopje" organized by the City of Skopje with cooperation from GIZ on 24 – 27 November 2014. Based on the obligations deriving from signing the Covenant of Mayors initiative, the City of Skopje organized annual these energy efficiency days. Three main topics were highlighted in three main events: mobility, education and energy efficiency in buildings. These events targeted the city officials, the general public, and teachers.
- "The City of Skopje Signing of a Memorandum of Understanding with the Network of Capital Cities of South East Europe" organized by GIZ in June 2014. The signing involved the planning of a new phase of mutual implementation of projects with the cities of Skopje, Zagreb, Sarajevo, Podgorica, Tirana and Freiburg. The cooperation will be based on sharing experiences in implementation of Sustainable Energy Action Plans in the capitals based on country specific needs.
- The development of a "Climate Change Challenge" (www.odtebezavisi.mk) which involves competition for citizens who have an innovative idea for addressing climate change issues (open till the end of February 2015). The process will support the development of ideas into a prototype which can then get additional technical assistance and pitch their ideas. The two ideas with the greatest potential will receive grants of USD 10,000.

Annex 1:

Mitigation actions considered, planned and underway in the Republic of Macedonia

Based on mitigation analyses conducted under the First Biennial Update Report, the Third National Communication on Climate Change and the Second National Energy Efficiency Action Plan

Note: Data marked with XX in the tables are related to measures that were taken into consideration without detailed analyses or there's no such information. These analyses can be performed in future, that will enable filling the missing data.

Mitigation actions in the energy sector – energy supply

Mitigation action 1: Expansion of large hydropower production

Mitigation Action: Expansion of large hydropower production	
Description: Construction and commissioning of large hydro-power resources to reduce dependence upon coal-fired power plants for electricity.	
Sector	Electric power
Gases	CO_2
Indicators	• Increase in MW capacity supplied by large hydropower • Increase in GWh produced by large hydropower per year • kt CO_2-eq reduced by large hydropower per year
Projections	• 109.2 MW by 2032 • 833.3 MW of capacity by 2050 • 300 GWh increase in production per year by 2032 • 1,800 GWh increase in production per year by 2050
Methodology	Building hydropower plants as follows: Until 2032: • HPP Sv. Petka – 36 MW • HPP Boshkov Most – 68.2 MW • Hydro project - Lukovo Pole (storage) + HPP Crn Kamen – 5 MW Between 2032 and 2050: • HPP Galishte – 193.5 MW • HPP Gradec – 54.6 MW • HPP Demir Kapija – 24 MW • HPP Gevgelija – 17 MW • HPP Babuna – 17 MW • HPP Gradsko – 17 MW • HPP Kukuricani – 17 MW • HPP Krivolak – 17 MW • HPP Dubrovo – 17 MW • HPP Militkovo – 17 MW • HPP Chebren – 333 MW
Assumptions	Investments in building new large-scale hydro power plants will provide stability in energy supply
Steps Taken	HPP Sv. Petka has completed construction and was put on the grid in 2012
Steps Envisaged	Planning, investment, and commissioning of hydro power plants
Results Achieved / Progress	• 36 MW capacity increase • 61 GWh produced per year

Mitigation action 2: Reconstruction of large existing hydropower production plants

Mitigation Action: Reconstruction of large existing hydropower production plants	
Description: Reconstruction and commissioning of large hydro-power resources to reduce dependence upon coal-fired power plants for electricity.	
Sector	Electric power
Gases	CO_2
Indicators	• Increase in MW capacity supplied by large hydropower • Increase in GWh produced by large hydropower per year • kt CO_2-eq reduced by large hydropower per year
Projections	• 18.3 MW by 2015 • 58.3 MW by 2020 • 50 GWh increase in production per year by 2015 • 80 GWh increase in production per year by 2020
Methodology	Reconstruction of hydropower plants as follows: • Hydro system Mavrovo (HPP Vrutok, HPP Raven, HPP Vrben) – 18.3 MW • HPP Shpilje – 40 MW • HPP Globochica • HPP Tikves
Assumptions	Investments in building new large-scale hydro power plants will provide stability in energy supply
Steps Taken	Hydro system Mavrovo (HPP Vrutok, HPP Raven, HPP Vrben)
Steps Envisaged	HPP Shpilje investments and reconstruction
Results Achieved / Progress	18.3 MW capacity increase 50 GWh produced per year

Mitigation action 3: Expansion of small hydropower energy production

Mitigation Action: Expansion of small hydropower energy production	
Description: Construction and commissioning of small hydro-power resources to reduce dependence upon coal-fired power plants for electricity.	
Sector	Electric power
Gases	CO_2
Indicators	• Increase in MW capacity supplied by small hydropower • Increase in GWh produced by small hydropower per year • kt CO_2-eq reduced by small hydropower per year
Projections	• 142 MW by 2032 • 200 MW of capacity by 2050 • 356 GWh increase in production per year by 2032 • 427 GWh increase in production per year by 2050
Methodology	Installation of small hydropower plants
Assumptions	Investments in building small hydropower plants will provide stability in energy supply
Steps Taken	66 concession agreements to design-build SHPPs were concluded with investment value of EUR 110 million.

Mitigation action 4: New thermal power plants powered by natural gas instead of coal

Mitigation Action: Investment in thermal power plants powered by natural gas instead of coal	
Description: Construction and commissioning of large thermal power plants powered by natural gas to reduce dependence upon coal-fired power plants for electricity.	
Sector	Electric power
Gases	CO_2
Indicators	• Increase in MW capacity supplied by gas • Increase in GWh produced by gas per year • kt CO_2-eq reduced by gas per year
Projections	• 700 MW by 2032 • 990 MW of capacity by 2050
Methodology	Investment in new gas pipeline Building gas powered plants • CHP Skopje 230 MW; • CC gas (200-300 MW).

Mitigation action 5: Expansion of wind energy production

Mitigation Action: Expansion of wind energy production	
Description: Construction and commissioning of wind power plants to reduce dependence upon coal-fired power plants for electricity.	
Sector	Electric power
Gases	CO_2
Indicators	• Increase in MW capacity supplied by wind power • Increase in GWh produced per year • kt CO_2-eq reduced per year
Projections	• Capacity increase of 360 MW by 2032 • Capacity increase of 360 MW by 2050 • 720 in GWh produced per year in 2032 • 720 in GWh produced per year in 2050
Methodology	• Installation of wind turbines • Wind power plants subsidized by feed-in tariffs
Assumptions	Feed-in tariffs sufficient to stimulate investment. Wind power can be integrated to address demand load.
Steps Taken	• Feed-in tariff established for wind power • Macedonia's state-owned power utility company ELEM started construction of the country's first wind farm (EUR 55 million) in 2013 in Bogdanci.
Steps Envisaged	
Results Achieved / Progress	• Wind farm of 36.8 MW • Around 100 GWh of electricity generation per year expected[1]
Emissions Reduction	66,177 tonnes/year[2]
International Market Mechanisms:	The Bogdanci wind farm is a CDM registered project: Project 8202

Mitigation action 6: Expansion of solar PV generation

Mitigation Action: Expansion of solar PV generation	
Description: Construction and commissioning of PV generation to reduce dependence upon coal-fired power plants for electricity.	
Sector	Electric power
Gases	CO_2
Indicators	• Increase in MW capacity supplied by solar PV power • Increase in GWh produced per year • kt CO_2-eq reduced per year
Projections	• Capacity increase of 21 MW by 2032 • Capacity increase of 25 MW by 2050 • 29 GWh produced per year in 2032 • 35 GWh produced per year in 2050
Methodology	• Installation of Solar PV panels • Solar power plants subsidized by feed-in tariffs
Assumptions	Feed-in tariffs sufficient to stimulate investment. Solar power can be integrated to address demand load.
Steps Taken	Feed-in tariff established for solar power

Mitigation action 7: Expansion of biomass electricity/heat generation capacity

Mitigation Action: Expansion of biomass electricity/heat generation capacity	
Description: Construction and commissioning of biomass co-generation plants to reduce dependence upon coal-fired power plants for electricity and heat.	
Sector	Electric power and heat
Gases	CO_2
Indicators	• Increase in MW capacity supplied by biomass • Increase in GWh produced per year
Projections	• Capacity increase of 12.5 MW by 2032 • Capacity increase of 15 MW by 2050 • 40 GWh_{el} produced per year by 2032 • 50 GWh_{el} produced per year by 2050 • 90 GWh_{th} produced per year by 2032 • 105 GWh_{th} produced per year by 2050
Methodology	• Installation of biomass facilities for energy production • Biomass power plants subsidized by feed-in tariffs
Assumptions	• Feed-in tariffs sufficient to stimulate investment. • Biomass heat can be integrated to address demand.
Steps Taken	Feed-in tariff established for biomass power

Mitigation action 8: Introduction of CO_2 tax and electricity import (market)

Mitigation Action: Introduction of CO_2 tax and electricity import (market)	
Description: Introduction of a CO_2 tax for power production – resulting in an increase in electricity imports.	
Sector	Electric power
Gases	CO_2
Indicators	• MWh per year import of electricity displacing coal-fired power • kt CO_2-eq reduced per year
Projections	• 1,370 kt CO_2-eq reduced per year in 2020 • 2,358 kt CO_2-eq reduced per year in 2030
Methodology	• Introduction of a tax on CO_2 emissions from fossil-fuel fired power plants resulting in a decreased supply from some sources and an increased import of electricity
Assumptions	• The CO2 tax 20 €/t in 2020, 25 €/t in 2025, and 30 €/t in 2030. • Domestic coal power plants still operate and they are competitive on the market, and the commissioning of new power plants is postponed for two to three years. • When there is not sufficient production of electricity by the domestic coal power plants it is supplemented by imported electricity or by domestic natural gas power plants, which are even more competitive than the coal power plants given the carbon prices.

Mitigation action 9: Reduction in electricity distribution losses

Mitigation Action: Reduction in electricity distribution losses	
Description: Improvement of the electricity grid to result in a reduction of distribution losses	
Sector	Electric power
Gases	CO_2
Indicators	• Overall reduction in % of electricity distribution losses • GWh per year losses reduced • kt CO_2-eq reduced per year
Projections	• Reduction in electricity distribution losses from 17% to 11% • 470 GWh losses reduced per year by 2020 • 740 GWh losses reduced per year by 2030 • 146 Kt CO_2-eq reduced per year in 2020 • 401 Kt CO_2-eq reduced per year in 2030
Methodology	• Reconstruction and construction of new distribution networks
Assumptions	• Investments in reducing electricity distribution losses will not be off-set by increased peaks in demand.
Steps Taken	The supplier of electricity (EVN Group) from April 2006 until 31 December 2011 has invested more than EUR 150 million constructing and modernizing more than 2,000 km of the electricity grid and 1000 transformer stations.

Mitigation action 10: Improvement of the heating distribution network in Skopje

Mitigation Action: Improvement of the heating distribution network in Skopje	
Description: Improvement of the heating distribution network of the district heating grid in Skopje – including installation of new/replacement of old equipment in measuring thermal sub-stations, installation of modern regulation and monitoring equipment at thermal sub-stations, and reconstruction of 1-2% per year of the distribution network.	
Sector	Energy – heating
Gases	CO_2
Indicators	• GWh per year losses reduced
Projections	• XX in GWh losses reduced per year in 2020
Methodology	• Installation of new / replacement of old equipment in measuring thermal sub-stations, as well as maintenance and verification of measuring equipment for achieving higher accuracy of thermal energy measurement; • Installation of modern regulation and monitoring equipment at thermal sub-stations, for the control and reduction of consumed thermal energy, which provides lower temperatures of heat carrier in the distribution system; • Reconstruction of 1-2% per year of the distribution network
Assumptions	Assumes sufficient heating tariffs to justify investments
Results Achieved / Progress	• Expected reduction of energy consumption in 2013 was 0.9% of the total produced heat and electricity used.

Mitigation actions in the energy sector – buildings sector

Mitigation action 11: Public awareness campaigns, EE info centres

Mitigation Action: Public awareness campaigns, EE info centres	
Description: Introduction of awareness raising campaigns and opening of energy efficiency info centres, in order to increase the awareness and to inform the citizens of possibilities to improve EE and of related benefits. The target group will be the residential and commercial buildings sector.	
Sector	Energy – buildings
Gases	CO_2
Methodology	• Awareness raising campaigns with videos and printed materials which will make EE information more available to the citizens • Info centres will employ energy advisors to give free of charge advice to citizens concerning possibilities of saving energy and related financial benefits.
Assumptions	• Assumes popular interest in EE measures.
Steps Taken	• Info Centre for Energy of the City of Skopje established • EVN established a Customer Relations Centre • Info Centre for Energy of the Republic of Macedonia established • Preparation and broadcasting of a documentary film under the GEF Sustainable Energy Project

Mitigation action 12: Introduction of end-use heat metering and consumption-based billing in Skopje's District Heating network

Mitigation Action: Introduction of end-use heat metering and consumption-based billing in Skopje's District Heating network	
Description: Introduction of end-use heat metering at the building and dwelling-level and consumption-based billing in Skopje's District Heating network. Energy bills should be clear and understandable (electricity, heat and natural gas) and individual metering implemented. This will increase consumer awareness of the way in which they themselves consume energy. Invoices should contain a graphical comparison of consumption in period accounts for this year and for the corresponding period last year. Accounts should be based on actual consumption. Accounts should also contain information on where to obtain advice on the efficient consumption of energy, and a toll-free line should be set up.	
Sector	Energy – Residential sector buildings
Gases	CO_2
Indicators	• Number of buildings with meters and consumption-based buildings/ Number of buildings on the network • Number of dwellings with meters and consumption-based buildings/ Number of dwellings on the network • GWh reduced per year for District Heating • kt CO_2-eq reduced per year
Projections	• XX buildings with meters and consumption-based buildings out of XX buildings • XX of dwellings with meters and consumption-based buildings out of 50,000 customers • 4.53 GWh reduced per year for District Heating by 2018 • XX kt CO_2-eq reduced per year
Methodology	• Installation of meters at the sub-station and/or building level • Installation of heat meters/ calorimeters at the dwelling level • Measurement of end-use of heat and efficiencies of heat usage
Assumptions	• Assumes reduction in actual consumption based on consumption-based billing
Steps Taken	• 100% of buildings on the DH system have building-level meters
Steps Envisaged	• Energy Regulatory Commission to amend the Rules for delivery of thermal energy to encourage installation of heat allocators • Public promotion to raise awareness and inform users • Provide technical assistance and advice to users • Ensure proper maintenance services of equipment.

Mitigation action 13: Building codes and enforcement/certification for new buildings and those undergoing major renovation

Mitigation Action: Building codes and enforcement/certification for new buildings and those undergoing major renovation	
Description: Implementation of building code enforcement for new buildings and those undergoing major renovations with area > 1000 m2– including requirements for level of kWh consumption per m^2. This also involves the implementation of the Rulebook on Energy Performance of Buildings	
Sector	Energy – Residential sector buildings
Gases	CO_2
Indicators	• m^2 of "A" certification level new buildings built or undergoing major renovation • kWh/m^2 reduction of energy demand in new buildings/buildings undergoing major renovation • GWh per year reduced per fuel type • kt CO_2-eq reduced per year
Projections	• XX m^2 of buildings achieving "A" certification level • XX kWh/m^2 reduction of energy demand over the baseline of XX kWh/m^2 • XX GWh per year reduced per fuel type • 833 Kt CO_2-eq reduced per year by 2020 • 2,343 Kt CO_2-eq reduced per year by 2030
Methodology	• Advanced solutions for building envelope • Installation of solar hot water systems • Replacement of firewood furnaces and coal furnaces with high efficiency models • Installation of air-sourced heat pumps • Installation of ground-sourced heat pumps
Assumptions	• Assumes support for these measures via public awareness and investment mechanisms. • Assumes that citizens, will invest in more advanced technologies/appliances (more efficient ones).
Steps Taken	The Rulebook on Energy Performance of Buildings and Rulebook on Energy Audits (in the buildings sector and in the industry sector) were prepared and adopted
Results Achieved / Progress	• 24.65 GWh saved in 2012

Mitigation action 14: Inspections of boilers/air conditioning systems

Mitigation Action: Inspections of boilers/air conditioning systems	
Description: Increased efficiency of boilers with effective rated output bigger than 20 kW and air conditioning systems in buildings with effective rated output bigger than 12 kW.	
Sector	Energy – Residential sector buildings
Gases	CO_2
Indicators	• Number of inspections carried out per year • GWh demand reduced per year
Projections	• XX inspections carried out per year • XX GWh of electricity demand reduced per year in 2020 • XX GWh of electricity demand reduced per year in 2030
Methodology	The Ministry of Economy and/or EARM would prepare guidelines for the order of control that should realize energy auditor during the inspection of boilers for hot water systems and air conditioners. Before implementing this measure, the following preconditions have to be meet: • Training and authorization of energy auditors and • Maintain evidence of completed inspections. The measure would be mandatory for new and existing heating systems. The auditing would be coupled with advising.
Assumptions	• Assumes support for these measures via public awareness and investment mechanisms. • Assumes that citizens, will invest in more advanced technologies/appliances (more efficient ones).
Steps Taken	Regular inspections is prescribed by the Rulebook on Energy Performance of Buildings
Results Achieved / Progress	• 0.70 GWh savings in 2012

Mitigation action 15: Retrofits in existing residential buildings/ Demand-side measures for energy efficiency for heating/cooling in existing buildings in the residential sector

Mitigation Action: Retrofits in existing residential buildings/ Demand-side measures for energy efficiency for heating/cooling in existing buildings in the residential sector	
Description: This action involves the retrofitting of residential buildings to reduce energy demand for heating and cooling.	
Sector	Energy – Residential sector buildings
Gases	CO_2
Indicators	• m^2 of buildings/dwellings implementing demand side measures • GWh per year reduced per fuel type • kt CO_2-eq reduced per year
Projections	• XX m^2 of buildings/dwellings implementing demand side measures • XX GWh per year reduced per fuel type • XX kt CO_2-eq reduced per year

Methodology	• Energy Efficiency in Social Housing
	• Information centres; Information campaigns on energy efficiency;
	• Financial support to natural persons for EE investments;
	• EE measures in existing multi-apartment residential buildings:
	  ○ Window and door replacement
	  ○ Attics insulation
	  ○ Façade insulation
	• Introduction of efficient lighting in residential apartments and common space

Assumptions	• Assumes sufficient financial mechanisms developed to encourage demand-side EE in households.
Steps Taken	A number of projects have been undertaken in this area including addressing EE in multi-apartment buildings.
Steps Envisaged	
Results Achieved / Progress	• 24.07 GWh savings in 2012

Mitigation action 16: Electrical appliance and equipment labelling, and energy performance standards

Mitigation Action: Electrical appliance and equipment labelling, and energy performance standards	
Description: Introduction of energy performance minimum standards for electrical appliances as well as labelling requirements for energy performance.	
Sector	Energy – Residential and commercial buildings
Gases	CO_2
Indicators	• Market share (% and total number) of higher class efficient appliances • GWh electricity demand reduced per year in 2020 • GWh electricity demand reduced per year in 2030 • kt CO_2-eq reduced per year in 2020 • kt CO_2-eq reduced per year in 2020
Projections	• 50% of higher class efficient appliances replacing inefficient appliances in the residential sector by 2030 • 30% higher class hot water and lighting appliances in the commercial sector by 2030 • 20% higher class heating and cooling appliances in the commercial sector by 2030 • 34 GWh of electricity demand reduced per year in 2020 • 220 GWh of electricity demand reduced per year in 2030 • 21 kt CO_2-eq reduced per year in 2020 • 142 kt CO_2-eq reduced per year in 2030
Methodology	• Labelling of electrical appliances • Minimum energy performance standards for electrical appliance
Assumptions	• Assumes purchasing power of households is sufficient to purchase appliances.
Steps Taken	The Rulebook on labelling and standard product information of the consumption of energy and other resources by energy-related products was adopted in 2011, and it was amended in 2012.[3] The implementation of this Rulebook gives an opportunity to the consumers to choose more energy efficient appliances

Mitigation action 17: Phasing out of incandescent light bulbs

Mitigation Action: Phasing out of incandescent light bulbs	
Description: This action would involve the ban of production, import and sales of incandescent lights	
Sector	Energy – Residential sector buildings
Gases	CO_2
Indicators	• Market share (% and total number) of LED, CFL, and other efficient bulbs • GWh electricity demand reduced per year • kt CO_2-eq reduced per year
Projections	• 100% of market share of LED, CFL and other efficient bulbs starting from 2016 • 170 GWh of electricity demand reduced per year in 2020 • 206 GWh of electricity demand reduced per year in 2030 • 66 kt CO_2-eq reduced per year in 2020 • 153 kt CO_2-eq reduced per year in 2030
Methodology	• Ban on incandescent lights with a short phasing out period
Assumptions	• Assumed that as of 2016 the Republic of Macedonia would introduce a ban on sales of incandescent lights • Assumed that the phasing out period will be 1 to 2 years, and after this period of time only efficient lights will be used (CFL, LED).

Mitigation action 18: Wider application of solar collectors

Mitigation Action: Wider application of solar collectors	
Description: Implementation of solar collectors within the residential sector to reduce fuel consumption for hot water.	
Sector	Energy – Residential sector buildings
Gases	CO_2
Indicators	• Number of households installing solar hot water heaters • GWh per year reduced in electricity demand • kt CO_2-eq reduced per year
Projections	• 550 kt CO_2-eq cumulative reduction by 2030
Methodology	• Installation of solar hot water systems
Assumptions	• Assumes support for these measures via public awareness and investment mechanisms.
Steps Taken	Subsidies for home heating from the government cover 30% of the investment (up to EUR 300) for installation of a solar system
Steps Envisaged	
Results Achieved / Progress	• 2,415 households subsidized as of 2013 • 16.97 GWh savings in 2012

Mitigation action 19: Phasing out of resistive heating devices

Mitigation Action: Phasing out of resistive heating devices	
Description: This action would involve a ban on selling heating devices with resistive heaters, such as electric heat stove, electric heaters etc. which are used in the households.	
Sector	Energy – Residential sector buildings
Gases	CO_2
Indicators	• GWh electricity demand reduced per year • kt CO_2-eq reduced per year
Projections	• 0% of market share of electric heaters starting from 2017 • 165 GWh of electricity demand reduced per year in 2020 • 550 GWh of electricity demand reduced per year in 2030 • 55 kt CO_2-eq reduced per year in 2020 • 401 kt CO_2-eq reduced per year in 2030
Methodology	• Ban on resistive heating devices with a short phasing out period
Assumptions	• Assumed that as of 2017 the Republic of Macedonia would introduce a ban on sales of electric heaters • Assumed that the phasing out period for these technologies shall be 10 years, taking into consideration the fact that a large number of households still use these type of devices and their life expectancy is longer compared to the incandescent lights.

Mitigation action 20: Street lighting efficiency upgrades

Mitigation Action: Street lighting efficiency upgrades	
Description: Improvement of energy management and auditing in buildings in the health sector, education sector, and other public building sector	
Sector	Energy – commercial and public sector
Gases	CO_2
Indicators	• km of street-lighting upgraded • Reduction in kWh/km demand - electricity • GWh of electricity per year reduced • kt CO_2-eq reduced per year
Projections	• XX km of street-lighting upgraded • Reduction of XX kWh/km demand - electricity • 15.0 GWh of electricity per year reduced in 2018 • XX Kt CO_2-eq reduced per year
Methodology	• Replacements as a part of general upgrades to the system • Energy Performance Contracting for investments
Assumptions	Assumes that investments continue to occur.
Steps Taken	A number of projects have been implemented and results are based on actual measured savings
Steps Envisaged	Continued investments in this area are envisaged
Results Achieved / Progress	• 7.68 GWh of savings in 2012

Mitigation action 21: Application of renewable energy in public sector buildings

Mitigation Action: Application of renewable energy in public sector buildings	
Description: This action encourages the wider application of solar thermal systems for hot water preparation, the use of heat pumps in heating systems, the use of biomass systems in public buildings	
Sector	Energy – commercial and public buildings sector
Gases	CO_2
Indicators	• # of buildings implementing renewable energy sources • GWh per year reduced per fossil fuel type • Kt CO_2-eq reduced per year
Projections	• XX buildings implementing renewable energy sources • XX GWh per year reduced per fuel type • XX kt CO_2-eq reduced per year
Methodology	• Installation of heating sources based on renewable resources (solar hot water, efficient biomass stoves/boilers and heat pumps)
Assumptions	Assumes the continued investment in these measures.
Steps Taken	• Currently mandatory for public buildings to implement solar water heaters where economically efficient
Results Achieved / Progress	• 2.09 GWh savings in 2012

Mitigation action 22: Application of renewable energy in commercial sector buildings

Mitigation Action: Application of renewable energy in commercial sector buildings	
Description: The aim of the measure is to achieve mass use of solar thermal systems for hot water and heat pump installation in hotels, private hospitals and similar buildings in the service sector which operate with huge quantities of hot water.	
Sector	Energy – commercial and public sector buildings
Gases	CO_2
Indicators	• # of buildings implementing renewable energy sources • GWh per year reduced per fossil fuel type • kt CO_2-eq reduced per year
Projections	• XX buildings implementing renewable energy sources • XX GWh per year reduced per fuel type • XX kt CO_2-eq reduced per year
Methodology	• Installation of heating sources based on renewable resources (solar hot water, efficient biomass stoves/boilers and heat pumps)
Assumptions	
Steps Taken	• The Rulebook for energy performance demands that for new buildings and when a building is subject to major reconstruction, highly efficient systems must to be installed, if their use is technically, environmentally and economically justified.
Steps Envisaged	• Control over the work of the energy auditors – proper realization of the legislation • Government financial incentives • NGO, private sector awareness, information, promotion • Development of domestic technologies and transfer of know-how by the academic institutions and through the private sector
Results Achieved / Progress	• 3.26 GWh in fuel savings in 2012

Mitigation actions in the energy sector – transport sector

Mitigation action 23: Introduction of biofuels as 10% of fuel mix

Mitigation Action: Introduction of biofuels as 10% of fuel mix	
Description: This action would involve the introduction of biofuels into the fuel mix	
Sector	Energy – transport
Gases	CO_2
Indicators	• Quantity (GWh equivalent) of biofuels used as a fuel • kt CO_2-eq reduced per year
Projections	• 686 GWh equivalent of biofuels used as a fuel (10%) by 2020 • 1,022 GWh equivalent of biofuels used as a fuel (10%) by 2030 • 175 kt CO_2-eq reduced per year by 2020 • 265 kt CO_2-eq reduced per year by 2030
Methodology	• Adoption a Rulebook on the manner of securing a relevant share of biofuels in the total energy consumption in transport • Measures to promote the use of blends with biofuels without significant increase of fuel prices (e.g. reducing the excise tax on biofuels and by introducing increased excise tax for oil derivatives not used in transport). • Stimulate the production of domestic raw materials for biofuels by supporting producers of biofuels to invest in agricultural production of raw materials, guaranteed purchase, favourable crediting lines, etc.
Assumptions	• Demand of 6,897 GWh demand for fuels projected in 2020. • Assumed that the percentage of biofuels by 2020 would change starting in 2015 with 0.5%, 1.25% in 2016, reaching 10% in 2020, and after 2020 it is assumed that the participation of biofuels shall remain at 10%.

Mitigation action 24: Awareness raising campaigns to improve driver behaviour

Mitigation Action: Awareness raising campaigns to improve driver behaviour	
Description: This action involves improving the driver behaviour to improve fuel economy.	
Sector	Energy – transport
Gases	CO_2
Indicators	• Total fuel reduction (GWh equivalent) • kt CO_2-eq reduced per year
Projections	• 63 GWh equivalent of total fuel reduction by 2020 • 16.7 kt CO_2-eq reduced per year by 2020
Methodology	• Awareness campaign on the benefits of better fuel efficient driving • Ex ante and ex post public surveys to measure impact
Assumptions	• Assumes no significant rebound effect in driving behaviour due to reductions in fuel consumption per km.

Mitigation action 25: Increased use of bicycles, walking and introduction of parking policy

Mitigation Action: Increased use of bicycles, walking and introduction of parking policy	
Description: This measure includes various actions aimed at promotion of more sustainable modes of transport and travel behaviour. This specifically means using public transport instead of one's own car and bycicle and walking instead of driving.	
Sector	Energy – transport
Gases	CO_2
Indicators	• Change in person-km per year travelled by car • Change in person-km per year travelled by public transport • Change in person-km per year travelled by bicycle • GWh equivalent of fuel saved • kt CO_2-eq reduced per year
Projections	• XX reduction in person-km per year travelled by car • XX increase in person-km per year travelled by public transport • XX increase in person-km per year travelled by bicycle • 5.5 GWh equivalent of fuel saved in 2020 • 17.8 GWh equivalent of fuel saved in 2030 • 1.7 kt CO_2-eq reduced per year by 2020 • 5.4 kt CO_2-eq reduced per year by 2030
Methodology	Specific activities to undertake this Action include: • Renewal of public transport bus fleet; • Promotion of greater use of bicycles – including investments in the bicycle network infrastructure, as well as a public campaign for greater use of bicycles; • Introduction of paid parking schemes to encourage public transport use; • Car-free day promotions through the media (TV, radio, posters, etc.);
Assumptions	• From the person-kms involving individual cars for short distances, it is assumed that 0.1% annually would start using a bicycle and 0.01% would start walking.
Steps Taken	• Renewal of the public bus transport fleet in Skopje has been accomplished
Steps Envisaged	• Training for eco-driving • Invest in bicycle infrastructure/ rent-a-bicycle system, public campaigns • Revise parking policy
Results Achieved / Progress	• 43.7 GWh savings in 2012

Mitigation action 26: Increased use of railways

Mitigation Action: Increased use of railways	
Description: This measure includes various actions aimed at promotion the use of railways for inter-city transport of people and of goods	
Sector	Energy – transport
Gases	CO_2
Indicators	• Change in person-km per year travelled by train • Change in tonne-km per year travelled by train • GWh equivalent of fuel saved for transport of people • GWh equivalent of fuel saved for transport of goods • kt CO_2-eq reduced per year
Projections	• Change of 145 million person-km (2011) to 270 million person-km (2030) per year travelled by train • Change of 423 million tonne-km (2012) to 1000 million tonne-km (2030) per year travelled by train • 7.68 GWh equivalent of fuel saved in 2018 • 26 kt CO_2-eq reduced per year in 2020 • 56 kt CO_2-eq reduced per year in 2030
Methodology	Specific activities to undertake this Action include: • Improvement of freight cars • Improvement of passenger trains
Assumptions	• Assumes that there will be remarkable financial sources for the realization of the activities. • Assumes that people will switch modes of transport • Assumes that price differentials will encourage shifting the mode of transport
Steps Taken	• The Government has ordered 150 new freight cars • The Government has ordered 6 new train compositions for passengers (locomotive + passenger wagons)
Steps Envisaged	• JSC Macedonian Railways Transport Skopje have to improve their service offer: o New wagons acquisition; o Publishing the rail timetables on internet and teletext; o Better service suited to the passenger needs as are information, modern ticket selling, Improvement of interior (restrooms, gates, o restaurants etc.) and o Preparation a media campaign for the advantages of railway transport. • Campaign promoting advantages of railway transport • Improve annual statistic data.
Results Achieved / Progress	• 2.9 GWh savings in 2012

Mitigation action 27: Extension of railway to Bulgaria

Mitigation Action: Extension of railway to Bulgaria	
Description: This measure involves a capital investment to establish railway links to Bulgaria resulting in a decrease of freight traffic via trucks	
Sector	Energy – transport
Gases	CO_2
Indicators	• Change in tonne-km per year travelled by truck • Change in tonne-km per year travelled by train • GWh equivalent of fuel saved for transport of goods • kt CO_2-eq reduced per year
Projections	• Change of 423 million tonne-km (2012) to 1900 million tonne-km (2030) per year travelled by train • 850 GWh equivalent of fuel saved by 2030 • 227 kt CO_2-eq reduced per year by 2030
Methodology	Specific activities to undertake this Action include: • Investment into the railway routes to Bulgaria
Assumptions	Assumes that the railway will be finished in 2022

Mitigation action 28: Improvement/renewal of vehicle fleet

Mitigation Action: Improvement of vehicle fleet	
Description: This action involves replacement of the old vehicle fleet is renewed based on the lowest price, so the old vehicles are replaced with vehicles having internal combustion engines.	
Sector	Energy – transport
Gases	CO_2
Indicators	• Number of cars classified as clean/energy efficient versus overall fleet • GWh equivalent of fuel saved using clean/energy efficient cars • kt CO_2-eq reduced per year
Projections	• XX clean cars/XX total fleet • 78 GWh equivalent of fuel saved using clean/energy efficient cars in 2020 • 537 GWh equivalent of fuel saved using clean/energy efficient cars in 2030 • 20 kt CO_2-eq reduced per year in 2020 • 140 kt CO_2-eq reduced per year in 2030
Methodology	• Reduction of taxes for purchase of new clean and energy efficient car and keeping the same/increasing existing costs for the other cars; • Provision of bank credits with lower interest rates, if a new clean and energy efficient car is purchased. • Lower costs for vehicle registration for clean and energy efficient cars; • Lower costs for parking in the centre of the city for the clean and energy efficient cars; • Lower ecological tax and tax on property (if there is any) for clean and energy efficient cars.
Assumptions	Assumes the market for newer more efficient cars continues to grow.
Steps Taken	Amendment of legislation: • Rulebook for identification and/ or identification and appreciation of vehicles technical condition (Official Gazette No. 131/2009 and 16/2010), • Rulebook for individual authorization of vehicles (Official Gazette No. 16/2010, 62/2010 and 185/2011) • Law for registration and technical inspection - part of Law for vehicles (Official Gazette 140/2008);
Steps Envisaged	• Implementation of EURO standards (EU new standard is EURO 5, while in Macedonia it is EURO 2) for import of new EE vehicles up to 2020 • Lower costs for EE vehicle registration • Registration period for EE vehicles (e.g., each 3 years for vehicle up to 8 years old) • Increase of registrations cost for old vehicles with EURO 2, with incompatible eco-test
Results Achieved / Progress	• 43.4 GWh savings in 2012

Mitigation action 29: Improving vehicle efficiency, tax exemption for hybrid and electric vehicles

Mitigation Action: Improving vehicle efficiency, tax exemption for hybrid and electric vehicles	
Description: This action would involve using fiscal measures to encourage the purchase of hybrid and electric vehicles.	
Sector	Energy – transport
Gases	CO_2
Indicators	• Number of cars classified as hybrid/electric versus overall fleet • GWh equivalent of fuel saved using clean/energy efficient cars • kt CO_2-eq reduced per year
Projections	• XX hybrid/electric cars/XX total fleet (10% by 2035) • 90 GWh equivalent of fuel saved using clean/energy efficient cars in 2020 • 610 GWh equivalent of fuel saved using clean/energy efficient cars in 2030 • 24 kt CO_2-eq reduced per year in 2020 • 158 kt CO_2-eq reduced per year in 2030
Methodology	• Exempt owners of hybrids/electric cars from paying annual registration tax to an amount not higher than 100€
Results Achieved / Progress	• 43.4 GWh savings in 2012

Mitigation action 30: Advancement of vehicle equipment

Mitigation Action: Advancement of vehicle equipment	
Description: This strategy is aimed at promoting the utilization of advanced equipment (i.e. low resistance tires and low viscosity lubricant) which can considerably contribute to fuel economy improvement. Furthermore, it is possible to reduce the fuel consumption by another few per cent via optimal vehicle maintenance. Regular awareness rising campaigns and driver training are crucial factors of success.	
Sector	Energy – transport
Gases	CO_2
Indicators	• Number of cars utilizing advanced equipment and optimal maintenance versus overall fleet • GWh equivalent of fuel saved • kt CO_2-eq reduced per year
Projections	• 600,000 cars utilizing advanced equipment and optimal maintenance/XX total fleet • 122 GWh equivalent of fuel saved in 2020 • 30 kt CO_2-eq reduced per year in 2020
Methodology	• Improvement of tire, low viscosity lubricant, vehicle maintenance • Public awareness campaign to encourage better maintenance

Mitigation action 31: Car free days

Mitigation Action: Car free days	
Description: A promotion of car free days can help to reduce the number of vehicles in use during this action. This measure should be applied on a national level and should be supported by nationwide promotion and marketing. The importance of establishment of the "car free days" is to make people to leave their cars and to get them acquainted to other modes of travel, he/she may find out to be unexpectedly good (value added).	
Sector	Energy – transport
Gases	CO_2
Indicators	• Reduction in person-km by car during car free day and as a direct result • GWh equivalent of fuel saved • kt CO_2-eq reduced per year
Projections	• XX person-km by car reduced during car free day and as a direct result • XX GWh equivalent of fuel saved • XX kt CO_2-eq reduced per year
Methodology	• Implementation of Car Free Days • National campaign and local-level campaigns • Monitoring of impacts via daily vehicle fleet reports
Assumptions	
Steps Taken	• European Car Free Day, 22 September established as an annual event
Steps Envisaged	• Car free days of national level, 3 days in the year • Preparation of campaign on a national and local level • Preparation of daily vehicle fleet reports (3 days in the year) • Information, nationwide promotion and marketing.

Mitigation actions in the energy sector – industry sector

Mitigation action 32: Improvement of process performances

Mitigation Action: Improvement of process performances	
Description: This action entails a number of different measures to improve EE in the processes for manufacturing. This could include improvements to processes such as compressed air, condensate distribution, steam traps, etc.	
Sector	Energy – industry
Gases	CO_2
Indicators	• # of industries improving process performances • GWh equivalent of fuel saved • kt CO_2-eq reduced per year
Projections	• XX # of industries improving process performances • 46.6 GWh equivalent of fuel saved by 2018 • XX kt CO_2-eq reduced per year
Methodology	• Improvement of process performances (Cleaner production, integrated pollution prevention and control – IPPC – permitting); • Energy Auditing; • Compressed air supply; • Good house-keeping
Steps Envisaged	• Provision of benchmarking information for industries (kWh/tonne of production) • Mandatory reporting of EE indicators by industry
Results Achieved / Progress	• 36.05 GWh savings in 2012

Mitigation action 33:Energy management in industry

Mitigation Action: Energy management in industry	
Description: This action provides support for the assessment of potential energy savings in industrial plants through an implementation of energy audit. The audit scheme for industry should include: • Mandatory energy audits for companies with an annual energy consumption of more than prescribed within the law; • Voluntary scheme for other companies, especially for SMEs and • Introduction and implementation of ISO 50001 scheme for Energy Management in Industry.	
Sector	Energy – industry
Gases	CO_2
Indicators	• # of industries adopting energy management standards • GWh equivalent of fuel saved • kt CO_2-eq reduced per year
Projections	• XX # of industries improving energy management standards • 33.26 GWh equivalent of fuel saved in 2018 • XX kt CO_2-eq reduced per year
Methodology	• Energy Auditing; • Introduction and implementation of ISO 50001 • Good house-keeping
Assumptions	Assumes industry interest in these measures.
Steps Taken	• Training of a certain number of companies by a USAID-funded project has begun
Results Achieved / Progress	• 17.2 GWh savings in 2012

Mitigation action 34: Introduction of efficient electrical motors

Mitigation Action: Introduction of efficient electrical motors	
Description: This action entails the introduction of efficient electrical motors in industry which reduces electricity consumption	
Sector	Energy – industry
Gases	CO_2
Indicators	• # of industries introducing efficient electrical motors • GWh saved per year • Kt CO_2-eq reduced per year
Projections	• XX # of industries introducing efficient electrical motors • 28.8 GWh electricity saved • XX kt CO_2-eq reduced per year
Methodology	• Installing of new high-efficiency electric motors • Installing of devices for frequency/ number of revolution control of existing electric motors.
Assumptions	Assumes industry interest in these measures.
Steps Envisaged	• Prepare manual for achieving fast control of rational energy consumption of existing electrical power engines. • Determination of economic viability of investing in the improvement of energy efficiency of the equipment • Providing access to soft loans for the purchase of EE equipment of this type.
Results Achieved / Progress	• 6.04 GWh savings in 2012

Mitigation action 35: Waste heat utilisation in industry

Mitigation Action: Waste heat utilisation in industry	
Description: This action entails the rearranging of industrial processes in order to utilise waste heat. For example, this would mean water recirculation in tanner facilities, usage of hot air in installations for baking bricks, the sensible heat in the gaseous combustion products from the chamber furnaces for heat treatment of refractory products emitted in large amount and at relatively high temperature, etc.	
Sector	Energy – industry
Gases	CO_2
Indicators	• # of industries utilising waste heat • GWh equivalent of fuel saved • Kt CO_2-eq reduced per year
Projections	• XX # of industries utilising waste heat • 251.8 GWh equivalent of fuel saved in 2018 • XX kt CO_2-eq reduced per year
Methodology	• Waste heat utilization in industry
Assumptions	
Steps Taken	• CDM case studies for utilization of waste heat identified
Steps Envisaged	• Launch a programme for waste heat utilization for small scale projects (not qualifying for CDM) and create a mechanism for control of project implementation • Support by provision of financial incentives/ fiscal measures/ soft loans for efficient use of waste heat • Realization of case studies in the National Strategy for CDM
Results Achieved / Progress	• 31.8 GWh savings in 2012
Emissions Reduction	
International Market Mechanisms:	Expected to be linked to the Clean Development Mechanism

Mitigation action 36: Cogeneration in industry

Mitigation Action: Cogeneration in industry	
Description: This action entails providing the necessary preconditions for distributed production of heat and electricity for small and micro energy consumers in the industrial sector, but also in public buildings if appropriate (such as hospitals, hotels etc.).	
Sector	Energy – industry
Gases	CO_2
Indicators	• # of industries implementing cogeneration facilities • # of industries switching fuels • GWh equivalent of fuel saved • Kt CO_2-eq reduced per year
Projections	• XX # of industries implementing cogeneration facilities • XX # of industries switching fuels • XX GWh equivalent of fuel saved • XX kt CO_2-eq reduced per year
Methodology	• Co-generation; • Fuel switching; • Waste heat utilization;
Steps Envisaged	• Promotion of application of micro and small-scale CHP in the industry and other sectors • Ensure faster transfer of know-how, good practice between industrial organizations, as well as to support inter-collaboration • Provide the companies with information and to prepare preconditions to obtain soft loans
Results Achieved / Progress	• 151 GWh savings in 2012

Mitigation actions in the waste sector

Mitigation action 37: Closing and covering the existing non-compliant landfills followed by gas extraction and flaring

Mitigation Action: Closing and covering the existing non-compliant landfills followed by gas extraction and flaring	
Description: This Action involves the closure, covering and flaring of methane gas within 4 large landfills in Macedonia	
Sector	Waste
Gases	CH_4
Indicators	• Tonnes of CH_4 flared per year • kt CO_2-eq reduced per year
Projections	• XX Tonnes of CH_4 flared per year • 11,450 kt CO_2-eq reduced by 2020
Methodology	• There are four municipal landfills which need urgent closure and rehabilitation: Kicevo, Ohrid, Kriva Palanka, and Gevgelija. • The action involves covering the whole disposal area and introducing gas extraction and flaring, converting methane emissions to CO_2. • Production of electricity as an option is not chosen because there is uncertainty in landfill gas quantities.
International Market Mechanisms:	IPA funds can be used along with municipal budgets and other donors

Mitigation action 38: Mechanical and biological treatment (MBT) in new landfills with composting

Mitigation Action: Mechanical and biological treatment (MBT) in new landfills with composting	
Description: This Action involves the sorting of waste for removal of metals, plastics and glass. It is a necessary step for any other treatment (composting, anaerobic treatment, or RDF development).	
Sector	Waste
Gases	CH_4
Indicators	• Tonnes of CH_4 reduced per year • Kt CO_2-eq reduced per year
Projections	• XX tonnes of CH_4 reduced per year • 7,678 kt CO_2-eq reduced by 2030
Methodology	• This measure involves the sorting of waste for removal of metals, plastics and glass. It is a necessary step for any other treatment (composting, anaerobic treatment, or RDF development).
International Market Mechanisms:	IPA funds can be used along with Public Private Partnerships, and other donors

Mitigation action 39: Mechanical and biological treatment (MBT) in one new landfill with composting plus production of Refuse-Derived Fuel (RDF) intended for cement industry

Mitigation Action: Production of Refuse-Derived Fuel (RDF) intended for cement industry	
Description: This Action involves the production of RDF from waste streams and then use in the cement industry as a source of energy instead of using fossil fuels.	
Sector	Waste
Gases	CH_4, CO_2
Indicators	• Tonnes of CH_4 reduced per year • GWh produced using RDF displacing other energy sources • kt of CO_2 reduced from displacement of other energy sources • kt CO_2-eq reduced per year
Projections	• XX tonnes of CH_4 reduced per year • XX GWh produced using RDF displacing other energy sources • XX kt of CO_2 reduced from displacement of other energy sources • 5,890 kt CO_2-eq reduced cumulatively by 2030
Methodology	• The production of RDF involves converting combustible waste materials to an engineered fuel. • The RDF system provides additional GHG reduction because all the carbon contained in the waste is incinerated instead of put into landfills – which can reduce methane emissions and displace fuel sources with higher-GHG content such as coal.

Mitigation actions in the agriculture sector

Mitigation action 40: Increase in organic farming

Mitigation Action: Increase in organic farming	
Description: Organic agriculture directly contributes to reduction of GHG emissions as it emits less N_2O from nitrogen application (lower nitrogen input), biomass waste burning is avoided (less N_2O and CH_4 emissions) and there is almost no usage of chemical fertilizers. The increased soil quality is also a value added that makes the agriculture sector more resilient to droughts or extreme weather events.	
Sector	Agriculture
Gases	N_2O, N_2O and CH_4
Indicators	• Ha of agriculture under organic agriculture • kt CO_2-eq reduced per year
Projections	• Increase from 4,663 ha in 2012 to 30,400 ha in 2030 • 63.76 kt CO_2-eq reduced per year in 2030
Methodology	• Financial support for organic production area • Re-imbursement of inspection and certification costs. • Financial support for organic farmers for production of approved organic seed material. • Co-financing of storage, packaging and processing
Assumptions	• For all type of crops, it is required that the Government gives adequate subsidies for the farmers and the benefit of the organic products is recognized by customers.

Mitigation action 41: Livestock management for less GHG-intensive enteric fermentation

Mitigation Action: Livestock management for less GHG-intensive enteric fermentation	
Description: Enteric fermentation is a natural part of the digestive process for many ruminant animals where anaerobic microbes, called methanogens, decompose and ferment food present in the digestive tract producing compounds that are then absorbed by the host animal. Measures to mitigate enteric fermentation would not only reduce emissions, they may also raise animal productivity by increasing digestive efficiency..	
Sector	Agriculture
Gases	CH_4
Indicators	• % of the population of the dairy cows and cattle taking propionate precursors or probiotics • kt CO_2-eq reduced per year
Projections	• 50% of the population of the dairy cows and cattle taking propionate precursors or probiotics by 2030 • 1,498 kt CO_2-eq reduced cumulatively by 2030
Methodology	• Improvement of the cattle food intake using propionate precursors and probiotics
Assumptions	• Mitigation measures related to enteric fermentation are expensive and are considered feasible only if the Government gives adequate subsidies in the upcoming period for replacement of feed intake of animals.

Mitigation action 42: Improved crop residues management

Mitigation Action: Improved crop residues management	
Description: The burning of crop residues is very common and causes various concerns: GHG emissions, pollution linked to respiratory and health issues, possible soil erosion, adverse effects on soil fertility, organic matter depletion and soil structure damage, reduced numbers of macro and micro-organisms, and fires that get out of control. Emissions could be reduced from this cumulative total if better crop residue management was used – especially by using the residues as a fuel source. With recent policy changes, open-fire burning of the agricultural residues in the country is strictly prohibited.	
Sector	Agriculture
Gases	CO_2, CH_4, and N_2O
Indicators	• The annual amount of briquettes produced (kt/year) • The annual amount of the re-used crop residues (kt/year) • The substitution of the usage of the ordinary biomass with agricultural residues briquettes (kt/year) • kt CO_2-eq reduced per year
Projections	• 3.12 kt/year of briquettes produced • XX kt/year of crop residues reused • XX kt/year of briquettes replacing ordinary biomass • 3,792 kt CO_2-eq reduced per year by 2030
Methodology	• The most effective and common practice for managing crop residues is using mechanical equipment for residue removal and packaging into briquettes for fuel use. • This measure provides high environmental and economic benefits, and investment in even the most expensive production plant (an investment of ~EUR 430,000) has a pay-back period of 4.3 years.
Steps Taken	• The burning of crop residues has been banned by law.

Mitigation action 43: Improved sprinkler and drip irrigation

Mitigation Action: Improved sprinkler and drip irrigation	
Description: Description: Irrigation is very carbon intensive because a lot of energy is spent for pumping water. Emissions are estimated at 1,448 kg CO_2-eq/ha for furrow irrigation, 446 kg CO_2-eq/ha for sprinkler irrigation and 792 kg CO_2-eq /ha for drip irrigation. Furthermore, inefficient irrigation that leaves the soil overly wet leads to higher emissions of N_2O. For a variety of crops, this action would involve the abandonment of of flood and furrow irrigation to favour sprinkler irrigation and drip irrigation, since they are proven to be more effective techniques. Additionally, it would involve higher frequency of irrigations with lower amounts of water per irrigation.	
Sector	Agriculture
Gases	N_2O, CO_2
Indicators	• Increase of yield production (t yield/year). • ha of crops under improved sprinkler and drip irrigation • kt CO_2-eq reduced per year segregated by product type
Projections	• Increase of yield production of XX t /year. • XX ha of crops under improved sprinkler and drip irrigation • XX kt CO_2-eq reduced per year
Methodology	• Abandonment of flood and furrow irrigation to favour sprinkler irrigation and drip irrigation. • Higher frequency of irrigations with lower amounts of water per irrigation.
Steps Taken	• Economic and financial analysis has been conducted on this measure to find the best combination as part of preparation of the Third National Communication.

Mitigation action 44: Altering tillage techniques

Mitigation Action: Altering tillage techniques	
Description: Conventional tillage practices may adversely affect long-term soil productivity due to erosion and loss of organic matter in soils. Sustainable soil management can be practiced through conservation tillage (including no-tillage), high crop residue return, and crop rotation. Conservation tillage is defined as a tillage system in which at least 30% of crop residues are left in the field and is an important conservation practice to reduce soil erosion. The advantages of conservation tillage practices over conventional tillage include: reducing cultivation cost; allowing crop residues to act as an insulator and reducing soil temperature fluctuation; building up soil organic matter; conserving soil moisture.	
Sector	Agriculture
Gases	N_2O, CO_2
Indicators	• ha of arable soil utilising conservation tillage techniques • kt CO_2-eq reduced per year
Projections	• 227,000 ha of arable soil utilising conservation tillage techniques • XX kt CO_2-eq reduced per year
Methodology	• Sustainable soil management through conservation tillage (including no-tillage), high crop residue return, and crop rotation. • Leaving at least 30% of crop residues in the field
Assumptions	• Assumes a rejection of conventional techniques of farmers because of the increased labour costs

Mitigation action 45: Improved management of fertilizers

Mitigation Action: Improved management of fertilizers	
Description: This action involves a fertilisation strategy in wet conditions in which fertilisers containing only NH_{4+} are applied instead of the commonly used NO_{3-} fertiliser, to mitigate N_2O emission from intensively managed arable land or grasslands. It also involves the reduction of the application of synthetic fertiliser in arable and grassland systems by an efficient use of manure that is otherwise disposed of as waste products.	
Sector	Agriculture
Gases	N_2O
Indicators	• The amount of the mineral fertilizers substituted with the organic fertilizers (t/year) • The area of application of the organic fertilizers (ha/year) • kt CO_2-eq reduced per year
Projections	• 7,500 t/year of mineral fertilizers substituted with the organic fertilizers • 90,986 ha/year of application of the organic fertilizers • XX kt CO_2-eq reduced per year
Methodology	• Utilizing NH_{4+} fertilisers instead of NO_{3-} fertilisers for wet conditions • Use of manures instead of synthetic fertilisers in arable and grassland systems

Mitigation action 46: Improved manure management

Mitigation Action: Improved manure management	
Description: This practice is based on the drying of cattle waste, since dry cattle manure produces ~14% of the methane than the equivalent in wet weight – which can be used for the production of organic fertilizers.	
Sector	Agriculture
Gases	N_2O, CH_4
Indicators	• t/year of organic fertilizers produced • # of composting plants implemented • kt CO_2-eq reduced per year
Projections	• XX t/year of organic fertilizers produced • 6 composting plants implemented • 37.5 kt CO_2-eq reduced per year
Methodology	• Ensure aerobic decomposition and avoid methane evolution, by daily spreading of manures and composting • Convert evolved methane to carbon dioxide, including anaerobic digestion and covered lagoon systems
Assumptions	• Assumes the ability to market organic fertilisers. • Assumes compliance with the law
Steps Taken	• This action measures fall under Integrated Pollution Prevention and Control (IPPC) environmental legislation (A-Integrated permits). Legislation has been passed to require their completion as an amendment of the Law on Environment (Official gazette of R.M, no.53/05) and IPPC Decree (Official gazette of R.M, no.89/05)

Mitigation action 47: Production of biogas from farming

Mitigation Action: Production of biogas from farming	
Description: This practice is based on the processing of animal waste in combination with other organic waste products such that they will create biogas which can be injected into the grid or burned for electricity/heat production. The leftover material can then be used for the production of organic fertilizers.	
Sector	Agriculture
Gases	CH_4, CO_2
Indicators	• t/year production of high quality compost (t/year) • MWh equivalent of biogas/electricity/heat produced • kt CO_2-eq reduced per year
Projections	• XX t/year production of high quality compost (t/year) • XX MWh equivalent of biogas/electricity/heat produced • XX kt CO_2-eq reduced per year
Methodology	• This would involve the introduction of system for biogas production on the major swine farms in the country (5 big farming associations)
Assumptions	• Assumes the proper incentives put into place for the use of biogas for electricity production.

Annex 2:

Detailed tables of the GHG Inventory

Table 1: Short summary of the national GHG emissions, year 1990 [Gg]

Categories	Emissions (Gg)			Emissions CO_2 Equivalents (Gg)			Total emissions in CO_2-eq (Gg)
	Net CO_2 (1) (2)	CH_4	N_2O	HFCs	PFCs	SF_6	CO_2-eq
Total National Emissions and Removals	6451.65	88.86	1.13	0.00	114.46	0.00	8781.84
1 - Energy	9201.23	8.03	0.15	0.00	0.00	0.00	9415.52
1.A - Fuel Combustion Activities	9201.23	0.52	0.15				9257.85
1.B - Fugitive emissions from fuels	0.00	7.51	0.00				157.67
1.C - Carbon dioxide Transport and Storage	0.00						0.00
2 - Industrial Processes and Product Use	825.59	0.09	0.00	0.00	114.46	0.00	941.83
2.A - Mineral Industry	286.13	0.00	0.00				286.13
2.B - Chemical Industry	0.31	0.00	0.00	0.00	0.00	0.00	0.31
2.C - Metal Industry	539.15	0.09	0.00	0.00	114.46	0.00	655.39
2.D - Non-Energy Products from Fuels and Solvent Use	0.00	0.00	0.00				0.00
2.E - Electronics Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F - Product Uses as Substitutes for Ozone Depleting Substances				0.00	0.00		0.00
2.G - Other Product Manufacture and Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H - Other	0.00	0.00	0.00				0.00
3 - Agriculture, Forestry, and Other Land Use	-3579.35	42.12	0.87	0.00	0.00	0.00	-2425.18
3.A - Livestock		40.03	0.16				890.13
3.B - Land	-3569.24		0.00				-3569.24
3.C - Aggregate sources and non-CO2 emissions sources on land	3.74	2.09	0.71				267.78
3.D - Other	-13.85	0.00	0.00				-13.85
4 - Waste	4.18	38.62	0.11	0.00	0.00	0.00	849.67
4.A - Solid Waste Disposal		36.50					766.57
4.B - Biological Treatment of Solid Waste		0.00	0.00				0.00
4.C - Incineration and Open Burning of Waste	4.18	0.35	0.00				11.46
4.D - Wastewater Treatment and Discharge		1.77	0.11				71.64
4.E - Other (please specify)	0.00	0.00	0.00				0.00
5 - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3			0.00				0.00
5.B - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
							0.00
Memo Items (5)							0.00
International Bunkers	15.77	0.00	0.00	0.00	0.00	0.00	15.90
1.A.3.a.i - International Aviation (International Bunkers)	15.77	0.00	0.00				15.90
1.A.3.d.i - International water-borne navigation (International bunkers)	0.00	0.00	0.00				0.00
1.A.5.c - Multilateral Operations	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table 2: Short summary of the national GHG emissions, year 2012 [Gg]

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)			Total emissions in CO2-eq (Gg)
	Net CO2 (1) (2)	CH4	N2O	HFCs	PFCs	SF6	CO2-eq
Total National Emissions and Removals	10011.46	111.10	1.15	0.00	6.00	0.00	12707.74
1 - Energy	8840.19	11.04	0.19	0.00	0.00	0.00	9132.18
1.A - Fuel Combustion Activities	8840.19	2.81	0.19				8959.25
1.B - Fugitive emissions from fuels	0.00	8.23	0.00				172.93
1.C - Carbon dioxide Transport and Storage	0.00						0.00
2 - Industrial Processes and Product Use	671.96	0.08	0.00	0.00	6.00	0.00	679.74
2.A - Mineral Industry	283.02	0.00	0.00				283.02
2.B - Chemical Industry	0.01	0.00	0.00	0.00	0.00	0.00	0.01
2.C - Metal Industry	388.93	0.08	0.00	0.00	6.00	0.00	396.72
2.D - Non-Energy Products from Fuels and Solvent Use	0.00	0.00	0.00				0.00
2.E - Electronics Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.F - Product Uses as Substitutes for Ozone Depleting Substances				0.00	0.00		0.00
2.G - Other Product Manufacture and Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H - Other	0.00	0.00	0.00				0.00
3 - Agriculture, Forestry, and Other Land Use	490.12	28.09	0.82	0.00	0.00	0.00	1335.51
3.A - Livestock		27.00	0.12				603.93
3.B - Land	484.37		0.00				484.37
3.C - Aggregate sources and non-CO2 emissions sources on land	5.75	1.09	0.71				247.21
3.D - Other	0.00	0.00	0.00				0.00
4 - Waste	9.19	71.89	0.13	0.00	0.00	0.00	1560.30
4.A - Solid Waste Disposal		68.30					1434.21
4.B - Biological Treatment of Solid Waste		0.00	0.00				0.00
4.C - Incineration and Open Burning of Waste	9.19	0.76	0.00				25.20
4.D - Wastewater Treatment and Discharge		2.83	0.13				100.89
4.E - Other (please specify)	0.00	0.00	0.00				0.00
5 - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3			0.00				0.00
5.B - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
							0.00
Memo Items (5)							0.00
International Bunkers	6.11	0.00	0.00	0.00	0.00	0.00	6.16
1.A.3.a.i - International Aviation (International Bunkers)	6.11	0.00	0.00				6.16
1.A.3.d.i - International water-borne navigation (International bunkers)	0.00	0.00	0.00				0.00
1.A.5.c - Multilateral Operations	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Annex 3:
Action Plan for the Scenario With Existing Measures (WEM)

Measure	Type	Stakeholders	Timeframe	Budget required	CO_2 emission reduction cumulatively by 2030 in kt
Labeling of appliances	Regulation	Ministry of Economy, Energy Agency, manufacturers and appliances vendors	Short term	Small budget	1,659
Public awareness campaigns and EE info centers	Capacity building, public awareness	Ministry of Economy, Energy Agency	Short term	Medium budget	967
Rulebook on energy performance of buildings	Regulation	Ministry of Economy, Energy Agency	Long term	Small budget	14,982
Increased use of railway	Policy	Ministry of Transport and Communications	Long term	Medium budget	525
Increased use of bicycles, walking and introduction of parking policy	Policy / Regulation / Public awareness	Ministry of Environment and Physical Planning, local self-government	Long term	Small budget	38
Renewal of the vehicle fleet	Policy, technical	Ministry of Transport and Communications, Ministry of Interior	Long term	Large budget	1,345
Distribution losses reduction	Technical	Distribution companies for transmission of electricity	Long term	Large budget	3,261
Electricity import (market)	Policy /Regulation	Energy Regulatory Commission, network transmission operator	Short term	Large budget	12,024
Increased utilization of RES	Policy	Ministry of Environment and Physical Planning, Ministry of Economy, Energy Agency	Long term	Large budget	5,648
Biofuels – delay until 2025	Policy	Ministry of Economy	Long term	Large budget	2,307
Higher penetration of solar collectors	Policy, technical	Ministry of Economy	Long term	Medium budget	550

Annex 4:
Proposed Action Plan on Gender and Climate Change Adaptation and Mitigation

Action	Type	Stakeholders [Coordinated by Climate Change Committee]	Timeframe for Commencement	Constraints	Water	Agriculture	Health	DRR	Energy & Transport	Tourism	Decision making
Climate Change (general):											
Effects of climate change, adaptation and mitigation are analysed from women's and men's perspectives and situation	Capacity building	Women's organizations; MOEPP training for other departments; university researchers; Institute of Gender Studies; government M&E; think tanks;	Short-term	Low awareness; limited capacity; financing	X	X	X	X	X	X	
Data in assessments and stocktaking is disaggregated by sex	Capacity building	All Government departments (part of national gender policy); collected and published by Office of Statistics	Short-term	Methodological and capacity constraints; database software needs to be developed	X	X	X	X	X	X	X
Gender sensitive criteria and indicators are developed for assessment, participation, monitoring and evaluation of climate change activities	Capacity building; policy	Gender focal points; university researchers; gender experts; NGOs M&E	Short-term	Low awareness; limited capacity; insufficient data and research; political interest	X	X	X	X	X	X	X
Targets set for participation of women and men in all activities	Policy	Gender focal points; Department for Equal Opportunities	Short-term	Guideline of EU targets adjusted to Macedonian circumstances							
Gender expertise is involved and consulted in climate change project implementation and monitoring	Policy; capacity building	Gender experts; NGOs; university researchers;	Short-term	Identification / availability of gender and climate change expertise; revise process to allow their inclusion		X		X	X	X	
Technology assessments take into account gender	Policy ; capacity building	Gender experts; NGOs; university researchers;	Medium-term	Low awareness and capacity development; need to identify expertise to advise							
Business and philanthropic communities should be sensitized re gender in climate change efforts		Private sector; part of Communications Strategy; Governmental liaison for civil society and foundations		Few business-government connections, especially with small businesses; no concrete philanthropic community; little tradition of business working with government							
Awareness raising of consumers	Capacity building	Consumers; Ministry of Energy (outreach); communications experts; women's organizations; consumer organizations	Short-term/ongoing	Low awareness; limited options for consumers					X		
Reduction of energy consumption	Investment	Consumers; private sector; transportation sector; Finance; consumer organizations	Medium-term	Low awareness; limited economic resources for investments in energy use reduction					X		
Reduction of solid fuel use for heating in households	Investment	Consumers; Ministry of Energy (outreach)	Long-term	Low awareness; limited economic resources for investments in energy use reduction					X		
Subsidies for cleaner energy are accessed by women farmers, heads of households, and business owners	Policy	Women business owners/ farmers; Ministry of Energy	Long-term	Low awareness; limited economic resources for investments in energy use reduction; isolation of female farmers and business owners					X		
Public transportation is accessible in both urban and rural locations	Policy	Population; transportation sector	Medium-term	Cost and distance of transport in rural areas					X		
Tax incentives for public transportation use are in place	Policy / legislation	Tax department		Government capacity; internal approval processes					X		
Campaigns promoting the use of public transit and energy-efficient transport	Policy; capacity building	Ministry of Energy/Transport; communications experts/agency	Medium-term						X		

Action	Type	Stakeholders [Coordinated by Climate Change Committee]	Timeframe for Commencement	Constraints	Water	Agriculture	Health	DRR	Energy & Transport	Tourism	Decision making
Primary Sector: Agriculture											
Extension and information systems reach women farmers and female members of farming households	Capacity-building	Women farmers; female members of farming households; members of agricultural associations; women's NGOs; gender focal points on local level; Ministry of agriculture, MOEPP	Short-term	The information approaches are not adapted to the mentality of rural women residents; participation in policy making and farmer's associations is low		X					
Women and female farmers have equal access to agricultural inputs	Capacity-building; investment	Women farmers; female members of farming households; members of agricultural associations; women's NGOs; gender focal points on local level; Ministry of agriculture, IPARD PA, MOEPP	Medium-term	Mentality, patriarchal families, stereotypes, gender neutral policies		X					
Women's experience and knowledge is included in agricultural production and extension	Capacity-building	Women's associations, women farmers; farmers' association; experts, research institutes, academia; Ministry of agriculture	Short-term	Research on women's experiences and knowledge is limited; development of training targeting know how transfer is rare		X					
Female and male farmers trained equally in cultivation techniques	Capacity building	Farmers; academia, experts	Medium-term	Participation of women farmers in educational activities is low; mentality of rural women; patriarchal traditions		X					
Agricultural information is more accessible via various information media	Capacity building	Ministry of agriculture, IPARD PA, Agency for rural development, media, farmers	Medium-term	Media and information dissemination in agricultural/rural areas is limited; use of technology is lower than in urban areas		X					
Research on climate-change induced effects on household members, by age and sex	Capacity building	Academia, experts, think tanks, government, SSO, MOEPP	Short-term; ongoing	Research on climate change is limited, expertise is limited		X					
Subsidies and support for adaptation and mitigation are equally targeted to female and male land owners, farmers and business owners	Policy; Investment	Ministry of agriculture, IPARD PA, Agency for rural development	Long-term	Low awareness of the need to support adaptation and mitigation		X					
Primary Sector: Tourism											
Women and men have equal access to ecotourism employment	Capacity-building	Ministry of Economy, Employment agency, MOEPP, tourism association (HOTAM)	Short-term	Under development of eco-tourism, limited access to finances in rural areas (no collateral to be provided)						X	
Female students are targeted for tourism training at secondary school and in employment training	Capacity-building; investment	Secondary schools, professional orientation services, Agency for employment, local self-government, Ministry of labour,	Short-term	VET schooling in decline, limited professional orientation at secondary school						X	

Action	Type	Stakeholders [Coordinated by Climate Change Committee]	Timeframe for Commencement	Constraints	Water	Agriculture	Health	DRR	Energy & Transport	Tourism	Decision making
Support for small-scale tourism-based enterprises provided in terms of product design, business management and market analysis	Capacity-building	Ministry of Economy, Agency of employment	Medium-term	Support schemes not directed to provide product design, business management and market analysis						X	
Primary Sector: Disaster and Risk Reduction											
Information and warning systems reach women and men equally in different locations	Capacity building	Population in rural areas; women's organizations; Ministry of Health; Ministry of Telecomm	Medium-term	Lower levels of access /control of ICT by females; few warning systems in place				X			
Women and women's groups are involved equally with men in disaster planning and preparedness	Capacity building	Women's organizations; Ministry of Health; emergency responders	Medium-term	Low awareness of gender component				X			X
Climate change data on droughts, floods, emergencies is analysed in terms of gender, age, ethnicity and geographic location	Capacity building	Ministry of Environment and Physical Planning; university researchers; gender experts	Short-term	Difficulty in gathering data in remote areas; low awareness				X			
Access of women and men to technology and finances for disaster preparation and recovery is analysed	Capacity building	Ministry of Finance; university researchers; gender experts	Short-term	Low awareness; making women and men aware of options is difficult in rural areas				X			
Primary Sector: Health											
Training, warning and information systems take into account situations of groups in society, by sex and age	Capacity building	Experts, academia, think-tanks, research institutes, MOEPP, Ministry of Health, Public health institute,	Medium-term	Low awareness (research) on the situations of different groups in society, no commitment for gathering age relevant data			X				
Health and emergency workers are trained in differing needs and situations of vulnerable groups	Capacity building	Faculty of medicine, local governments, MOEPP, Crisis management centre, experts	Medium-term	Disconnection between education system and research on social determinants of climate change			X				
Sector: Participation in decision making											
Women are adequately represented in the workforce and decision making in energy, agriculture, water, telecommunication and transport sectors	Capacity building; private sector	Equal opportunities department MLSP, line-ministries, gender focal points	Medium-term	Patriarchal traditions, low awareness among politicians, low participation of women in political parties		X	X		X		X
Targets set for women's participation in climate change decision-making at all levels	Policy	Climate change committee, line-ministries, gender focal points	Short-term	Participation does not guarantee that the women's voice will be heard if women policy makers do not know the situation of women as vulnerable groups in climate change							X
Gender budgeting process includes climate change components		MLSP, MoF, line ministries, gender focal points, NGOs (M&E)		Low interest for GRB; limited capacity for GRB							X

Action	Type	Stakeholders [Coordinated by Climate Change Committee]	Timeframe for Commencement	Constraints	Water	Agriculture	Health	DRR	Energy & Transport	Tourism	Decision making
National and municipal level gender focal points receive climate change training and vice versa, either in face to face or online format	Capacity building	Gender focal points, equal opportunities department MLSP, equal opportunities commissions on local level, ZELS (training centre), NGOs	Short-term	Low awareness and interest in climate change, online training modules in limited use							X
Gender audits are developed for finance mechanisms and impact assessments related to climate change	Policy	State audit office, NGOs, Department for equal opportunities MLSP, MOEPP	Short-term	Low awareness and interest in climate change, low awareness and interest in gender audit (State Audit office), limited capacity							X
Women and women's organizations participate in water use and management associations	Policy	Local governments, water companies, women's associations, Ministry of agriculture, Ministry of health, MOEPP	Short-term	Patriarchal traditions, low awareness of gender equality at local level							X
Sector: Communications and Training											
Climate change communications strategy integrates gender	Policy	MOEPP; communications experts/agency; gender experts; consumer organizations; women's organizations; MLSP	Short-term	Communications agencies have low awareness; little data on gender trends in consumption and use in Macedonia							
Public information campaigns are targeted to male and female perspectives, situations and access to resources	Capacity building	MOEPP; communications experts/agency; gender experts; consumer organizations; women's organizations	Medium-term	Communications agencies have low awareness; little data on gender trends in consumption and use in Macedonia							
Representation of female climate change communications focal points at all three levels	Capacity building	All levels of government; MLSP; MOEPP	Medium-term	Low awareness							
Household campaigns target females and males	Capacity building	Consumers; women's organizations; communications agency	Short-term	Communications agencies have low awareness; little data on gender trends in consumption and use in Macedonia							
National multi-stakeholder workshops and roundtables held on gender and climate change	Capacity building	Parliament, MOEPP; MLSP	Short- and medium-term	Financial resources; political interest							

Annex 5:

Indicative policy paper for determination of potential national greenhouse gas emission limitation/reduction targets

As the UNFCCC COP 21 approaches, Republic of Macedonia will be expected to deliver a pledge for post 2020 greenhouse gas (GHG) emissions target. There are two possible types of pledges expected from the government, based on its Third National Communication, one consistent with Quantified Emissions Reduction or Limitation Targets (QELRC) type promising to reduce average yearly GHG emissions over the budget period (probably 2021-2028), from the certified emissions base year (1990, or some other), the other being deviation from business as usual (BAU) promising to reduce emissions from expected BAU emissions. Choosing between the two sets is more political than substantial, QELRC type of pledge being pertaining to developed countries and DEV BAU type of pledge pertaining to developing countries. The government should choose based on where it wants to be perceived. Also, DEV BAU type of pledge will psychologically deliver more agreeable numbers.

There is also a question of the level of ambition that the Government of the Republic of Macedonia wants to show on the way to COP 21. If it wants to be consistent with already existing policies and measures, and thus show only ambition not to retract on already implemented policies, it could either pledge MediumLow QELRC of 7% change for GHG emissions for budget period 2021-2028 from 1990, or it could offer -32% deviation from BAU in 2030, consistent with BAUdev_High scenario from TNC. The -20% DEV BAU in 2020 is already consistent with existing measures.

If the Government wants to show more ambition, consistent with additional measures, it could either pledge Medium QELRC of -2% change for GHG emissions for budget period 2021-2028 from 1990, or it could offer -35% deviation from BAU in 2030. Implementing additional measures prior to 2020 would mean DEV BAU of -25% in 2020.

The available options and necessary decision to be made are summarized in Figure A-1. The Government has to decide to be more or less ambitious, which may depend on its negotiating platform, and to pledge a QELRC or DEV BAU type of contribution.

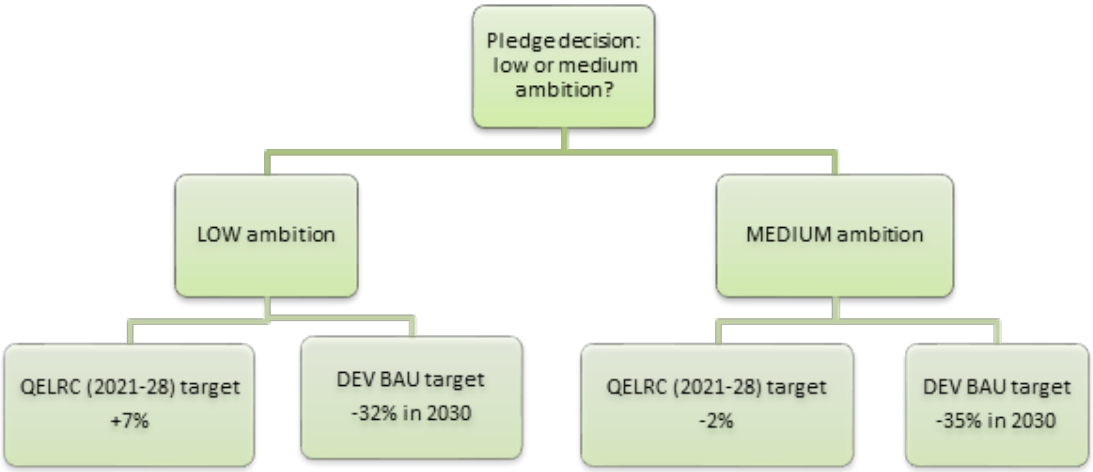


Figure A-1: Options and decisions to be made

Based on all the analyses conducted so far, the following can be recommended as the **first indicative pledge of the Republic of Macedonia**:

DEVELOPING COUNTRY LIKE TYPE OF PLEDGE

LOW AMBITION: 20% deviation of BAU in 2020 and 30% deviation of BAU in 2030, achievable with WEM measures

MEDIUM AMBITION: 25% deviation of BAU in 2020 and 35% deviation of BAU in 2030 achievable with WAM measures

DEVELOPED COUNTRY LIKE TYPE OF PLEDGE

LOW AMBITION: 7% change for GHG emissions for budget period 2021-2028 compared to 1990 level

MEDIUM AMBITION: -2% change for GHG emissions for budget period 2021-2028 compared to 1990 level

However, **the process of determination of national contributions should be continued in an intensive dialog with the relevant policy makers and other stakeholders, using the existing technical and analytical capacity.** Specifically,

- The three sectors covered by FBUR, buildings, transport and energy supply, should be revisited, to confirm/revise measures in WEM and especially in WAM scenarios;
- The analysis should be extended to other sectors, as waste, agriculture and industry;
- Sensitivity analyses concerning the base year should be conducted (having in view relevant UN and EU processes) and most adequate base year should be agreed upon;
- Peaking year should be determined for WEM and WAM scenarios (following the suit of the recent indicative pledge of China);
- Given the EU candidate status, Macedonian mitigation contribution should be analysed in the context of EU 2030 climate and energy package;
- The model should be refined so that ETS and non-ETS sectors may be modelled separately, having in mind different measures applied in them. ETS sector will be mainly governed by the price of emission certificates, while the non-ETS sector will continue to be governed by the national polices and measures;

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