Montenegro

SECOND BIENNIAL UPDATE REPORT
ON CLIMATE CHANGE

2019

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4AR – Fourth Assessment Report
AFOLU – Agriculture, Forestry and Other Land Use
BAT – Best Available Technology
BUR – Biennial Update Report
CAPEX – Capital Expenditure
CC – Climate Change
CO_2eq – Carbon Dioxide Equivalent
CRF – Common Reporting Format
DCC – Directorate for Climate Change
EC – European Commission
ECRAN – Environment and Climate Regional Accession Network
EDS – Energy Development Strategy
EE – Energy Efficiency
EEPPB – Energy Efficiency Programme in Public Buildings
EPA – Environmental Protection Agency
EU – European Union
EU ETS – European Union Emissions Trading Scheme
FBUR – First Biennial Update Report
FOD – First Order Decay
GCF – Green Climate Fund
GEF – Global Environment Facility
GHG – Greenhouse Gas
GPG-LULUCF – Good Practice Guidelines for Land Use, Land-Use Change and Forestry
GWP – Global Warming Potential
HFC – Hydrofluorocarbons
HPP – Hydroelectric Power Plant
IEA – International Energy Agency
IHMS – Institute for Hydrometeorology and Seismology
INDC – Intended Nationally Determined Contribution
IPCC – Intergovernmental Panel on Climate Change
IPPU – Industrial Processes and Product Use
KAP – Aluminium Plant Podgorica
LEAP – Long-Range Energy Alternative Planning
LPG – Liquefied Petroleum Gas
MARD – Ministry of Agriculture and Rural Development
MCF – Methane Correction Factor
MEEP – Energy Efficiency in Montenegro

MEPX – Montenegrin Power Exchange
MMR – Monitoring Mechanism Regulation
MoE – Ministry of the Economy
MONSTAT – State Statistical Office
MRV – Monitoring, Reporting and Verification
MSDT – Ministry of Sustainable Development and Tourism
MTMA – Ministry of Transport and Maritime Affairs
NAP – National Adaptation Plan
NC – National Communication
NCCS – National Climate Change Strategy
NCSDCCICM – National Council for Sustainable Development, Climate Change and Integrated Coastal Management
NDC – Nationally Determined Contribution
NEAS – National Strategy with the Action Plan for Transposition, Implementation and Enforcement of the EU Acquis on Environment and Climate Change
NECP – National Energy and Climate Plan
NFI – National Forest Inventory
NIR – National Inventory Report
NSDS – National Sustainable Development Strategy
OPEX – Operating Expenses
ORF-EE – Open Regional Forum for South-East Europe – Energy Efficiency
PFCs – Perfluorocarbons
PIV – Protein intake value
RIPAP – Regional Implementation of the Paris Agreement
SBUR – Second Biennial Update Report
SD – Sustainable development
SDG – Sustainable Development Goal
SMW – Solid Municipal Waste
SNC – Second National Communication
SPP – Solar Power Plant
SUMSEEC – Sustainable Urban Mobility in South-East European Countries
TCNT – Towards Carbon-Neutral Tourism in Montenegro
TNC – Third National Communication
TPP – Thermoelectric Power Plant
UNFCCC – United Nations Framework Convention on Climate Change
WAM – With Additional Measures
WEM – With Existing Measures
WPP – Wind Power Plant
QA/QC – Quality Assurance/Quality Control

Montenegro

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EXECUTIVE SUMMARY

MONTENEGRO is a mountainous country in South-East Europe, on the Balkan Peninsula. The total area of the territory is 13 812 km^2, while the territorial sea area is 2 540 km^2. There are 1 256 settlements in the country, of which 40 settlements are of a city type and in which about 62% of the population lives, while the rest of the population lives in rural settlements. During recent years, the migration of the population has increased from less developed areas of the northern region to the central and coastal regions, where living conditions are more favourable. This migration has increased pressure on resources in urban settlements. This negative impact has also been reflected in rural areas, especially in the mountains, since a lot of land is now uncultivated and has reverted to weeds, bushes and trees.

Montenegro has 620 029 inhabitants (2011 Census). Of this population, 26.3% are younger than 19 years old, 60.9% 19–65 years old and 12.8% over 65 years old. Of the 26.3% under 19, 51.9% are male and 48.1% are female; in the group between 19 and 65 years the ratio was 49.5% vs. 50.5% (male vs. female) and in the older group there was a higher percentage of women, 57.1% vs. 42.6%.

Montenegro regained its independence in 2006 and has a parliamentary political system. Administratively, it is divided into 23 political-territorial units, i.e. municipalities, which perform local governance functions. The capital of Montenegro is Podgorica, which is also the largest city (with 186 000 inhabitants).

The period between 1990 and 2015 was accompanied by major changes in the structure of economic activity. The share of agriculture, and industry, has significantly decreased in terms of gross value added (GVA). By 2015, industry had reduced its share in the GVA from 20.8% to only 12.9%. According to the industrial policy, by 2020 we can expect a gradual recovery. In 2030 the largest contribution to the GVA is expected to be from the services sector, predominantly from tourism (67% GVA, and 79% employment) with some recovery in industry, up to 20% in 2020, and to 22% in 2030, with a growth in employment by up to 13%.

The energy sector is the main source of anthropogenic greenhouse gas (GHG) emissions. In Montenegro this accounted for 72.37% of the total GHG emissions in 2015. The main energy-consuming industrial processes in Montenegro are mining and the metal industry. In the metal industry sector, the most prominent activities are aluminium and steel production. Other industrial facilities involve the processing of food, beverages, tobacco, textiles, agricultural lime, leather products, paper, medications and rubber and plastic products.

In recent years, Montenegro's tourist sector has experienced rapid development with an increase in the number of visitors and investments, becoming the main and most dynamic economic sector. In the business-as-usual scenario, in 2020 the tourist sector's GHG emissions will rise to 40% above the 1990 baseline. As a result, Montenegro's government has decided to curb the sector's emissions and pursue low-carbon development.

In Montenegro, the transport sector accounts for 20% of the national GHG emissions, and it is the only sector where substantial increases in GHG emissions have been observed. The upward trend is predicted to continue and increase to nine times the 1990 value by 2030. There are many old vehicles (produced in the period 1980–1994), and the average age of all registered vehicles in 2013 was 14.9 years. The largest share in road transport is occupied by passenger and commercial vehicles.

Agricultural land in Montenegro covers an area of 309 241 hectares and represents 22.4% of the territory (95.2% are family farms and 4.8% registered agricultural businesses). It is fragmented. Due to the depopulation of rural areas, forests are encroaching, and pastures and meadows are turning into forest land. The increasing prevalence of forest fires is causing damage, in addition to the loss of wood and biomass. There is also a reduction in the resistance in forests and in their biodiversity, and in the destruction of authentic landscapes and soil structures, all of which have contributed to erosion and serious degradation of the land.

STRATEGIC FRAMEWORK

The National Climate Change Strategy (NCCS) is the key strategic overview of the area of climate change in Montenegro to 2030. It provides guidance and direction for climate-change policies, as well as analysis of the mitigation policies measures and actions that will be implemented during this period to reduce GHG emissions. The NCCS has a strong focus on harmonization with the EU's climate-change legislative framework, as well as mitigation measures, while it is relatively vague on adaptation to climate change.

Montenegro has also established a high-level, multi-institutional council, chaired by the President of Montenegro, which focuses on sustainable development. The council was established by the government in 2008, marking a positive development in inter-institutional coordination and cooperation. The council's 2013 reform strengthened its mandate in the field of climate change, as a strategic priority of the government towards the creation of a low-carbon society. In 2016, it became the National Council for Sustainable Development, Climate Change and Coastal Area Management (NCSDCCCAM – in the further text, the Council).

The government recently adopted the Strategy for Disaster Risk Reduction with the Dynamic Action Plan for the Implementation of the Strategy for the period 2018–2023. The strategy is a basic document aimed at highlighting the most important disaster risk reduction segments at the local and national levels.

Adaptation is not included in Montenegro's NDC, as Montenegro as yet does not have any adaptation policy and/or strategic document. However, Montenegro has a relatively pristine environment which is under threat from climate change. Montenegro needs to build adaptation into its national sector strategies and development practices and needs to make sure these fit well with its mitigation strategies and its wider sustainable development goals.

GHG EMISSIONS AND REMOVALS

Figure ES1 (total emissions and removal) shows the trends in GHG emissions and removals for the period 1990–2015. These trends have been derived from Montenegro's updated GHG emissions inventory prepared in 2018. Energy and industrial processes account for the largest shares of total CO_2eq emissions. Production of electricity and heat for manufacturing processes (including the aluminium production plant) has had the most significant impact on emissions. Transport emissions are increasing and expected to continue to increase as a result of Montenegro's blossoming tourist industry. PFCs in aluminium production, by-products of electrolysis, have been a major contributor to Montenegro's industrial process emissions. Recent reductions result from a reduction in output and from plant closures. Net emission removals in the categories of agriculture and land use are a result of Montenegro's forest land, which is a large carbon sink. This large forestry sink is slightly offset by emissions from livestock and fertilizers and being applied to soils by Montenegro's relatively small agricultural industry which is mainly traditional and in some areas organic. In addition, due to depopulation of rural areas, forests are encroaching, pastures and meadows are transformed into forest land, which also has an impact on the reduction of GHG emissions from the agriculture sector.

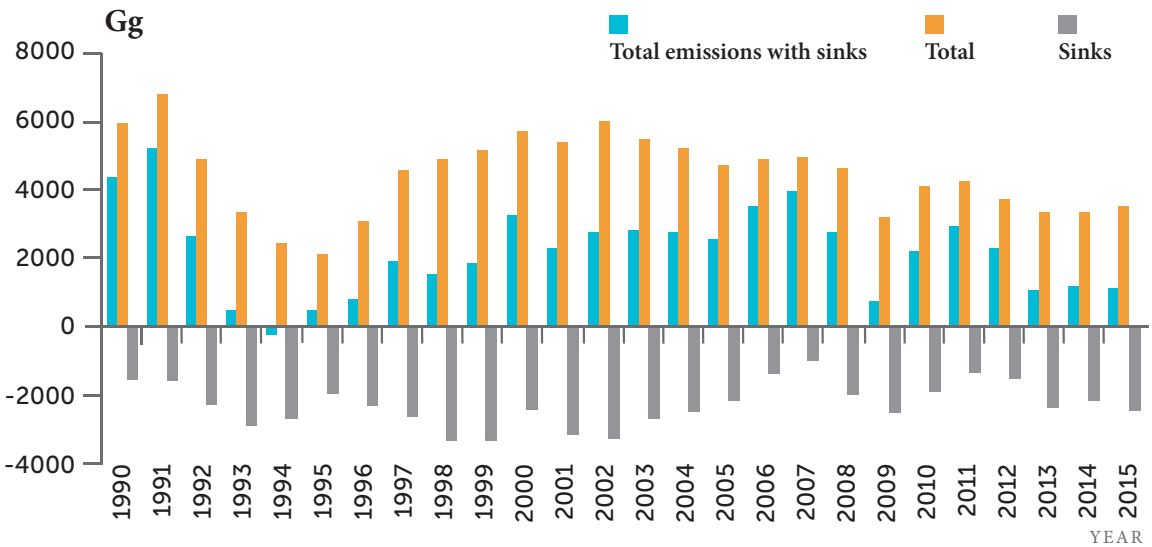


FIGURE ES1: Total GHG emissions expressed as CO_2eq with sinks, 1990–2015 (Gg)

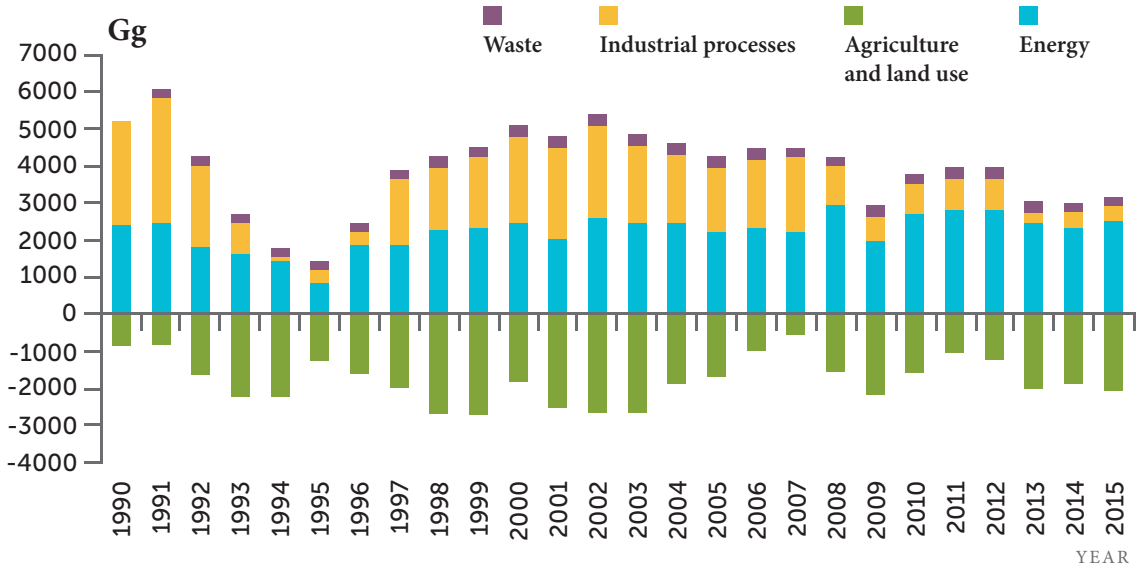


FIGURE ES2: GHG emissions expressed as CO_2eq by sector, 1990–2015 (Gg)

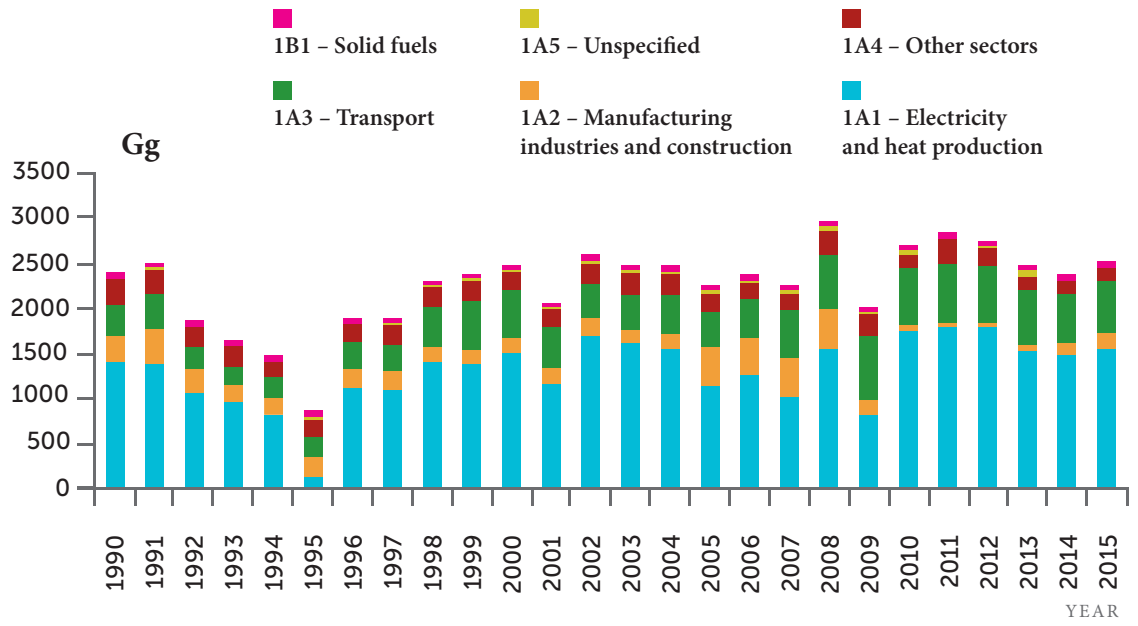


FIGURE ES3: Emissions CO_2eq from energy subsectors, 1990–2015 (Gg)

GHG EMISSIONS: REMOVAL TARGETS AND ACTION

Montenegro has set an ambitious GHG mitigation target through its NDC, which is for a 30% reduction in GHG emissions by 2030 (compared to the reference year 1990). Montenegro already achieved and exceeded in 2013 this target of a 40% reduction compared to the 1990 level. This was achieved as a result of reduced economic activity by the Aluminium Plant Podgorica (KAP) and in the agricultural sector, as well as a general decline in industrial activity since 1990 and the financial crisis.

Montenegro's need to continue to reduce GHG emissions has been taken extremely seriously, despite conflicting economically attractive opportunities for local coal and lignite, and a flourishing tourist industry. The forecast economic growth for 2017–2030 is based around clean energy (hydroelectric power plants (HPPs), wind, photovoltaic, biomass, and energy-efficiency programmes in transportation (building the national highway and other projects), industry (especially the metal industry), tourism (tourist resorts and hotels) and agriculture. Montenegro remains determined to use the energy resources trapped in the form of its coal deposits; hence plans for the modernization of its coal combustion plant to ensure the long-term stability of the power system and a reliable power supply from which to launch its low-carbon strategy. In the period 2017–2030, Montenegro hopes to continue to reduce GHG emissions without jeopardizing economic growth through:

- **Energy-efficiency measures**: Several years of investments in increasing energy efficiency in public (healthcare, education, cultural and administrative) buildings and residential buildings has occurred through two programmes: the Montenegro Energy Efficiency Programme (MEEP) and the Energy Efficiency Programme in Public Buildings (EEPPB), implemented by 2022 and 2020, respectively. These programmes have already resulted in great savings and, by extension, emission reductions.
- **Improvement of industrial technologies** (primarily in the metal industry)
- **Increase in the share of energy from renewable** sources in gross final energy consumption up to 33% by 2020. This includes installation of hydroelectric, PV, wind and biomass plants. One prominent domestic programme for households is Energy Wood, providing interest-free loans for households for purchasing and installing heating systems using modern forms of biomass. This programme is running in three phases, with 1 000 biomass-powered heating systems installed so far, reducing emissions by 1 388 tCO_2 annually.
- **Modernization of the energy generation and distribution sector.**

As the main driver of Montenegro's economic growth and investment, the tourist sector is responsible (directly and indirectly) for a large share of GHG emissions from transport, accommodation and other tourist-related activities. In April 2013, UNDP launched the Towards Carbon Neutral Tourism Project (www.lowcarbonmne.me), which will adopt a comprehensive approach to minimizing the carbon footprint of the most dynamic economic sector, with the ultimate objective of reducing GHG emissions from the tourist sector.

CONSTRAINTS AND GAPS

This report highlights **the support needed in delivering on Montenegro's commitments** under the Paris Agreement. These include capacity-building support, as well as support for the implementation of action. The following areas are elaborated in more detail in chapter 4.

- **Monitoring, Reporting and Verification (MRV) of GHG trends and mitigation action**:
  - » Permanent national system for the estimation of GHG emissions by sources and sinks and reporting of the inventory and national inventory reports (NIR).
  - » Update the existing rulebook to define concrete tasks for each contributing institution and/or data supplier.
  - » Conduct a detailed analysis of the obligations from the EU Monitoring Mechanism Regulation (MMR) and identify relevant gaps and needs.
  - » Training for key representatives in MSDT DCC to enhance knowledge and capacities.
  - » Continuous team building and capacity building for staff working in the relevant institutions.
  - » Training and deployment of systems relating to the GHG inventory.
  - » Capacity strengthening for drafting a low-carbon development strategy.

- **Support needed for the implementation of mitigation actions**:
  - » **Energy generation**: Hydro-potential, wind, solar energy and biomass, investment in energy infrastructure including: pipelines, new transmission-system facilities, upgrades of the existing transmission and distribution systems, support for entrepreneurship in the energy sector, and reductions of technical and technological losses in electricity generation and transmission/distribution.
  - » **Energy efficiency:** Energy-efficiency technology, widespread use of 'smart' systems in consumption management and in network technology.
  - » **Other mitigation actions**: Invest primarily in organic farming, smaller-scale investment in forestry, investment in solid waste disposal infrastructure, industrial waste and wastewater management facilities.
  - » **Capacity building in expertise and skills** required to implement mitigation measures. Expertise concerning energy efficiency and renewable-energy sources. Promotion and installation of solar PV systems in different economic sectors. Scientific institutions should also assume an important role and should take an active part in activities concerning capacity building.
  - » **Access to funds:** Support needed in accessing international funds that have relatively low interest rates (from international financial institutions and state-owned and private banks).
  - » **Raising the awareness of the public and of key decision makers**: Enhance public awareness regarding CC, in order to involve the private sector, local authorities and community engagement to reduce GHG emissions through incentives, workshops and the dissemination of material.

It is necessary to be cautious about the use of borrowing at high interest rates for the implementation of actions. In addition to allocations from the national budget, Montenegro should step up the implementation of EU support programmes in order to fund CC activities. More efforts are also needed to secure donations for projects, as this would diminish the need for loans.

MRV SYSTEM

Montenegro is striving to establish a national Monitoring, Reporting and Verification (MRV) system which will ensure its climate actions avoid conflicts with its sustainable development goals. Well informed, transparent decision making, which maximizes synergies between climate action (SDG 13) and the other SDGs is needed. This is only possible with an MRV system which provides stable and increasingly transparent, accurate and complete national data and an expert resource to use it to inform decision makers and international assessment of progress. Chapter 5 highlights the current state **of the MRV system in Montenegro**. The key goals of the MRV system are to:

- Gather evidence on Montenegro's climate challenges (e.g. GHG emissions, vulnerabilities and impacts) and opportunities (GHG removals, low-carbon development, new economic opportunities).
- Inform decision makers and to report information on Montenegro's progress in adaptation and mitigation, ambition, actions, their support (including climate finance) and their joint benefits.
- Establish and maintain national expertise in CC and climate actions to support Montenegro in developing a low-carbon, well adapted and climate-resilient economy.
- Provide technical advice and guidance to government, national negotiations, national action implementation, businesses and the public on climate challenges, action and progress.
- Provide transparent, high-quality reports (e.g. national reports, NCs, BURs, NDCs).

Montenegro's MRV system is in its infancy. It is designed to support reporting on NCs, on Biennial Update Reports, on GHG Inventories and the provision of other relevant information on climate action on a regular basis. Montenegro is working towards a higher level of transparency than is mandatory for non-Annex-I countries and is regularly preparing inventories and has also prepared two NCs and two BURs.

Montenegro is in the process of drafting the Law on Climate Change which will regulate the mitigation of and adaptation to the negative impacts of CC. Through this law, the competent authority for environmental affairs (the MSDT) is committed to delivering the National Climate Change Adaptation Plan and for the coordination of MRV activities tracking mitigation action. Furthermore, the law will include development of GHG inventory, ETS, as well as GHG emission projections. Other relevant ministries will be mandated with the implementation of specific climate actions.

CHAPTER

National Circumstances

GENERAL INFORMATION

Montenegro is a mountainous country in South-East Europe, on the Balkan Peninsula. The total area of the territory is 13 812 km^2, while the territorial sea area is 2 540 km^2. The length of its land borders is 614 km, while the Adriatic Sea coastline is 316 km.

Montenegro regained its independence in 2006 and has a parliamentary political system. Administratively, it is divided into 23 political-territorial units – municipalities – which perform the function of local governance. The capital of Montenegro is Podgorica, which is also the largest city (with 186 000 inhabitants), while the city of Niksic is the second-largest (with 72 450 inhabitants).

DEMOGRAPHIC AND POPULATION TRENDS

According to census data from 2011, Montenegro has 620 029 inhabitants, with a density of population of 44.9 inhabitants per km^2. Out of a total number of 620 029 inhabitants, 306 236 are male and 313 793 are female. According to the census, 26.3% of the population were younger than 19 years old, 60.9% were 19–65 years old and 12.8% were over 65 years old. Of the younger generation, 51.9% are male and 48.1% are female; in the group between 19 and 65 years the ratio of male to female was 49.5% vs. 50.5% and in the older group there was a higher percentage of women, 57.1% vs. 42.6%.

There are about 1 256 settlements in the country, of which 40 settlements are of a city type, where about 62% of the population lives, while the rest of the population live in rural settlements. Out of the total number of women, 65.5% live in urban areas, while for men this percentage is 63.2%.

During recent years, migration of the population has increased from the less developed areas of the northern region to the central and coastal regions, where living conditions are more favourable.

This migration has increased pressure on resources in urban settlements which developed for industrial and residential use. This negative impact has been reflected in rural areas, especially in the mountains, since a lot of land is now uncultivated and has reverted to weeds, bushes and trees.

LAND USE

The variety of soil in Montenegro is the result of interaction between natural soil factors, the relief, parent substrata, climate, vegetation and living organisms, including man-influenced, as well as paedogenesis, processes. Their conjunction has formed mainly autogenous, and to a much lesser extent hydrogenous, land.

Agricultural land in Montenegro covers an area of 309 241 hectares and represents 22.4% of the territory (95.2% is family farms and 4.8% is registered agricultural businesses) and is very fragmented.

Due to the depopulation of rural areas, the forests are encroaching and pastures and meadows are turning into forest land.

Data from the National Forest Inventory (NFI), prepared in 2010, shows that forests cover 60% of the territory of Montenegro, while forest soil covers an additional 9.7%, which represents a significant part of the country's territory. In its structure, high forests cover 51.1% of the country's territory and represent 48.9% of the total forest area. Most of the high-forest areas are in the northern part of Montenegro. Coppice forests are a characteristic of the central and coastal parts of the country, while on the coast there are substantial areas of forest underbrush and small areas occupied by wild scrubland and degraded forest formations.

According to the NFI, Montenegro is characterized by a dominance of hardwood trees, which occupy 76.2% of the forest area, while 23.8% of forest areas are covered by coniferous forest. Dominant species are beech, oak, spruce, fir and pine. The proportion of species present on the surface in relation to their proportion of volume differs significantly. The total number recorded in the inventory includes: 59 deciduous and 12 coniferous tree species.

Within the context of the degradation of forest land, fires have caused significant damage in addition to the loss of wood; this is reflected in the degradation of the environment, in a reduction of resistance in forests and in their biodiversity, and in the destruction of authentic landscapes and soil structures, all of which have contributed to erosion and serious degradation of the land.

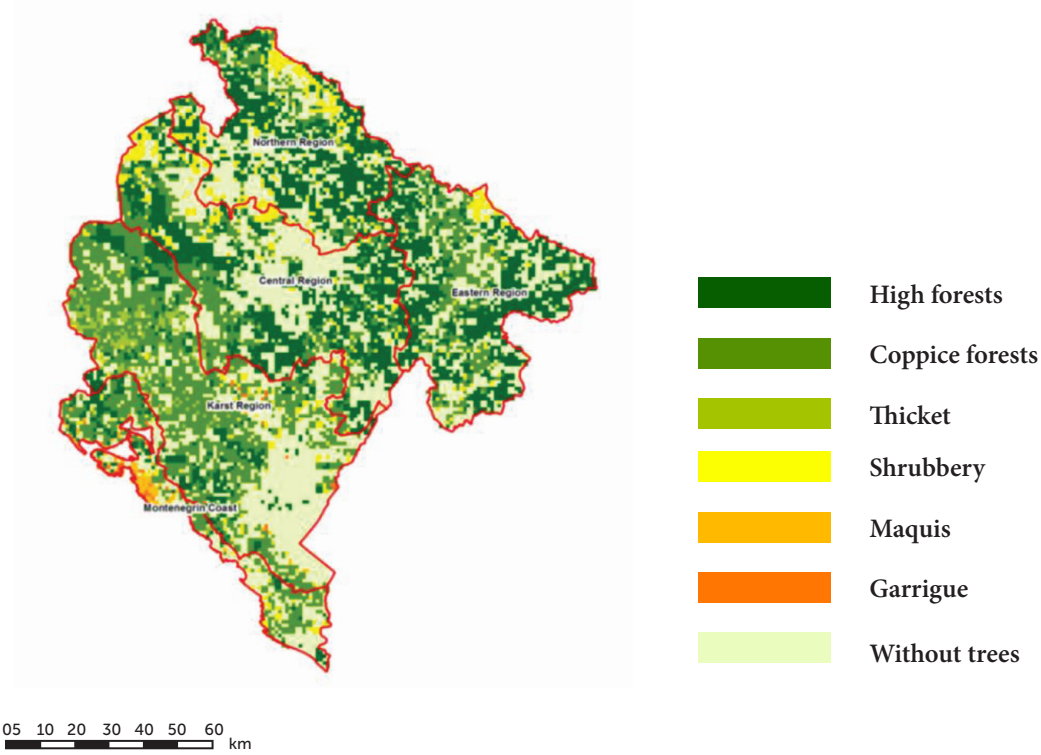


FIGURE 1: Categories of Forests in Montenegro

CLIMATE CHANGE AND ECONOMIC PARAMETERS

Climate change is nowadays a central challenge to people and places around the globe. The costs of inaction are high, and smart solutions can drive economic opportunities, innovation and greater energy reliability, which are goals that all humans can embrace. Through the Paris Agreement (PA) the world agreed on a path forward and for the first time agreed on mutual action, which rocketed climate change to the top of the list of global issues.

Accelerating action to adapt to and mitigate the consequences of climate change is critical. Montenegro has set an ambitious GHG mitigation target through its NDC, which is for a 30% GHG emission reduction by 2030 (compared to the 1990 reference year). The need to reduce GHG emissions has been taken extremely seriously despite conflicting economically attractive opportunities of local coal and lignite availability and a flourishing tourist industry. Montenegro has a relatively pristine environment which is under threat from climate change. Therefore, building resilience through adaptation has to be Montenegro's primary objective. Montenegro needs to build adaptation into its national sectoral strategies and development practices and needs to make sure these fit well with its mitigation strategies and its wider sustainable development goals.

Montenegro is striving to establish a national Monitoring, Reporting and Verification (MRV) system which will ensure its climate actions avoid conflicts with its sustainable development goals. Well-informed transparent decision making, which maximizes synergies between climate action (SDG 13) and the other SDGs is needed. This is only possible with an MRV system which provides stable and increasingly transparent, accurate and complete national data, and an expert resource to use it to inform decision makers and international assessment of progress.

Based on data from the State Statistical Office (MONSTAT), the gross domestic product of Montenegro in 2015 amounted to €3 625 million, while in 2014 it amounted to €3 458 million. Gross domestic product per capita in 2015 amounted to €5 826, while in 2014 it amounted to €5 561.

TABLE 1: Gross Domestic Product 2014–2015

		2014	2015
1	Gross domestic product at current prices, € millions	3458	3625
2	Population, thousands	621.8	622.2
3	Gross domestic product at constant prices (last year's prices), € millions	5561	5826
4	Gross domestic product at constant prices (last year's prices), € millions	3422	3575
5	Real GDP growth (%) (GDP at current year's current prices / GDP in current prices of the previous year) x 100 – 100	1.8	3.4
6	Nominal GDP growth (%) (current year current GDP / GDP at current prices in the previous year) x 100 – 100	2.8	4.8
7	Deflator (%) (current year current GDP / GDP at constant prices for the current year) x 100 – 100	1.1	1.4

The graph below (Figure 2), presented in the Socio-Economic Analysis[1] developed for the purposes of ratification of the Paris Agreement, shows the real growth rate of Gross Domestic Product (GDP) and industrial output during the period 1990–2016. Their correlation can be seen in the period of transitional recession during the nineties, as well as during the economic crisis, but also a gradual change of the structure of the Montenegrin economy, from the "over-industrialized" economy of the Yugoslav market to the gradual construction of an open, euroized (*introduction of the euro as its currency) and a service-oriented economy, with a development model based on FDI growth and the strengthening of the services sector (which marks the biggest increase in employment).

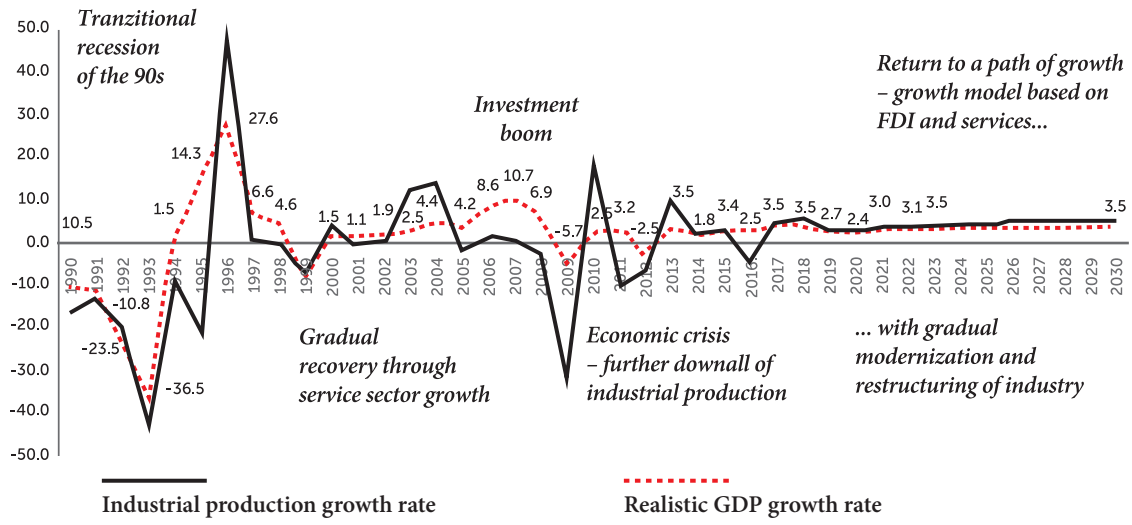


FIGURE 2: Real growth rate of GDP in the period 1990–2016 and projections until 2030 (IMF until 2022); Industrial production index in the period 1990–2016 and its gradual modernization and restructuring until 2030.

As stated in the above mentioned socio-economic analysis, the period between 1990 and 2015 was also accompanied by major changes in the structure of economic activity and registered employment and unemployment (Table 2). The share of agriculture, and industry in particular, has significantly decreased both in terms of gross value added (GVA) and in terms of employment, while industry participated the most in the growth of registered unemployment. By 2015, industry had reduced its share in the GVA from 20.8% to only 12.9%. According to the industrial policy, by 2020 we can expect a gradual recovery (up to 20% in the GDP), so its gradual growth can be expected in the structure of the GVA up to 22% in 2030, with growth in employment up to 13% of the total registered employment. Furthermore, in 2030 the largest contribution to the GVA is projected to be provided by the services sector (a relative reduction down to 67% of the GVA, and up to 79% of employment). With a gradual recovery of the economy and with an average rate of 3.5% in the period after 2022, a decrease in registered unemployment is expected, where the goal would be to reduce the rate to a single digit by the end of the period from 10.3% to 9.5%. The number of employees in the industrial sector would increase from 20 900 in 2015 to 27 000 in 2030.

[1] "Socio-Economic Analysis of Investments for Ratification of Paris Agreement", G. Đurović, S. Perović, N. Jablan, June 2017.

TABLE 2: The participation of the sectors in Gross Value Added (GVA) and employment in 1990, 2000, 2010 and 2015, and projections for 2030.

Structure/sectors	1990		2000		2010		2015		2030*	
	% BDV	% empl.	% BDV	% empl.	% BDV	% empl.	% BDV	% empl.	% BDV	% empl.
Agriculture and forestry	12.2		12.5	2.1	9.2	1.4	9.8	1.5	6.0	2.0
Industry	20.8		19.1	25.3	14.6	15.3	12.9	11,9	22.0	13.0
Construction	4.0		4.3	4.8	5.9	5.0	4.6	5,3	5.0	6.0
Other services	63.0		64.1	67.8	70.3	78.3	72.7	81.3	67.0	79.0
Total (€ millions and thousands of empl.)	1 618	169.5	966	140.7	2 608	161.7	2 992	175.6	100	210
Registered unemployment	53 700		81 100		32 026		39 991		24 000	
Unemployment rate	24.1		36.6		16.5		18.5		9.5–10.3	

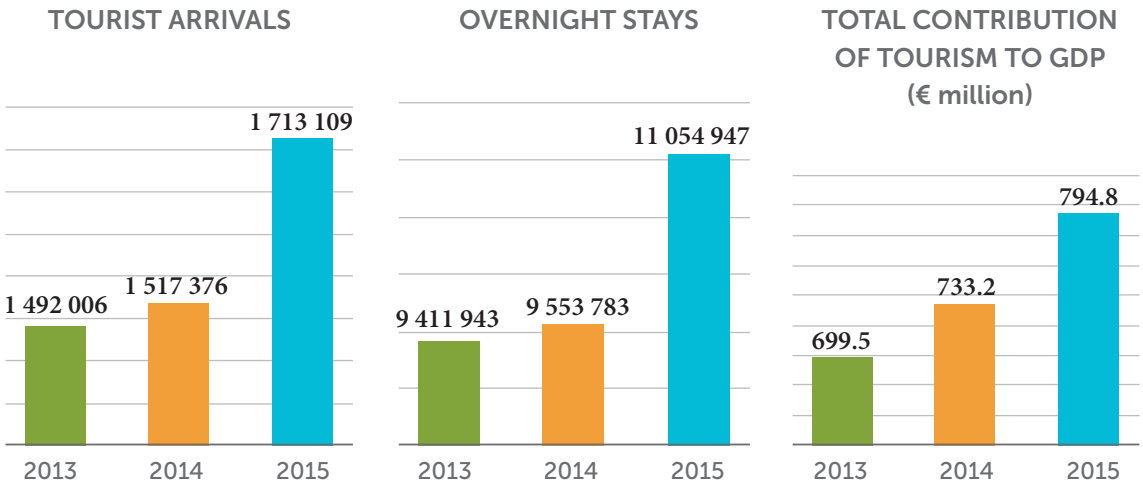
Source: *MONSTAT, UNSTAT (GAV for 1990) and projections for 2030*

TOURISM

In recent years, Montenegro's tourist sector has experienced rapid development with an increase in the number of visitors and investments, becoming the main and most dynamic economic sector. As a major contributor to the country's gross domestic product (GDP), it is one of the strategic drivers of economic growth. However, in the business-as-usual scenario, the tourist sector's greenhouse gases (GHGs) emissions will rise to 40% above the 1990 baseline in 2020. As a result of this state of affairs, Montenegro's government has decided to curb the sector's emissions and pursue its low-carbon development.

Montenegro registered 1 713 109 tourists arrivals during 2015, representing an increase of 12.9% in relation to the previous year. The total overnight stays of tourists accounted for 11 054 947 nights, 15.7% more than in 2015 (MONSTAT, 2016).

The total contribution of tourism to the national GDP was estimated in €794.8 million (22% of total GDP), 8.4% more than in 2014 (World Travel & Tourism Council, 2016).



Source: Study "GHG emissions for Tourism in Montenegro, developed by "Factor CO_2"

FIGURE 3: Main tourism figures for 2013–2015

AGRICULTURE

In 2013 agriculture created 2 771 registered jobs (1.6% of the total number of employees in Montenegro). However, this calculation did not take into consideration jobs created by family farms (according to the 2010 census, 48 824 family farms engaged a total of 98 341 people; calculated as annual work units, this represents almost 30% of the total employment in Montenegro). In 2013, GDP was €3.327 billion, of which agriculture represented €436.8 million (an increase of €42.4 million). Imports in 2013 amounted to €470.6 million (26.4% of all imports).

Primary agriculture represented the greatest share of GDP. Poor product finalization in rural areas is due to a focus on self-subsistence, the sale and marketing of products through unregistered channels, a lack of cooperation between producers, poor market information and the infrequent use of new technology.

ENERGY AND INDUSTRY

The energy sector is the main source of anthropogenic GHG emissions. In Montenegro it accounted for 71.8% in 2014 and 72.37% in 2015 of the total GHG emissions. The energy sector includes all the activities referring to combustion of fuels (solid, liquid, gaseous and bio fuels) from stationary and mobile sources, as well as fugitive emissions. Fugitive emissions arise during production, transportation, processing, storage and distribution of fossil fuels.

According to the energy balances, energy production in Montenegro in 2014 and 2015 was as follows:

TABLE 3: Energy Production in Montenegro 2014–2015

	2014 (GWh)	2015 (GWh)	2014/2015 (%)
Hydro-power plants	1 686	1 460	-13.4
Thermo-power Plant	1 322	1 411	6.73
TOTAL	3 008	2 871	-4.55

- Hydroelectric power plant "Perućica" produced 783 GWh;
- Hydroelectric power plant "Piva" produced 631 GWh;
- Thermoelectric power Plant "Pljevlja" produced 1 411 GWh;
- Small HPPs produced 45.5 GWh.

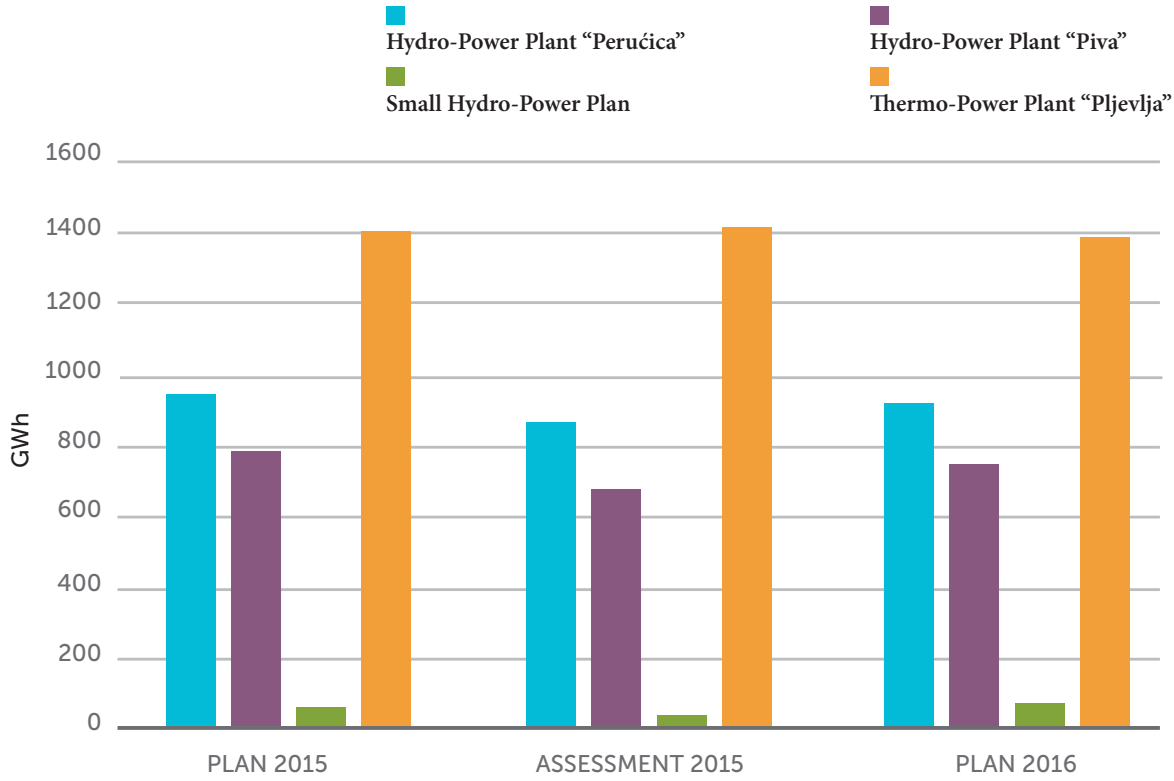


FIGURE 4: Energy production in the period 2015–2016

In relation to energy consumption, according to the energy balances, the biggest energy consumers are the distributive network and the Podgorica Aluminium Plant.

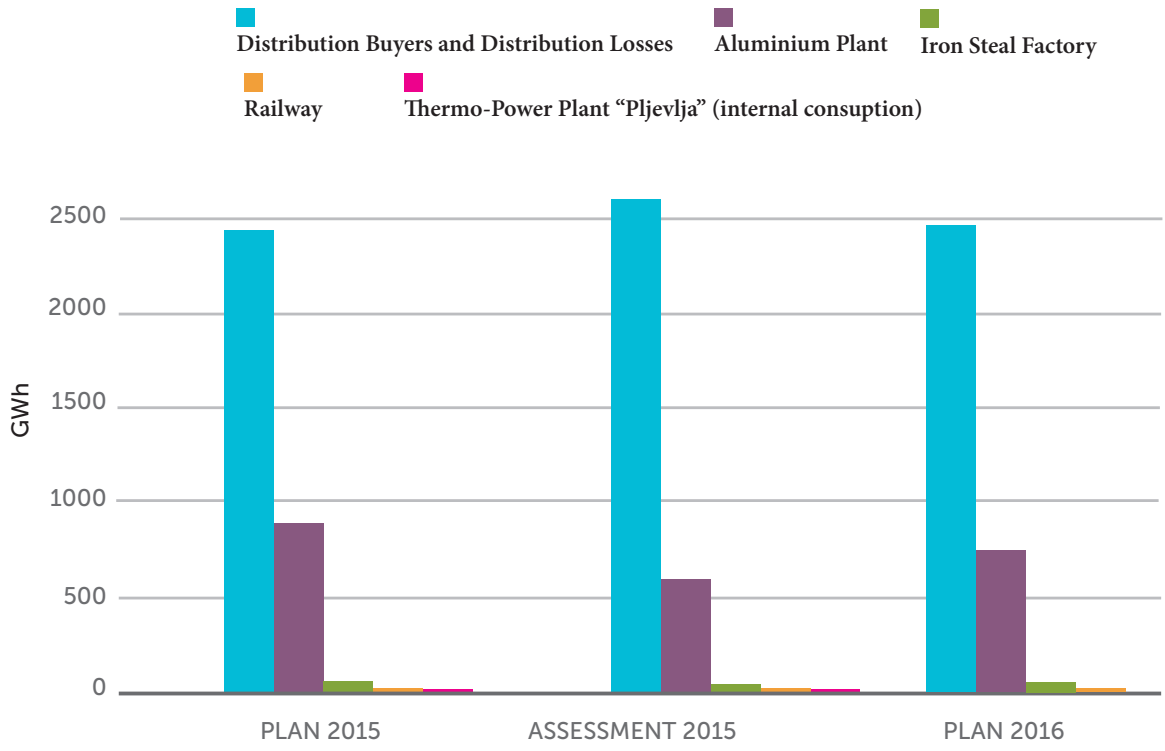


FIGURE 5: Energy Consumption

The main industrial processes in Montenegro are mining and the metal industry. In the metal industry sector, the most prominent areas are aluminium and steel production. Other industrial facilities include the processing of food, beverages, tobacco, textiles, agricultural lime, leather products, paper, medications and rubber and plastic products.

Before 1991, the economic development of Montenegro was characterized by intensive industrial production, where GHG emissions from industrial processes accounted for 49.6% of the total in 1991. After that, the industrial production saw a steady decline, with the total emissions from this sector accounting for 11.7% of the total in 2014, and no more than 10% in 2015.

Industrial plants predominantly use obsolete technology characterized by high levels of emissions. The largest industrial facilities operate in extractive metallurgy and metal processing. Recently, the structure of industrial production changed somewhat due to an increase in food and beverages and the introduction of chemical production.

There are many mining and mineral zones in Montenegro and they are spread over large areas. Research in Montenegro's terrain has identified 28 kinds of mineral resources, of which 15 have been exploited. It is estimated that 23 mineral types are raw materials that are of economic importance. In the previous spatial plans, the areas that are meant to be preserved for exploitation have not been precisely indicated. Data on the occurrence and deposit levels of white and red

bauxite shows that almost one-third of the territory of Montenegro could be registered for this purpose. Coal mines are present near Berane and Pljevlja.

The most important ore minerals are red and white bauxite, followed by lead-zinc ore, lignite, brown coal, copper, mercury, mineral resources for architectural and building purposes, including building stone and decorative stone, tufa, gravel, sand, brick clay, cement marl, dolomite, barytes, bentonite, quartz sand, etc. Bauxite mines exist in the high karst areas (the most important of which are located in the Municipality of Niksic, in Niksic Zupa), and lead and zinc mines which are located in Mojkovac and Pljevlja. Copper ore, which has not yet been exploited, is present in Varina, near Pljevlja. Architectural construction stone is present in several locations and in all parts of Montenegro. The total geological reserves of red bauxite amount to 96.244 million tons, white bauxite amounts to about 1.65 million tons with further potential reserves estimated at a level of around 2.9 million tons, and the total reserves of lead and zinc amount to 46.83 million tons. Geological reserves of copper in Pljevlja are estimated at 5.297 million tons with further potential reserves estimated at around 2 041 million tons. The total reserves of architectural building stone are estimated at around 95 million tons.

TRANSPORT

In Montenegro, the transport sector accounts for 20% of the national GHG emissions and it is the only sector where substantial increases in GHG emissions have been observed and this upward trend is predicted to continue: from 110 $ktCO_2eq$ in 1990 (NDC baseline year), up to 609 $ktCO_2eq$ in 2013 and further, up to 993 $ktCO_2eq$ in 2030 in the business-as-usual scenario, i.e. more than a nine-fold increase compared to the baseline. The National Climate Change Strategy identifies transport as a priority sector for climate-change actions and outlines a number of measures and targets related specifically to increasing the use of public transport and the promotion of more energy-efficient vehicles and electric vehicles for public and individual transportation. The strategy also stresses the need to increase the resilience of the transport sector to predicted climate impacts due to its vulnerability and the key role it plays in the country's economic and social development.

Based on the Action Plan for the Application of Renewable Energy Sources and Energy Efficiency Measures in the Transport Sector[1], the transport sector in Montenegro is based on oil derivatives (petrol, diesel fuel and LPG) for road traffic and electricity for rail traffic, while road traffic makes up the most significant share. According to the structure of fuels used to drive registered vehicles in the last 5 years, the highest-represented vehicles run on diesel and motor gasoline. The use of biofuels and other alternative fuels (except LPG) is not represented. Implementation of energy-efficiency measures in the transport sector is still at its very beginning.

The largest share in road transport is occupied by passenger and commercial vehicles, while the other remaining categories are represented with a very low participation. In addition, there are

[1] EU-funded project implemented by European Profile and Eptisa.

many old vehicles (produced in the period 1980–1989 and 1990–1994), and the average age of all registered vehicles in 2013 was 14.9 years. Considering the age structure, most of the vehicles do not meet the Euro-3 standard, while the number of vehicles that meet the Euro-5 standard is relatively small (9%). Petrol stations are well distributed over the territory of Montenegro, of which 71 (67.6% of the total number) provide a supply of LPG. All municipalities, except for the Royal Capital of Cetinje, have organized public transport. The total number of public transport routes is 106 – the largest number of routes is in the Municipality of Podgorica (28), and the smallest is in the Municipality of Berane (3). All municipalities have a larger number of suburban public transport routes compared to the number of city routes. Some municipalities (Berane and Danilovgrad) have only suburban routes. The length of public transport routes varies considerably in different municipalities: the smallest length of routes is in the municipalities of Berane and Tivat, and the largest is in the municipalities of Niksic and Podgorica. The largest number of transported passengers is in the Municipality of Podgorica, and the smallest is in the Municipality of Berane. The lowest age of vehicles is in the Municipality of Danilovgrad (5 years) and the highest is in the Municipality of Niksic (up to 16 years old), while in all other municipalities this figure exceeds 7 years. The share of private carriers engaged in public transport is low – the largest are in the municipalities of Danilovgrad and Bijelo Polje, and this is relatively low in Podgorica, Bar, Herceg Novi, Tivat and Ulcinj.

INSTITUTIONAL FRAMEWORK FOR CLIMATE CHANGE IN MONTENEGRO

Montenegro became a party to the UN Framework Convention on Climate Change (UNFCCC) by succession, after becoming independent in 2006, being a non-Annex-I Party to the UNFCCC.

The Ministry of Sustainable Development and Tourism (MSDT) is the main national entity responsible for national environmental and climate-change policy and the National Focal Point to the UNFCCC.

Montenegro adopted the Law on Ratification of the Paris Agreement in October 2017, confirming its INDC submitted to the UNFCCC in September 2015, with a goal of a 30% GHG emission reduction by 2030 (compared to the reference year 1990).

Montenegro's institutional set-up and capacities have showed some progress over the past years. Montenegro prepared and submitted its Initial National Communication (INC) in 2011. The report focused mainly on the preparation of a detailed inventory of GHG emissions and a general description of the steps taken or envisaged to implement the Convention. The Second National Communication (SNC) was submitted in May 2015. The First Biennial Update Report (FBUR) was prepared and submitted to the UNFCCC Secretariat in January 2016. Furthermore, Montenegro prepared its first Technology Needs Assessment report (TNA) in 2012, which identified and assessed appropriate mitigation and adaptation technologies for the Montenegrin context.

The National Climate Change Strategy (NCCS) to 2030 is the key strategic overview in the area of climate change in Montenegro until 2030. It provides guidance and direction for climate-change policies until 2030, as well as analysis of the mitigation policies measures and actions that will be implemented during this period in order to reduce GHG emissions. The NCCS has a strong focus on harmonization with the EU climate-change legislative framework, and it is relatively vague on adaptation to climate change.

Montenegro has also established a high-level multi-institutional council, chaired by the President of Montenegro, which focuses on sustainable development. The council was established by the government in 2008, marking a positive development in inter-institutional coordination and co-operation. The council's 2013 reform strengthened its mandate in the field of climate change, as a strategic priority of the government towards the creation of a low-carbon society. In 2016, this became the National Council for Sustainable Development, Climate Change and Coastal Area Management (NCSDCCCAM – in the further text, the Council).

Additional climate-change-related policies include the 2016 National Strategy of Sustainable Development to 2030 (NSSD) and the National Strategy with Action Plan for Transposition Implementation and Enforcement of the EU Acquis on the Environment and Climate Change 2016–2020 (NEAS). As key strategic document, climate-change issues are articulated throughout the NSSD. The NSSD also introduced the concept of resource efficiency and the need for a circular economy. These concepts are considered a significant contribution to the achievement of climate-change policy goals. NEAS is a critical aspect of establishing the necessary actions to meet the EU's climate-change requirements and the costs of full alignment with the EU's environmental and climate-change requirements. It also provides a baseline against which the government determines its progress.

Montenegro is currently preparing the Law on Climate Change, the very first piece of legislation related specifically to climate change. The law will encompass EU requirements in this area, i.e. it will be in line with the EU Acquis (e.g. ETS, MMR, etc.).

Country commitments

The 30% reduction is an economy-wide absolute emission reduction target, covering all GHG, not controlled by the Montreal Protocol and includes the following sectors: energy, industrial processes, agriculture and waste. GHG removals from forestry and other land use are not included in the accounting, due to the relatively high uncertainty of this data. Montenegro reserves the right to review its NDC to 2020, upon the availability of more accurate data and improved technical studies regarding land use, changes to land use, and forestry and to include this in its updated NDC. An adaptation component is also not included in the NDC, as Montenegro does not have any adaptation policy and/or strategy document as yet. The level of emissions of greenhouse gases from the sectors included in the NDC amounted to 5 239 kilotons of CO_2eq in 1990. Montenegro is committed to reducing this by at least 30%, i.e. by 1 572 kilotons of CO_2eq, to a level that is lower than or equal to 3 667 kilotons CO_2eq, by 2030.

As early as 2013, there was a significant reduction in GHG emission by about 40% compared to 1990 levels, which was achieved primarily by reducing the activity in the sector of industrial processes (Aluminium Plant Podgorica (KAP)) and in the agricultural sector. Thus, the energy sector increased its share in total GHG emissions (excluding sinks) to 76% in 2013.

It is important to note that, in the previous period, the reduction in GHG emissions was a result of an overall decrease in economic activity, especially in the metal industry sector in the period of the so-called "transitional recession" of the 1990s and its gradual and modest recovery since the beginning of the 21st century to the present day.

The forecast economic growth for the period 2017–2030 is based on priority development projects in the fields of: energy generation (hydroelectric power plant (HPP), small HPPs, wind power plants, photovoltaic power plants, the thermoelectric power plant (TPP) Pljevlja II, energy-efficiency programmes, etc.), transportation (building the national highway and other projects), industry (especially the metal industry), tourism (tourist resorts and hotels) and agriculture. Long-term projects are covered by special studies and sector strategies (Energy Development Strategy (EDS) to 2030 and the associated 2016–2020 action plan), as well as by the National Sustainable Development Strategy of Montenegro (NSDS) until 2030 with its 2016–2020 action plan and the National Climate Change Strategy to 2030 (NCCS).

In the period 2017–2030, without jeopardizing the growth of economic activities, measures to reduce the GHG emissions should be primarily realized through:

- Energy-efficiency measures
- Improvement of industrial technologies (primarily in the metal industry)
- An increase in the share of energy from renewable sources in gross final energy consumption of up to 33% by 2020
- Modernization of the energy-generation sector

The socio-economic analysis of investments developed prior to ratification of the PA covers the investments in three sectors (energy, industry and agriculture) needed to achieve the NDC mitigation goal, as well as the sources and amounts of funding for each investment. The main purpose of the socio-economic analysis was to explore whether ratification of the PA would have a positive net contribution/effect for the wider community (to achieving long-term sustainability, including economic and wider social development) and whether it is therefore worth being implemented. In line with this study, funding of priority investment projects for the period 2017–2030 amounts to €1.754 million, of which 91% will be derived from investors, while 9% will come from public funds.

TABLE 4: Sources of funding priority investments for the implementation of INDC[1]

	INVESTMENTS	Total	Sources of funding programmes and projects			
		2017–2030	Budget (including loans and grants, i.e. donations)		Investor	
		€ million	€ million	%	€ million	%
I	ENERGY					
1	**New hydroelectric power plants**					
	1.1 River Morača Hydroelectric Power Plants Project	493.71			493.71	100
	1.2 River Komarnica Hydroelectric Power Plant Project	178.00			178.00	100
2	**Revitalization of existing HPPs**					
	2.1 Revitalization of HPP Piva Project	62.70			62.70	100
	2.2 Revitalization of HPP Perućica Project	44.00			44.00	100
3	**TE Pljevlja**					
	3.1 Revitalization of TPPP I Project	64.50			64.50	100
	3.2 Construction of TPPP II Project	385.20			385.20[1]	100
4	**RSE – Wind power plants construction programme**					
	4.1 Krnovo Wind Power Plant					
	4.2 Možura Wind Power Plant	76.00			76.00	100
	4.3 Wind Power Plant (3) 33 MW	55.00			55.00	100
5	**Small hydroelectric power plants**					
	5.1 Construction of small HPPs	160.00			160.00	100
	5.2 Revitalization of existing sHPPs	19.00			19.00	100
6	**Investments in the EE and incentives to the EE and RES from the budget**	140.00	140.00	100		
7	**Construction of biogas power plant**	1.20			1.20	100
II	INDUSTRY					
	KAP – Modernization of technological processes	48.60			48.60	100
III	AGRICULTURE					
	Agricultural and environmental measures	26.12	26.12	100		
	TOTAL	1 754.03	166.12	9	1 587.91	91

*The expected participation of EPCG with its own capital should range from 15.0% to 30.0% of the total investment in TPP II (Study on the construction of TPPP II, Deloitte Ltd, Podgorica, 9 August 2016, page 56).

[1] "Socio-Economic Analysis of Investments for Ratification of Paris Agreement", G. Đurović, S. Perović, N. Jablan, June 2017.

As a major driver of Montenegro's economic growth and investment, the tourist sector is responsible (directly and indirectly) for the large share of GHG emissions from transport, accommodation and other tourist-related activities. In April 2013, UNDP launched the Towards Carbon-Neutral Tourism Project (www.lowcarbonmne.me), which will adopt a comprehensive approach to minimizing the carbon footprint of the most dynamic economic sector, with the ultimate objective being to reduce GHG emissions from the tourist sector.

In addition, the government recently adopted the Strategy for Disaster Risk Reduction with the Dynamic Action Plan for the Implementation of the Strategy for the period 2018–2023. The strategy is a basic document aimed at highlighting the most important disaster risk reduction segments at the local and national levels. The key segment of the strategy is the prevention of new risks and the reduction of existing ones, through the implementation of integrated comprehensive economic, social, health, educational, environmental and other measures; prevention and reduction of society's exposure and vulnerability to the risk of disaster, increased readiness for reaction and renewal, and the stability of the society itself. The goals of the strategy are in line with the Sendai Disaster Risk Reduction Framework, as well as the global efforts and demands of the international community, the European Commission and the United Nations' Disaster Risk Reduction Programme.

GENDER EQUALITY AND CLIMATE CHANGE

Montenegro is a parliamentary democracy where gender equality is recognized in its legal and policy framework as one of the main principles. The Constitution of Montenegro (2007) proclaims the equality of all citizens as one of its main principles and provides the opportunity for the introduction of special measures for achieving overall equality, including equality between women and men; the Anti-Discrimination Law (adopted in 2010, amended in 2011, 2014 and 2017) and the Law on Gender Equality (adopted in 2007 and amended in 2010, 2011 and 2015), which is accompanied by the Action Plan for Gender Equality (2007–2010, 2011–2016 and 2017–2021), lay the foundation for legal and institutional protection from gender-based discrimination. National laws and strategies recognize the importance of gender equality in policies related to climate change include the following:

- National Strategy for Sustainable Development until 2030, which includes the measure related to Sustainable Development Goal No. 5 – "Eliminate gender discrimination",
- Strategy for Development of Agriculture and Rural Areas 2015–2020,
- National Strategy on Women's Entrepreneurship (2015–2020), which could be fully implemented in all climate change policies that are related to economic activities, entrepreneurship and equal distribution of economic power and resources,
- A gender-sensitive approach is declared as one of the leading principles of the National Climate Change Strategy until 2030, but gender sensitivity is not integrated into the objectives and measures of the Strategy and its Action Plan.

Montenegro has a relative equal balance of male and female residents. Women only make up 46% of the employed population, with the majority (75%) of women's jobs being in education. Equal access to political and economic power, as well as access to resources is also hampered by the traditional patriarchal culture, which prevents the social equality intended by Montenegro's anti-discrimination laws.

Montenegro has ratified international treaties, such as the UN Convention on the Elimination of All Forms of Discrimination against Women (CEDAW) and the United Nations' Framework Convention on Climate Change (UNFCC), which promote a gender-sensitive approach and encourage the signatory countries to mainstream gender into national sustainable development and climate-change policies. There is still a substantial gender gap in local and national decision making across the government. In the Parliament of Montenegro, 19 out of 81 MPs are women (23.5%), while in local parliaments, women make up 25.5%. Men tend to hold the key positions at the both national and local levels (Speaker of the Parliament, the Deputy Speakers, the presidents of local councils and their deputies). In the working bodies of the National Parliament currently 13.79% of the members are women[1]. Three committees are chaired by women – the Legislative Committee, the Gender Equality Committee and the Anti-Corruption Committee[2]. When it comes to the executive branch, in the national government, men occupy the positions of prime minister and all three deputy prime ministers, and only four out of 21 ministers are women[3] (21%). At the local level, three out of the 23 mayors (13%) are women[4]. In general, there is also a substantial gender gap among the occupations of legislators, officials, and managers. Accordingly, only 22.0% of legislators, officials and managers are women.[5]

[1] The Parliament has 15 working bodies, of which 14 are committees and one is a commission. Since the last parliamentary elections in October 2016, the opposition has not been participating in the work of the Parliament.

[2] Report on Implementation of the Action Plan for Chapter 23 for 2016, Parliament of Montenegro, 2017, http://www.skupstina.me/images/dokumenti/plan-zakonodavnog rada/Izvje%C5%A1taj_o_sprovodjenju_Akcionog_plana_za_2016._godinu.pdf.

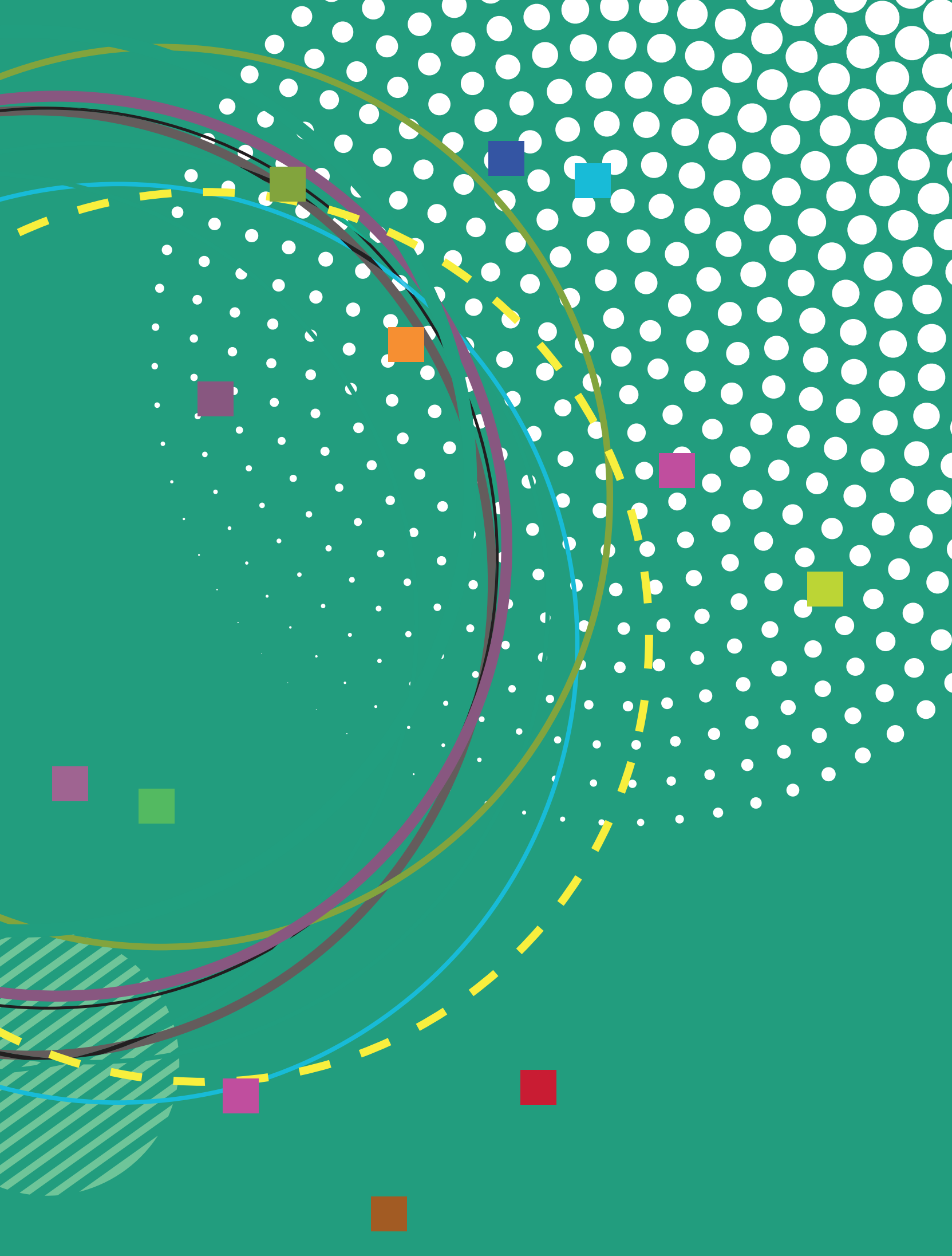
[3] The Minister of Science, Minister of the Economy, Minister of Public Administration and Minister without Portfolio. This is for the government that was established after the parliamentary elections held on October 2016.

[4] Municipalities of Gusinje, Kolašin, Tivat and Šavnik.

[5] Women and Men in Montenegro, 2016, page 98, MONSTAT and Ministry of Human and Minority Rights http://www.monstat.org/userfiles/file/publikacije/ZENE%20I%20MUSKARCI%20U%20CRNOJ%20GORI%20-%202016%20za%20STAMPU.pdf (accessed on 19 July 2017).

CHAPTER

National GHG Inventory



INTRODUCTION

The National Greenhouse Gas Inventory Report (NIR) for Montenegro covering the period 1990–2015, and the emissions report for the same period, were developed within the framework of the Second Biennial Update Report (SBUR) to the United Nations Framework Convention on Climate Change (UNFCCC). The report provides details on developing the Greenhouse Gas (GHG) Inventory for 2014 and 2015 and the inventory update for the period 1990–2013. The methodology applied is the one proposed by the Intergovernmental Panel on Climate Change (IPCC) from 2006[1], while the IPCC software tool (ver. 2.54) was used for calculating emissions. The NIR provides information on the sources of data used for calculating emissions, the methods applied, emission factors, GHG emission trends, and the quality control and assurance procedures.

BACKGROUND ON GHG INVENTORIES AND CLIMATE CHANGE

Montenegro ratified the UNFCCC by succession in 2006, and thus became a non-Annex-1 party to the Convention on 27 January 2007. The Kyoto Protocol was ratified on 27 March 2007, and Montenegro became a non-Annex-B party on 2 September 2007. By ratifying the UNFCCC and the Kyoto Protocol, Montenegro joined countries sharing the same concerns and undertaking an active role in international efforts to address climate change (CC).

On 11 October 2017, the Parliament of Montenegro enacted a law ratifying the Paris Agreement. Thus, Montenegro became a party which has also ratified the Paris Agreement and undertaken to contribute to GHG emissions reduction globally. Montenegro has committed itself to reducing GHG emissions by at least 1 572 kt, to the level of 3 667 kt or less. Montenegro's contribution to international efforts to address CC issues, expressed through the Intended Nationally Determined Contribution (INDC) to reductions in GHG emissions, is set at a minimum of 30% by 2030 compared to 1990 as the baseline year.

The present report is made in line with the UNFCCC's reporting guidelines for annual inventories, as provided in Decision 18/CP.8 of the Conference of Parties. In line with the IPCC guidelines, we used national emission factors wherever possible (in some activities in the sectors of energy, industry, agriculture and forestry), thus increasing the accuracy of the calculated emis-

[1] 2006 IPCC guidelines for National Greenhouse Gas Inventories and Good Practice Guidelines and Uncertainty Management in National GHG Inventories.

sions. For other activities which are sources of GHG emissions, we used the default values for emission factors. The calculation includes emissions stemming from anthropogenic activities, which include the following direct GHG emissions: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and synthetic gases (hydrofluorocarbons (HFCs) and SF_6). Greenhouse gas emission sources and sinks are split into six main sectors: energy; industrial processes; use of solvents and other products; agriculture; land use and forestry; and waste.

INSTITUTIONAL AND ORGANIZATIONAL STRUCTURE FOR DEVELOPING A GHG INVENTORY

The Environment Law and the Air Protection Law provide a legal framework for CC monitoring and reporting in Montenegro. The legal framework falls within the scope of the Ministry of Sustainable Development and Tourism (MSDT). The law has entrusted the Environmental Protection Agency (EPA) with keeping and updating the GHG Inventory, data management and storage. The GHG Inventory is part of the environmental database.

The Rulebook on the Methodology and Contents of the GHG Inventory was adopted under the Air Protection Law. The Rulebook stipulates that the GHG Inventory is developed in accordance with the UNFCCC reporting guidance with the IPCC guidelines specifying the sectors, categories and activities recognized as sources of GHG emissions. Consequently, data holders have been identified which are relevant for calculating emissions. Data reporting is carried out in the stipulated format and within the set timeframe.

QA/QC plan

The Quality Assurance and Quality Control (QA/QC) Plan for the GHG Inventory is envisaged by the Rulebook on the Methodology and Contents of the GHG Inventory (Official Gazette of Montenegro 66/17). It stipulates the data quality control procedures and the method of archiving the inventory, the accompanying resources and documentation.

The quality control procedures were developed in compliance with Regulation (EU) No. 525/2013 on the mechanism for monitoring and reporting GHG emissions, currently being transposed into domestic legislation. In the future, development of the Data Reliability Plan and data control are envisaged.

Data verification

In line with the IPCC Guidelines[2] verification of the inventory was carried out through a series of simple checks for completeness and accuracy, including: checking of arithmetic errors, comparison of national statistics with international statistics and the verification of estimated CO_2

[2] Good Practice Guidelines and Uncertainty Management in National GHG inventories.

emissions from the energy sector, comparing the results obtained through sector-based and reference approaches.

AN OVERVIEW OF GHG EMISSIONS TRENDS

Total CO_2eq emissions

This section describes total GHG emissions expressed as carbon dioxide equivalents (CO_2eq). GHG emissions are expressed as CO_2eq in line with the guidance provided in the Fourth Assessment Report (4AR IPCC). The global warming potential (GWP) figures are as follows:

- CO_2 – 1;
- CH_4 – 25;
- N_2O – 298;
- CF_4 – 7 390;
- C_2F_6 – 12 200;
- SF_6 – 22 800;
- HFC23 – 14 800;
- HFC125 – 3 500;
- HFC134 – 1 430;
- HFC134a – 4 470;
- HFC152a – 124;
- HFC227ea – 3 220;
- HFC236fa – 63 009 810;
- HFC4310mee – 1 640.

TABLE 5: Total GHG emissions expressed in CO_2eq by sector, 1990–2015 (Gg)

Year	Energy (Gg CO_2eq)	Industrial processes (Gg CO_2eq)	Agriculture and land use Emissions + sinks (Gg CO_2eq)	Waste (Gg CO_2 eq)	Total emissions with sinks (Gg CO_2eq)	Total emissions without sinks (Gg CO_2eq)
1990	2 409	2 603	−819	179	4 372	5 903
1991	2 506	3 343	−838	182	5 193	6 738
1992	1 856	2 166	−1 608	185	2 599	4 872
1993	1 649	810	−2 204	188	444	3 283
1994	1 466	103	−1 974	191	−214	2 406
1995	853	363	−1 230	194	180	2 083
1996	1 888	332	−1 608	198	810	3 086
1997	1 894	1 772	−1 957	201	1 911	4 513
1998	2 310	1 6845	−2 673	205	1 527	4 836
1999	2 383	1 889	−2 646	208	1 834	5 118
2000	2 480	2 348	−1 768	212	3 272	5 682
2001	2 056	2 490	−2 468	214	2 293	5 372
2002	2 606	2 548	−2 635	216	2 735	5 989
2003	2 480	2 109	−1 989	217	2 817	5 428
2004	2 467	1 898	−1 822	217	2 759	5 178
2005	2 251	1 760	−1 673	217	2 554	4 656
2006	2 374	1 869	−926	215	3 533	4 873
2007	2 251	2 029	−531	216	3 965	4 928
2008	2 963	1 064	−1 521	214	2 720	4 626
2009	2 016	671	−2 163	212	737	3 216
2010	2 701	851	−1 559	211	2 204	4 071
2011	2 832	864	−971	211	2 936	4 242
2012	2 747	444	−1 148	211	2 254	3 735
2013	2 474	316	−1 975	209	1 024	3 335
2014	2 373	386	−1 808	203	1 154	3 305
2015	2 528	411	−2 012	203	1 131	3 494

TABLE 6: GHG emission sinks in CO_2eq, 1990–2015 (Gg)

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Sinks (Gg)	1 531	1 545	2 273	2 839	2 620	1 903	2 275	2 602	3 309	3 283
Year	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Sinks (Gg)	2 410	3 079	3 254	2 610	2 419	2 101	1 340	964	1 907	2 479
Year	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**				
Sinks (Gg)	1 867	1 306	1 481	2 312	2 151	2 363				

Figures 6 and 7 show the net GHG emissions expressed as CO_2eq over the period 1990–2015. Figure 6 shows the total emissions including sinks, while Figure 7 shows the emissions without sinks. The GHG emission sinks for the period observed are shown in Table 6.

The total emissions with sinks range between –214 Gg CO_2eq in 1994 and 5 193 Gg in 1991. The high level of CO_2eq sinks stems from the good forest coverage of Montenegrin territory. The low level of emissions from the agricultural sector is partly a result of the incomplete assessment of emissions due to a lack of pertinent data.

The total GHG emissions (sinks excluded) shown as CO_2eq range between 2 406 Gg in 1994 and 6 738 Gg in 1991.

Figure 8 shows CO_2eq emissions by sector for the period 1990–2015.

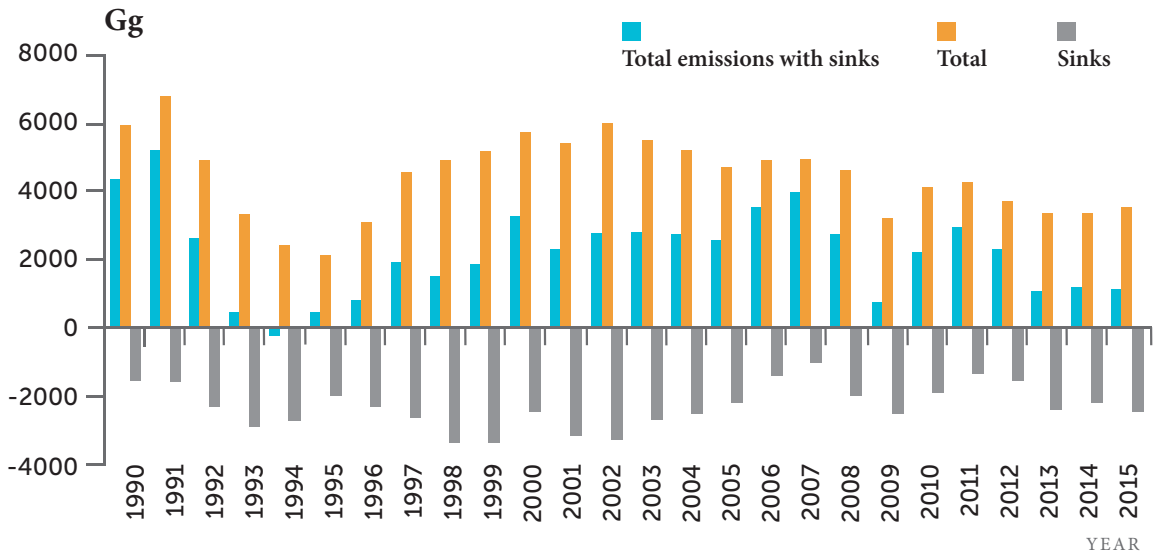


FIGURE 6: Total GHG emissions expressed as CO_2eq with sinks, 1990–2015 (Gg)

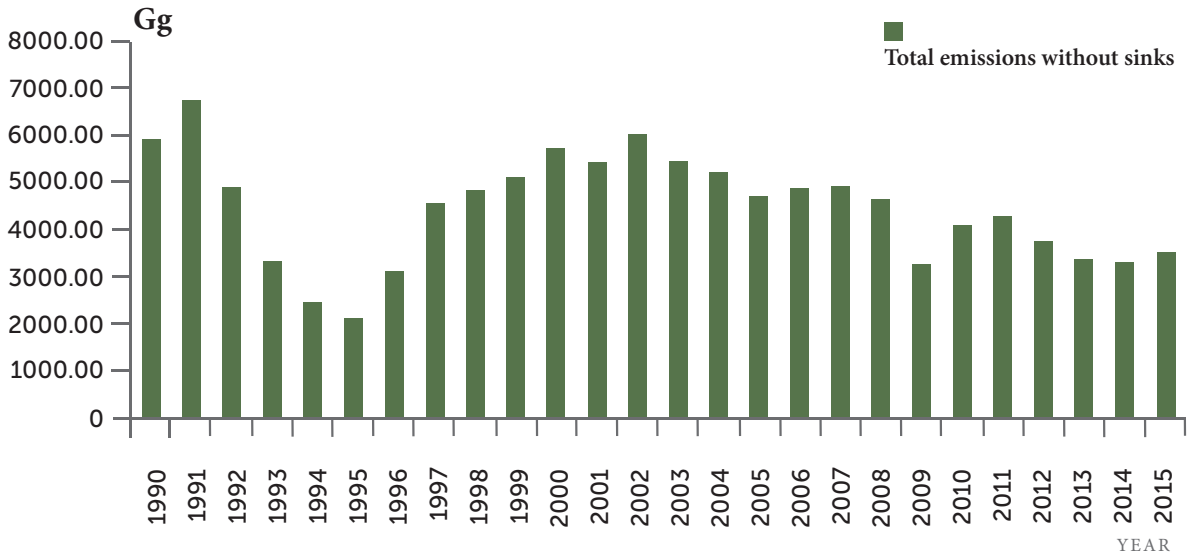


FIGURE 7: Total GHG emissions expressed as CO_2eq without sinks, 1990–2015 (Gg)

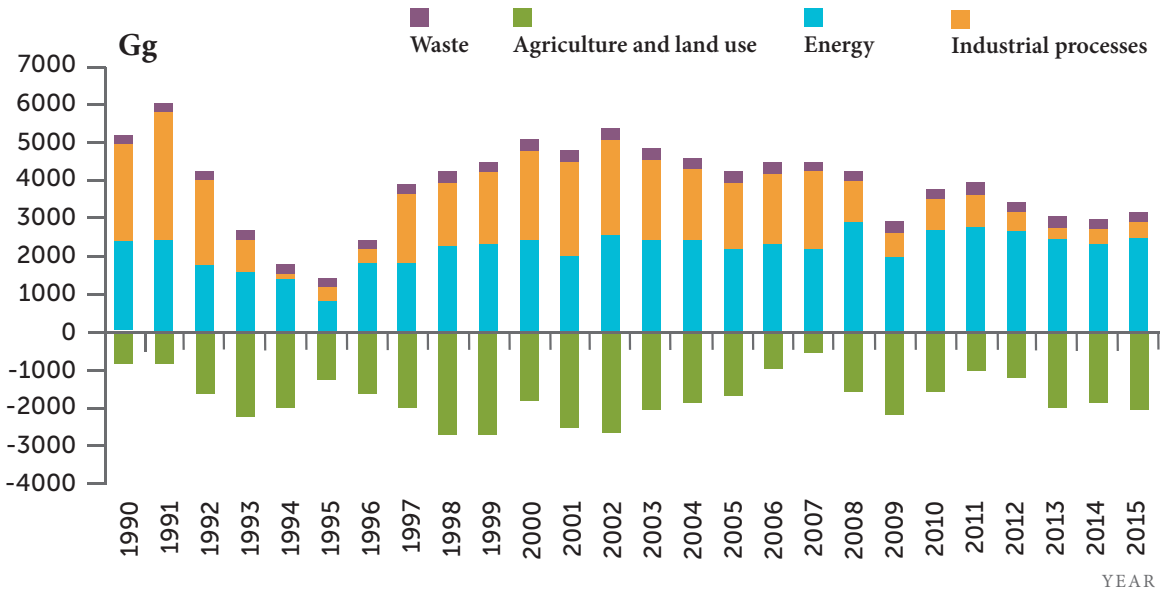


FIGURE 8: GHG emissions expressed as CO_2eq by sector, 1990–2015 (Gg)

As shown in Figure 8, energy and industrial processes account for largest shares of total CO_2eq emissions for the reporting period. Hence, fluctuations in emissions are recorded over the reporting period depending on energy consumption and industrial output.

The share of emissions from the energy sector ranges between 37.19% in 1991 and 74.17% in 2013. The share for industrial processes ranges between 4.29% in 1994 and 49.61% in 1991. The CO_2eq emissions from agriculture range between 7.57% in 2010 and 32.30% in 1995, while waste has the lowest share, ranging between 2.70% in 1991 and 7.94% in 1994.

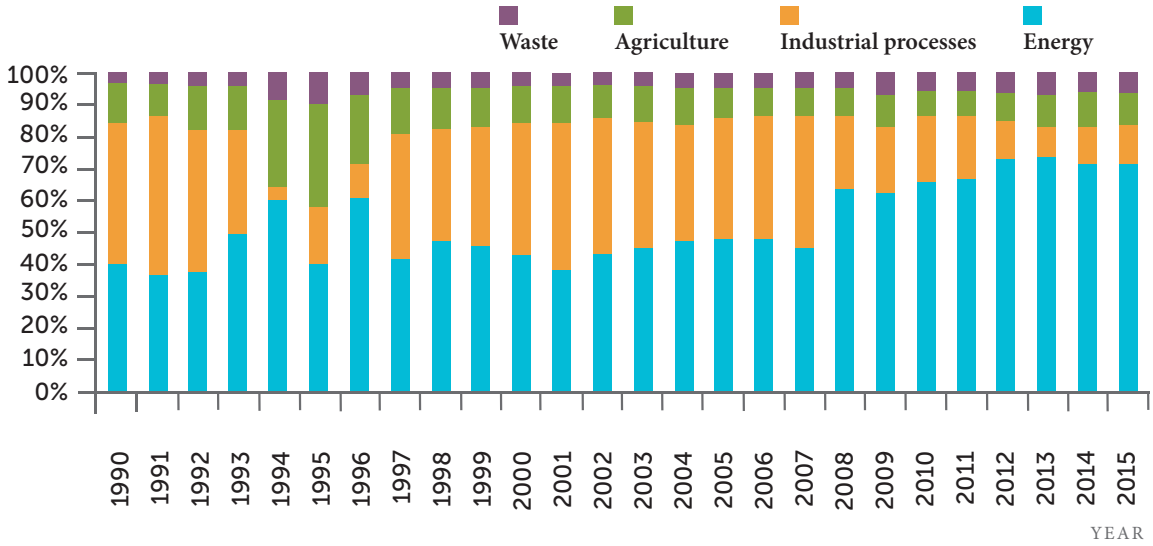


FIGURE 9: Sector-based shares of GHG emissions in CO2eq, 1990–2015 (%)

As shown in Table 7 and Figure 10, the largest share of total GHG emissions is accounted for by CO_2 (38.03%–72.34%), followed by perfluorocarbons (PFCs) (CF_4 and C_2F_6) ranging between 6.92% and 46.54%, while the share of CH_4 ranged between 11.71% and 40.68%, and N_2O between 2.43% and 7.74%. The lowest share is of SF_6, between 0.01% and 0.07%. According to the data available during the recalculation of the inventory, the HFC emissions were estimated for the period 2011–2015 with the EPA's statistical data. The 2006 IPCC software tool was used for automatic calculation for the period 2005–2010 for use of products from subsector 2F as substitutes for ozone-depleting substances only (2F1 – refrigeration and air-conditioning).

TABLE 7: Total GHG emissions expressed as CO_2eq, 1990–2015 (Gg)

Year	CO_2	CH_4 – CO_2eq	N_2O – CO_2eq	PFC – CO_2eq	SF_6 – CO_2eq	HFC – CO_2eq	Total
1990	2 452	882	179	2 389	0.78		5 903
1991	2 563	863	177	3 136	0.78		6 738
1992	1 878	837	164	1 993	0.78		4 872
1993	1 553	837	156	738	0.78		3 283
1994	1 368	813	151	73.4	0.78		2 406
1995	797	848	161	277	0.78		2 083
1996	1 806	840	161	277	0.78		3 086
1997	1 918	818	153	1 623	0.78		4 513
1998	2 331	813	151	1 542	0.84		4 836
1999	2 402	822	149	1 743	0.84		5 118
2000	2 521	820	160	2 180	0.92		5 682
2001	2 143	789	145	2 295	0.92		5 372
2002	2 646	853	147	2 343	0.97		5 989
2003	2 541	832	153	1 902	1.15		5 428
2004	2 534	815	148	1 681	1.33		5 178
2005	2 319	664	117	1 550	1.43	1.85	4 656
2006	2 442	660	119	1 646	1.49	5.42	4 873
2007	2 416	577	125	1 797	1.49	10.6	4 928
2008	3 007	638	120	842	1.52	17.4	4 626
2009	1 990	559	111	530	1.54	25.6	3 216
2010	2 761	499	98.9	677	1.55	35.1	4 071
2011	2 818	600	117	658	1.6	45.9	4 242
2012	2 702	594	117	259	2	61.3	3 735
2013	2 395	587	116	161	2.19	73.3	3 335
2014	2 297	588	110	223	2.23	85.4	3 305
2015	2 440	597	120	240	1.88	94.1	3 494

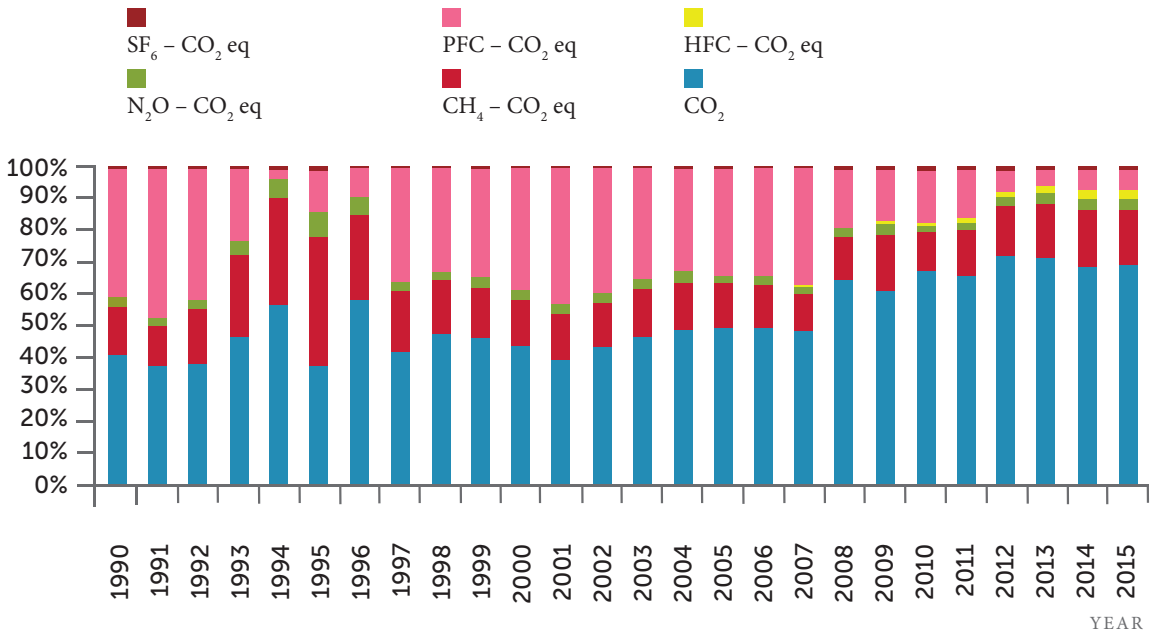


FIGURE 10: Shares of GHG emissions in total CO2eq emissions, 1990–2015 (%)

Total CO_2 emissions

Figure 11 shows total CO_2 emissions. Over the reporting period the largest share of CO_2 emissions is accounted for by energy (89%–97%), while industrial processes account for 3%–10%.

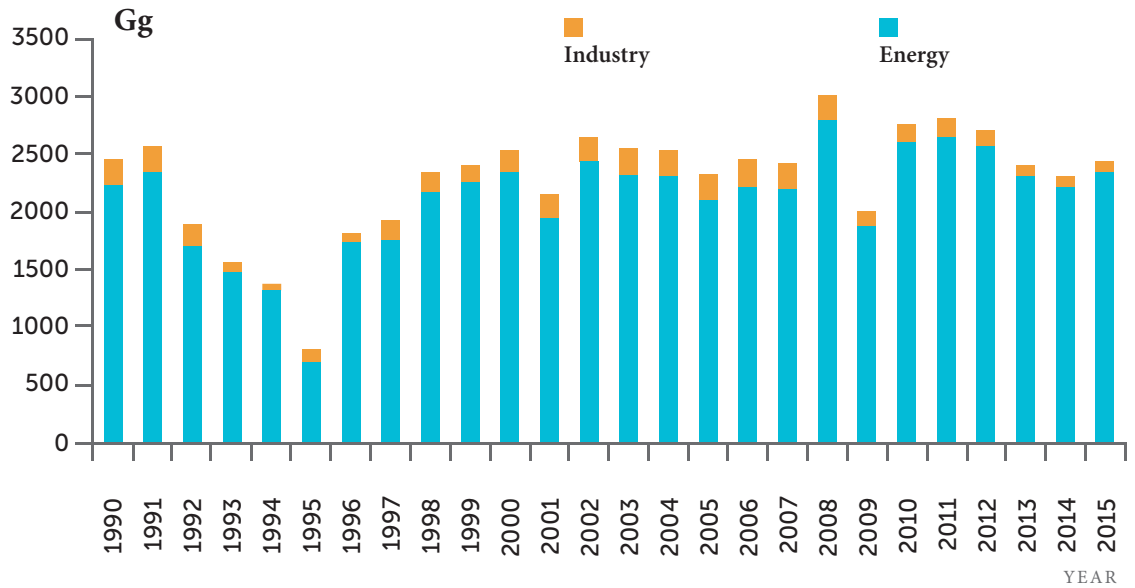


FIGURE 11: Total CO_2 emissions by sector, 1990–2015 (Gg)

Total CH_4 emissions

Figure 12 shows the total CH_4 emissions. Over the reporting period, the largest share of CH_4 emissions stems from agriculture (44%–66%), with energy accounting for 6.8%–22.7%, and waste for 20%–40%.

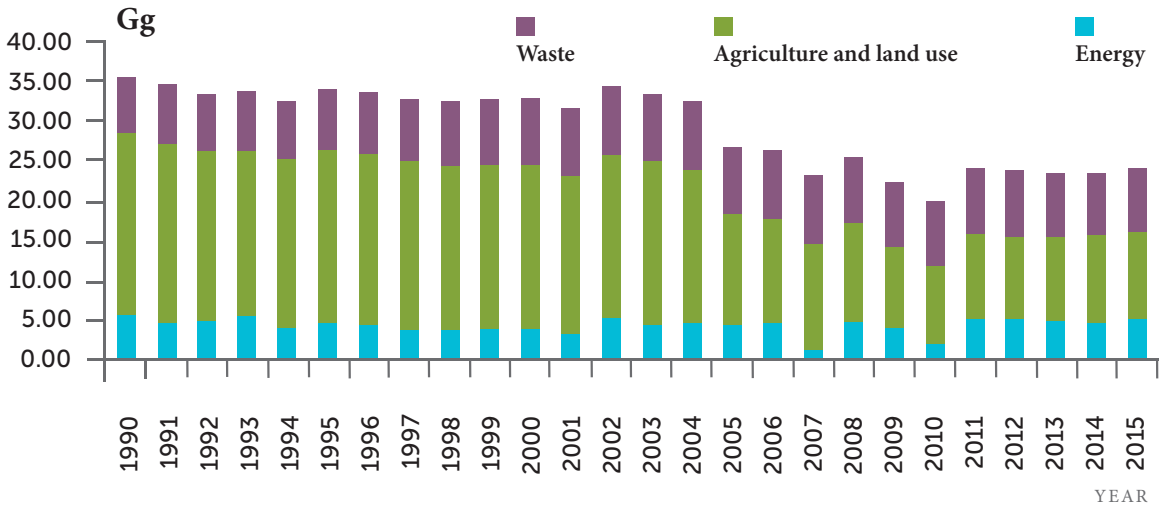


FIGURE 12: Total CH_4 emissions by sector, 1990–2015 (Gg)

Total N_2O emissions

Figure 13 shows total N_2O emissions. Over the reporting period the largest share of N_2O emissions is accounted for by agriculture (60%–82%), followed by energy with 11%–28%, and waste with 0.02%–0.04%

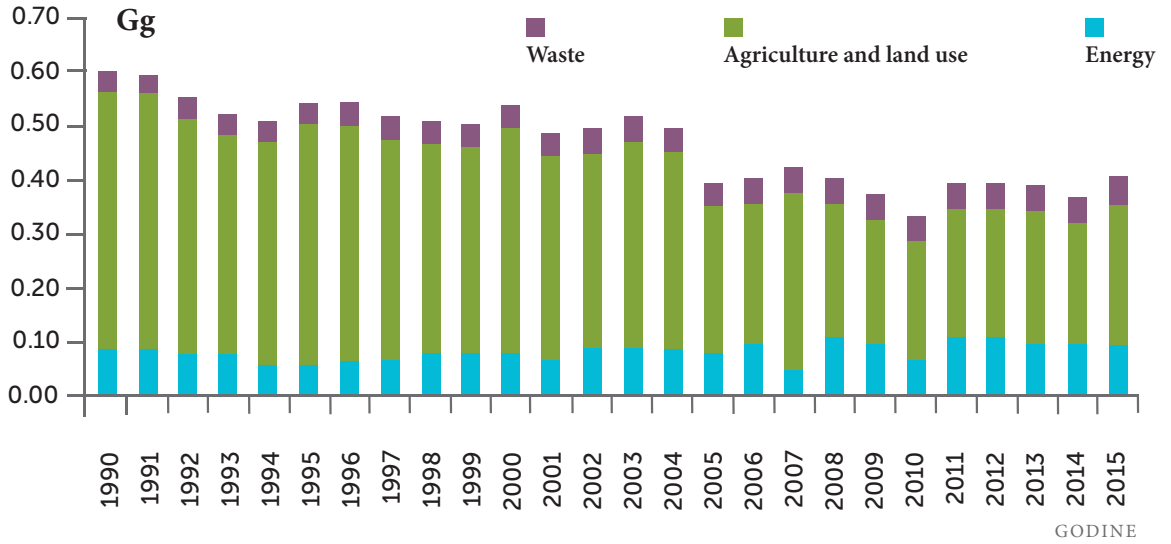


FIGURE 13: Total N_2O emissions by sector, 1990–2015 (Gg)

Total PFC emissions

According to the data available for the reporting period, the emissions of PFCs (CF_4, C_2F_6) from industrial processes, i.e. aluminium production and electrolysis plants were estimated (Figure 14).

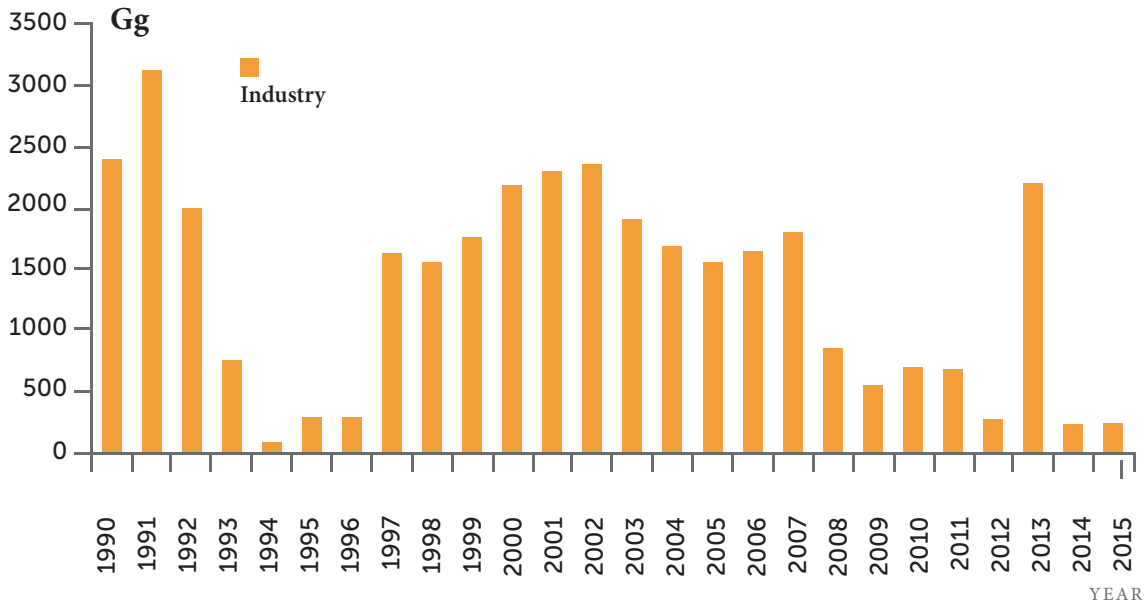


FIGURE 14: Total PFC emissions from industrial processes, 1990–2015 (CO_2 Gg)

Total SF_6 emissions

According to the data available for the reporting period, SF_6 emissions from subsector 2G – manufacture and use of other products (2G1 – electrical equipment) were calculated (Figure 15).

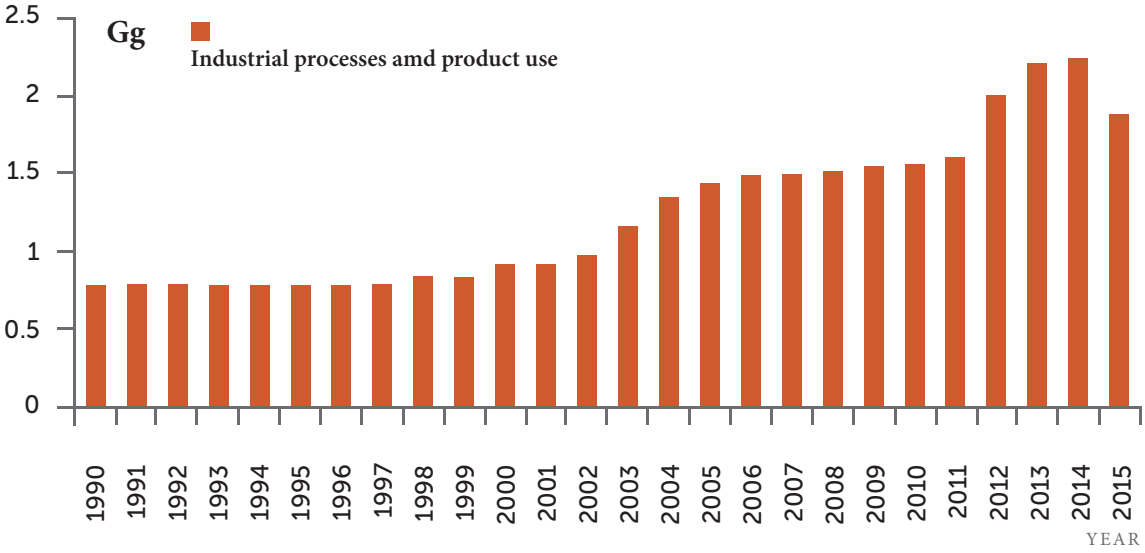


FIGURE 15: Total SF_6 emissions from industrial processes, 1990–2015 (CO_2 Gg)

Total HFC emissions

Data to assess the total emissions of HFCs was available for the period 2011–2013. Estimates were made for the use of products in subsector 2F, substitutes for ozone-depleting substances, i.e. activity 2F1 – refrigeration and air-conditioning (Figure 16).

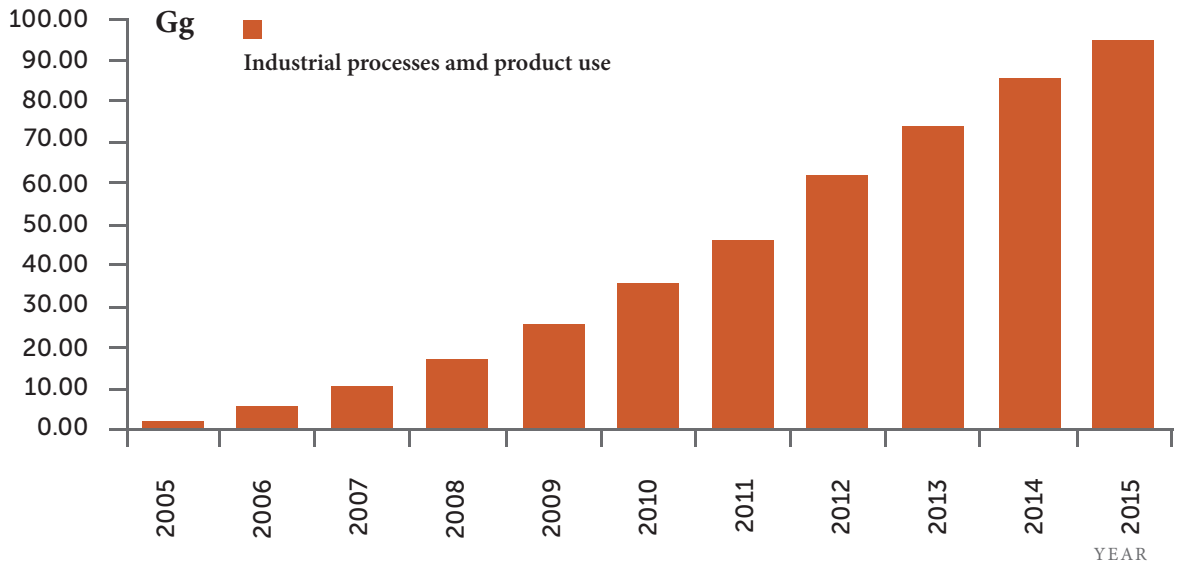


FIGURE 16: Total HFC emissions from industrial processes, 2005–2015 (Gg)

ANALYSIS OF KEY CATEGORIES AND INVENTORY COMPLETENESS

The analysis of key sources and the completeness of the inventory was carried out based on the methodology set out by the IPCC[1], using a Tier-1 approach. Table 8 gives an assessment of the trends for key emission sources for 1990 and 2015, and Table 9 shows the source and sink categories whose emissions were not estimated for 2015. The IPCC marks (not occurring (NO) and not estimated (NE)) were used to show non-estimated categories.

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

[1] IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories

The level assessment categories and their contribution in 2014 found the most significant categories with the highest absolute values of Gg CO_2eq.

The trend assessment used 1990 as the base year and 2014 as the latest inventory year. The purpose of this trend assessment was to emphasize the categories with trends that were significantly different from the trend of the overall inventory, regardless of whether the category's trend was increasing or decreasing or was a sink or source.

TABLE 8: Analysis of key emission sources – trends in 1990 and 2015

Category	Estimated CO_2eq emissions in 1990 (Gg)	Estimated CO_2eq emissions in 2015 (Gg)	Trend	Aggregate share in total emissions (%)
2C3 – Metal industry – Aluminium production – PFCs	2 389	240	0.217	41%
1A1 – Fuel combustion – Energy (solid fuels) – CO_2	1 111	1 555	0.158	70%
1A3b – Fuel combustion – Transport – Road transportation – CO_2	330	563	0.065	82%
1A2 – Fuel combustion – Manufacturing industries and construction – CO_2	61	179	0.025	87%
2F1 – Product use as substitutes for ozone-depleting substances – Refrigeration and air-conditioning – HFCs, PFCs	n/a	94	0.017	90%
4A – Solid waste disposal – CH_4	158	178	0.015	93%
3A1 – Enteric fermentation – CH_4	484	230	0.011	95%
1A4 – Fuel combustion – Other sectors – CO_2	178	68	0.007	96%

TABLE 9: GHG source and sink categories not estimated in 2015

Sector/category according to the IPCC	IPCC mark
1 ENERGY	
1A2 – Industry and construction	
1A2b – Non-ferrous metals	NO
1A2c– Chemicals	NO
1A2d – Pulp, paper and print	NO
1A2g – Transport equipment	NO
1A2h – Machinery	NO
1A2i – Mining and quarrying	NE
1A2k – Construction	NE
1A2l – Textile and leather	NO
1A3 – Transport	
1A3c – Railway transport	NE
1A3di – International water-borne navigation (bunkers)	NE
1A3e – Other	NE
1A4 – Other sectors	
1A4ci – Combustion in stationary sources	NE
1A4ciii – Fishing (mobile combustion)	NE
1A5 – Non-specified	
1A5b – Mobile sources	
1A5bi – Mobile (aviation component)	NE
1A5bii – Mobile (water-borne component)	NE
1A5c – Multilateral operations	NE
1B – Fugitive emissions	
1B1ai – Underground mines	NO
1B1b – Spontaneous combustion and burning – coal dumps	NE
1B1c – Solid fuel transformation	NE
1B2 – Oil and natural gas	NO
1B3 – Other emissions from energy production	NE
1C – CO_2 transport and storage	NO
2 INDUSTRIAL PROCESSES	
2A – Mineral industry	NO
2B – Chemical industry	NO
2C – Metal industry	
2C2 – Ferroalloys production	NO
2C4 – Magnesium production	NO
2C5 – Lead production	NO
2C6 – Zinc production	NO
2C7 – Other	NO
2E – Electronic industry	NO
2F – Product uses as substitutes for ODS	
2F1b – Mobile air-conditioning	NE

2F2 –Foam-blowing agents	NE
2F3 –Fire protection	NE
2F4 – Aerosols	NE
2F5 – Solvents	NE
2F6 – Other applications	NE
2G – Other product manufacture and use	
2G1a – Manufacture of electrical equipment	NO
2G1c – Disposal of electrical equipment	NE
2G2 – SF_6 and PFCs from other product uses	NE
2G3 – N_2O from product uses	NE
2H – Other industry	
2H1 – Pulp and paper industry	NO
2H3 – Other industry	NO
3 AGRICULTURE, FORESTRY AND LAND USE	
3A – Livestock	
3A1b – Enteric fermentation – buffalo	NO
3A1e – Enteric fermentation – camels	NO
3A1g – Enteric fermentation – mules and asses	NE
3A1j – Enteric fermentation – other	NE
3A2b – Manure management – buffalo	NO
3A2e – Manure management – camels	NO
3A2g – Manure management – mules and asses	NE
3A2g – Manure management – other	NE
3B – Land	
3B1b – Land converted to forest land	NE
3B3b – Land converted to grassland	NE
3B4 – Wetlands	NE
3B5 – Settlements	NE
3B6 – Other land	NE
3C – Aggregate sources	
3C1c – Emissions from biomass burning in grasslands	NE
3C1dvEmissions from biomass burning in other land	NE
3C7 – Rice cultivation	NE
3C8 – Other	NE
3D – Other	NE
4 WASTE	
4B – Biological treatment of solid waste	NO
4C1 – Waste incineration	NO
4C2 – Open burning of waste	NE
4D2 – Industrial wastewater treatment and discharge	NE
4E – Other	NE
5 OTHER	NE

ENERGY

The energy sector is the main source of anthropogenic GHG emissions. In Montenegro it accounted for 71.8% in 2014 and 72.37% in 2015 of the total GHG emissions. The energy sector includes all the activities referring to combustion of fuels (solid, liquid, gaseous and bio fuels) from stationary and mobile sources, as well as fugitive emissions. Fugitive emissions arise during the production, transportation, processing, storage and distribution of fossil fuels.

Data sources

The data referring to consumption, import and distribution of fuels in Montenegro are reported by the national statistics office – MONSTAT. Such data is covered and arranged as an energy balance, which is the basis for estimating GHG emissions from the energy sector. For the purpose of drawing up the national inventory, but also as a part of their regular activities, MONSTAT updated the energy balances for 2014 and 2015.

For verification of the inventory, the records of fossil-fuel consumption in large industrial facilities provided to the EPA for its information were used.

Emission trends

The estimation of direct GHG emissions from the energy sector was carried out according to the 2006 IPCC Methodology and the 2000 IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories. In line with the available national data (lower calorific values and specific carbon emissions from fossil-fuel combustion), a combined Tier-1 and Tier-2 approach was used to estimate emissions. The estimated emissions from different energy subsectors over the reporting period are shown in Tables 10, 11, 12 and 13.

GHG emissions expressed as CO_2eq

The largest share in total energy sector emissions is accounted for by activities related to power and heat generation. The reported drop in emissions from 1992–1995 and in 2009 was a result of reduced output from the Thermoelectric Power Plant (TPP) "Pljevlja", reduced production at the energy facility of the Aluminium Plant Podgorica (KAP), as well as an overall economic downturn in the country.

Emissions from the transport subsector record slowed, but saw a steady increase commensurate with the increase in the number of motor vehicles in the country (Table 10). The need to align the methodology for developing planned and effectuated energy balances with reporting requirements to EUROSTAT (European Statistics) and International Energy Agency (IEA) encouraged MONSTAT to create a new reporting format. The most prominent difference refers to biomass consumption. It includes the consumption of firewood and woodchips, pellet, charcoal and other primary solid biomass types. It is also noteworthy that the definition jet kerosene was introduced into aviation fuel, whereas until 2013 the term jet fuel had been used.

TABLE 10: CO_2eq emissions from energy sectors and subsectors, 1990–2015 (Gg)

Category	1990	1991	1992	1993	1994	1995	1996
1 – Energy	2 409	2 506	1 856	1 649	1 466	853	1 888
1A – Fuel combustion	2 363	2 467	1 817	1 601	1 425	805	1 847
1A1 – Energy industries	1 435	1 394	1 093	996	827	166	1 120
1A2 – Manufacturing industries & construction	278	395	258	195	206	202	241
1A3 – Transport	346	399	251	195	217	233	287
1A4 – Other sectors	286	257	206	209	169.2	195	190
1A5 – Non-specified	18.9	21.9	9.68	6.48	6.50	9.9	9.64
1B – Fugitive emissions from fuels	46.2	39.1	38.5	48.00	40.8	47.4	40.8
1B1 – Solid fuels	46.2	39.1	38.5	48.00	40.8	47.4	40.8
Category	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
1 – Energy	1 894	2 310	2 383	2 480	2 056	2 606	2 480
1A – Fuel combustion	1 859	2 275	2 348	2 446	2 027	2 549	2 445
1A1 – Energy industries	1 115	1 417	1 397	1 522	1 181	1 725	1 632
1A2 – Manufacturing industries & construction	200	183	180	176	188	190	161
1A3 – Transport	303	426	519	519	452	368	385
1A4 – Other sectors	219	220	227	200	187	237	238
1A5 – Non-specified	21.5	29.5	25.2	28.6	19.3	29.7	28.9
1B – Fugitive emissions from fuels	35.3	34.8	35.4	34.1	29.1	57.0	35.2
1B1 – Solid fuels	35.3	34.8	35.4	34.1	29.1	57.0	35.2
Category	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
1 – Energy	2 467	2 251	2 374	2 251	2 963	2 016	2 701
1A – Fuel combustion	2 430	2 219	2 338	2 222	2 925	1 995	2 658
1A1 – Energy industries	1 564	1 145	1 273	1 025	1 561	841	1 767
1A2 – Manufacturing industries & construction	171	439	428	458	455	170	83.7
1A3 – Transport	437	409	435	531	606	707	619
1A4 – Other sectors	237	196	177	175	271	245	156
1A5 – Non-specified	22.2	29.1	25.7	33.1	32.6	32.9	32.7
1B – Fugitive emissions from fuels	36.4	31.3	36.0	28.4	37.9	20.8	42.2
1B1 – Solid fuels	36.4	31.3	36.0	28.4	37.9	20.8	2 658
Category	**2011**	**2012**	**2013**	**2014**	**2015**		
1 – Energy	2 832	2 747	2 474	2 373	2 528		
1A – Fuel combustion	2 789	2 708	2 437	2 337	2 485		
1A1 – Energy industries	1 807	1 807	1 543	1 495	1 563		
1A2 – Manufacturing industries & construction	53.2	44.2	76.1	148	181		
1A3 – Transport	666	643	615	536	573		
1A4 – Other sectors	257	208	131	158	168		
1A5 – Non-specified	6.31	6.30	72.2	0.00	0.00		
1B – Fugitive emissions from fuels	43.0	38.9	36.9	36.0	43.9		
1B1 – Solid fuels	43.0	38.9	36.9	36.0	43.9		

Total GHG emissions expressed as CO_2eq from the energy sector over the period 1990–2015 are shown in Figure 17, while Figure 18 presents CO_2eq emissions by energy subsectors.

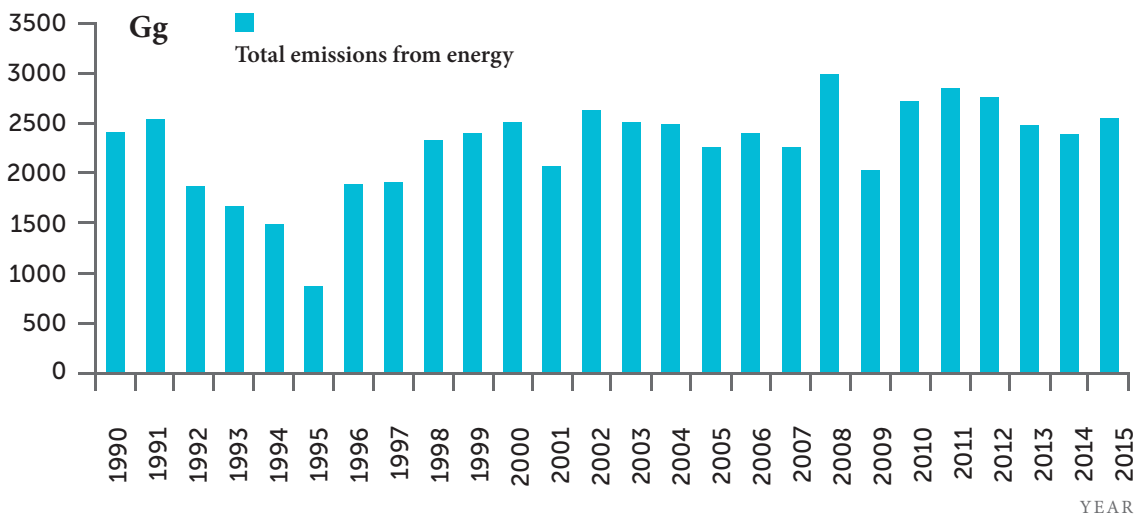


FIGURE 17: Total CO_2eq emissions from the energy sector, 1990–2015 (Gg)

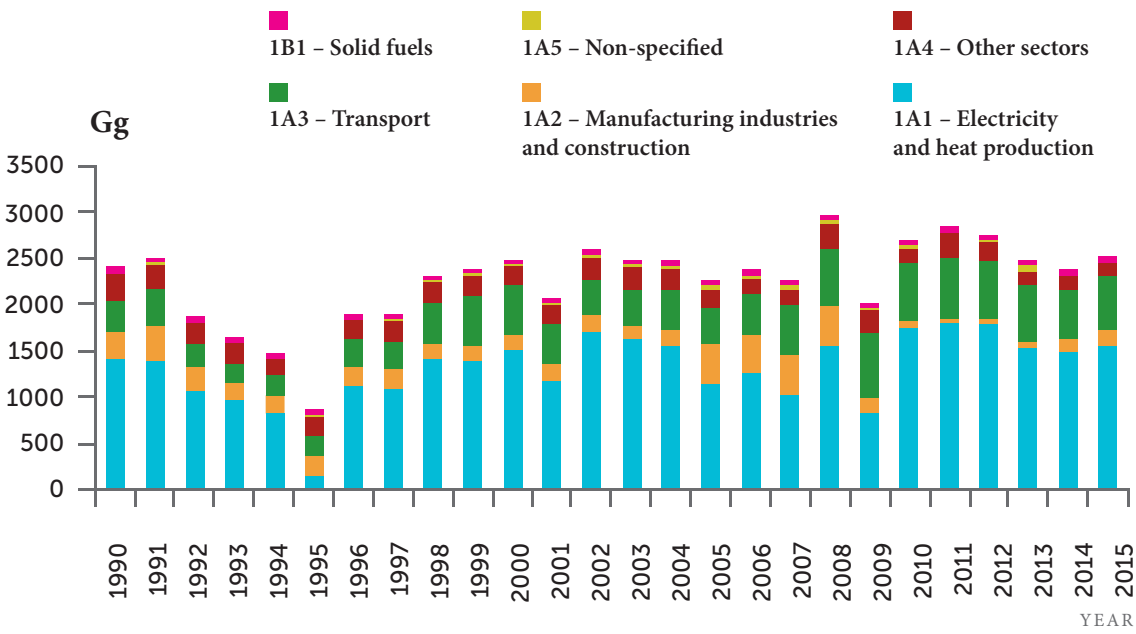


FIGURE 18: Emissions CO_2eq from energy subsectors, 1990–2015 (Gg)

CO_2 emissions

Due to the burning of lignite in TPP "Pljevlja", activity 1A1a – Electricity and Heat Production accounts for the largest share of CO_2 emissions from the energy sector (Table 11 and Figure 19).

TABLE 11: CO_2 emissions from energy sector and its subsectors, 1990–2015 (Gg)

Category	1990	1991	1992	1993	1994	1995
1 – Energy	2 239	2 357	1 706	1 481	1 340	712
1A – Fuel combustion	2 239	2 357	1 706	1 481	1 339	712
1A1 – Energy industries	1 428	1 388	1 088	991	823	165
1A2 – Manufacturing industries & construction	277	393	257	194	205	201
1A3 – Transport	338	390	246	190	212	228
1A4 – Other sectors	178	165	106	99.9	93.0	108
1A5 – Non-specified	18.5	21.7	22.1	6.26	6.26	9.40
Category	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
1 – Energy	1 752	1 770	2 189	2 257	2 353	1 949
1A – Fuel combustion	1 752	1 770	2 189	2 257	2 353	1 949
1A1 – Energy industries	1 115	1 110	1 411	1 391	1 515	1 175
1A2 – Manufacturing industries & construction	240	199	182	179	175	187
1A3 – Transport	281	296	416	508	508	442
1A4 – Other sectors	107	143	151	155	126	125
1A5 – Non-specified	9.40	21.0	29.0	24.7	28.2	18.8
Category	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
1 – Energy	2 442	2 335	2 318	2 113	2 226	2 197
1A – Fuel combustion	2 442	2 335	2 318	2 113	2 226	2 197
1A1 – Energy industries	1 717	1 625	1 557	1 140	1 267	1 020
1A2 – Manufacturing industries & construction	189	161	170	438	426	456.8
1A3 – Transport	360	377	427	401	425	519.9
1A4 – Other sectors	147	145	142	106	85.9	171.7
1A5 – Non-specified	29.1	28.2	21.7	28.2	21.7	28.2
Category	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
1 – Energy	2 804	1 875	2 623	2 661	2 580	2 315
1A – Fuel combustion	2 804	1 875	2 623	2 661	2 580	2 315
1A1 – Energy industries	1 554	837	1 759	1 799	1 799	1 536
1A2 – Manufacturing industries & construction	453	170	83.4	52.2	43.2	75.0
1A3 – Transport	594	692	606	653	631	604
1A4 – Other sectors	179	148	144	150	100	29.1
1A5 – Non-specified	25.1	28.2	31.3	6.2	6.3	71.3
Category	**2014**	**2015**				
1 – Energy	2 222	2 364				
1A – Fuel combustion	2 222	2 364				
1A1 – Energy industries	1 488	1 555				
1A2 – Manufacturing industries & construction	146	179				
1A3 – Transport	526	563				
1A4 – Other sectors	61.6	67.7				
1A5 – Non-specified	0.00	0.00				

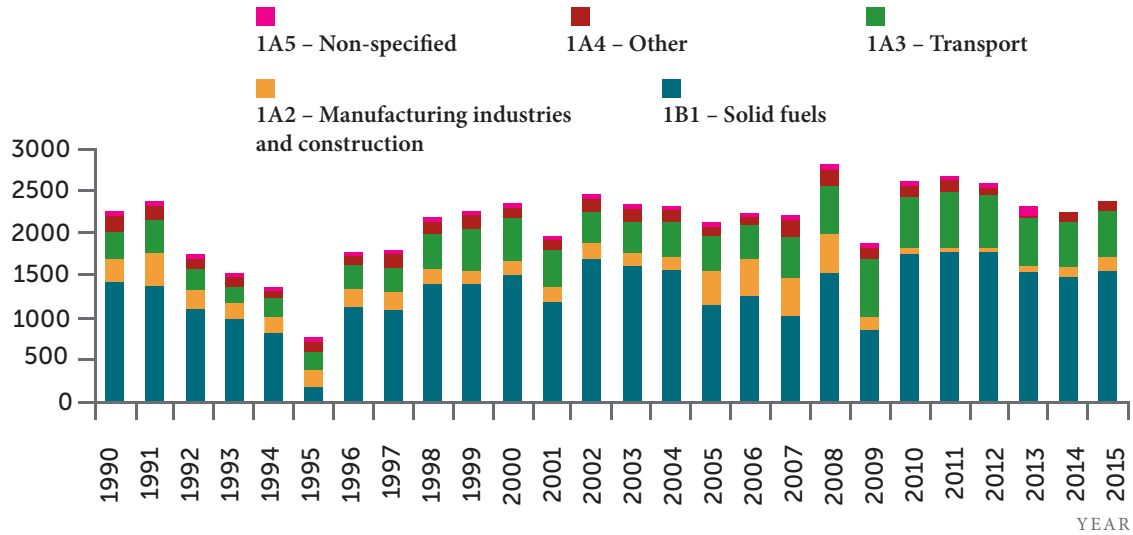


FIGURE 19: Total CO_2 emissions from the energy sector, 1990–2015 (Gg)

CH_4 emissions

Comparing CH_4 emissions with CO_2 emissions, one sees that the level of methane emissions from the energy sector is rather low and refers to combustion in other energy activities (1A4) and fugitive emissions from fuels (1B), including fugitive emissions from Pljevlja Coal Mine (Table 12 and Figure 20).

TABLE 12: CH_4 emissions from the energy sector and its subsectors, 1990–2015 (Gg)

Category	1990	1991	1992	1993	1994	1995	1996
1 – Energy	5.73	4.92	5.09	5.79	4.35	4.97	4.59
1A – Fuel combustion	3.88	3.35	3.55	3.87	2.72	3.08	2.96
1A1 – Energy industries	0.02	0.02	0.02	0.01	0.01	0.01	0.01
1A2 – Manufacturing industries & construction	0.01	0.02	0.01	0.01	0.01	0.01	0.01
1A3 – Transport	0.11	0.12	0.08	0.06	0.06	0.07	0.08
1A4 – Other sectors	3.73	3.19	3.44	3.78	2.63	2.98	2.85
1A5 – Non-specified	0.01	0.00	0.01	0.01	0.01	0.02	0.01
1B – Fugitive emissions from fuels	1.85	1.56	1.54	1.92	1.63	1.90	1.63
1B1 – Solid fuels	1.85	1.56	1.54	1.92	1.63	1.90	1.63
Category	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
1 – Energy	4.15	3.94	4.08	4.07	3.46	5.52	4.76
1A – Fuel combustion	2.74	2.54	2.67	2.71	2.30	3.24	3.36
1A1 – Energy industries	0.02	0.02	0.02	0.02	0.02	0.02	0.02
1A2 – Manufacturing industries & construction	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1A3 – Transport	0.09	0.13	0.15	0.13	0.11	0.08	0.10
1A4 – Other sectors	2.60	2.38	2.48	2.54	2.15	3.11	3.21
1A5 – Non-specified	0.01	0.01	0.01	0.01	0.01	0.01	0.02
1B – Fugitive emissions from fuels	1.41	1.39	1.42	1.36	1.16	2.28	1.41
1B1 – Solid fuels	1.41	1.39	1.42	1.36	1.16	2.28	1.41

Category	2004	2005	2006	2007	2008	2009	2010
1 – Energy	4.86	4.50	4.79	1.56	4.99	4.47	2.30
1A – Fuel combustion	3.40	3.25	3.34	0.42	3.47	3.64	0.61
1A1 – Energy industries	0.02	0.01	0.01	0.01	0.02	0.01	0.02
1A2 – Manufacturing industries & construction	0.01	0.02	0.02	0.02	0.02	0.01	0.00
1A3 – Transport	0.10	0.10	0.11	0.11	0.11	0.14	0.12
1A4 – Other sectors	3.26	3.10	3.15	0.11	3.17	3.33	0.42
1A5 – Non-specified	0.01	0.02	0.05	0.16	0.16	0.15	0.04
1B – Fugitive emissions from fuels	1.46	1.25	1.44	1.14	1.52	0.83	1.69
1B1 – Solid fuels	1.46	1.25	1.44	1.14	1.52	0.83	1.69

Category	2011	2012	2013	2014	2015
1 – Energy	5.53	5.39	5.11	4.90	5.36
1A – Fuel combustion	3.81	3.84	3.64	3.46	3.60
1A1 – Energy industries	0.02	0.02	0.02	0.01	0.02
1A2 – Manufacturing industries & construction	0.02	0.02	0.02	0.02	0.03
1A3 – Transport	0.10	0.10	0.07	0.09	0.10
1A4 – Other sectors	3.67	3.71	3.51	3.33	3.46
1A5 – Non-specified	0.00	0.00	0.02	0.00	0.00
1B – Fugitive emissions from fuels	1.72	1.55	1.47	1.44	1.76
1B1 – Solid fuels	1.72	1.55	1.47	1.44	1.76

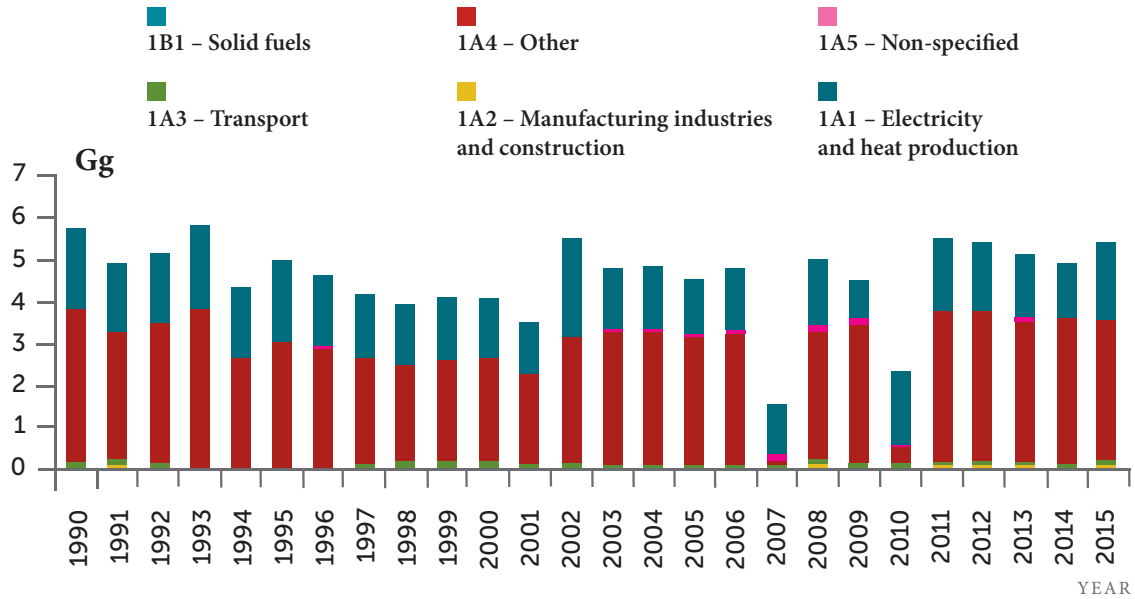


FIGURE 20: Total CH_4 emissions from the energy sector, 1990–2015 (Gg)

N_2O emissions

Over the reporting period a low level of N_2O emissions from the energy sector is recorded, with the highest share from 1A4 – Other sectors, related to fuel combustion, with a negligible share from the transport sector (Table 13 and Figure 21).

TABLE 13: N_2O emissions from the energy sector and its subsectors, 1990–2015 (Gg)

Category	1990	1991	1992	1993	1994	1995	1996
1 – Energy	0.09	0.09	0.08	0.08	0.06	0.06	0.07
1A – Fuel combustion	0.09	0.09	0.08	0.08	0.06	0.06	0.07
1A1 – Energy industries	0.02	0.02	0.02	0.01	0.01	0.00	0.02
1A2 – Manufacturing industries & construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1A3 – Transport	0.02	0.02	0.01	0.01	0.01	0.01	0.01
1A4 – Other sectors	0.05	0.04	0.05	0.05	0.04	0.04	0.04
1A5 – Non-specified	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1B – Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1B1 – Solid fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Category	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
1 – Energy	0.07	0.08	0.08	0.08	0.07	0.09	0.09
1A – Fuel combustion	0.07	0.08	0.08	0.08	0.07	0.09	0.09
1A1 – Energy industries	0.02	0.02	0.02	0.02	0.02	0.02	0.02
1A2 – Manufacturing industries & construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1A3 – Transport	0.02	0.02	0.03	0.03	0.02	0.02	0.02
1A4 – Other sectors	0.03	0.03	0.03	0.03	0.03	0.04	0.04
1A5 – Non-specified	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1B – Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1B1 – Solid fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Category	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
1.A – Fuel combustion	0.09	0.08	0.10	0.05	0.11	0.10	0.07
1A1 – Energy industries	0.09	0.08	0.10	0.05	0.11	0.10	0.07
1A2 – Manufacturing industries & construction	0.02	0.02	0.02	0.01	0.02	0.01	0.03
1A3 – Transport	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1A4 – Other sectors	0.02	0.02	0.02	0.03	0.03	0.04	0.03
1A5 – Non-specified	0.04	0.04	0.04	0.00	0.04	0.04	0.01
1B – Fugitive emissions from fuels	0.00	0.00	0.01	0.00	0.01	0.00	0.00
1B1 – Solid fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1A – Fuel combustion	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Category	**2011**	**2012**	**2013**	**2014**	**2015**		
1 – Energy	0.11	0.11	0.10	0.10	0.10		
1A – Fuel combustion	0.11	0.11	0.10	0.10	0.10		
1A1 – Energy industries	0.03	0.03	0.02	0.02	0.02		
1A2 – Manufacturing industries & construction	0.00	0.00	0.00	0.00	0.00		
1A3 – Transport	0.03	0.03	0.03	0.03	0.03		
1A4 – Other sectors	0.05	0.05	0.05	0.04	0.05		
1A5 – Non-specified	0.00	0.00	0.00	0.00	0.00		
1B – Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00		
1B1 – Solid fuels	0.00	0.00	0.00	0.00	0.00		

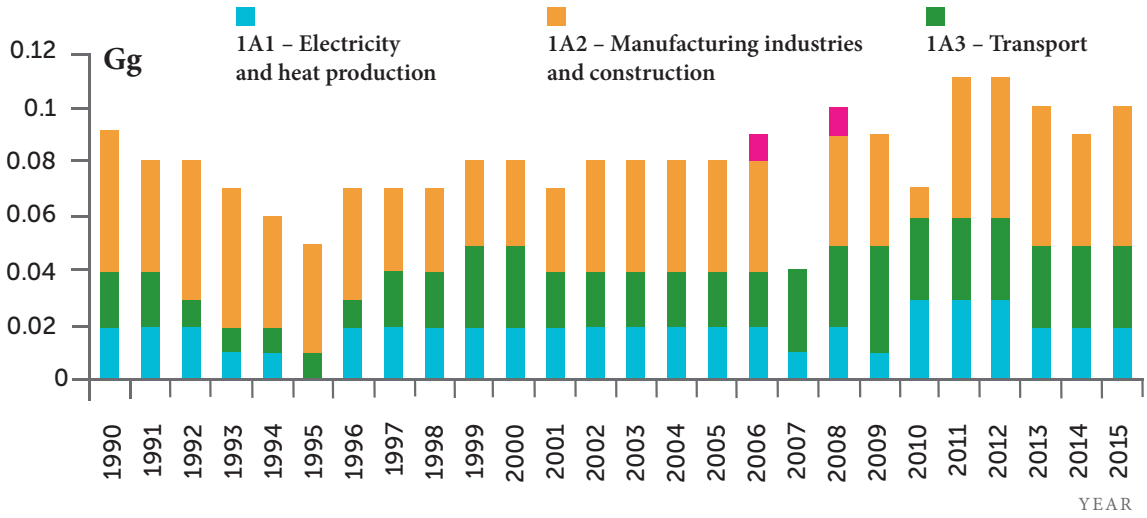


FIGURE 21: Total N_2O emissions from the energy sector, 1990–2015 (Gg)

Activity indicators and emission factors

The emissions were calculated using the combined Tier-1 and Tier-2 approaches from the IPCC 2006 methodology. This methodology includes combined use of the default and national emission factors, i.e. lower heating values and specific carbon emissions in fossil fuels. Oxidation factor 1 was used for the entire time series. The emission factors of fossil fuels and the type of biomass used are given in Table 15.

TABLE 14: Lower heating value and carbon contents of fuels and non-energy oil derivatives

FOSSIL FUEL	LOWER HEATING VALUE	UNIT	Spec. emission of CO2 – C (t /TJ)
Brown coal	16.75	MJ/kg	26.2
Lignite	9.21	MJ/kg	27.6
Wood and wood waste	15.6	MJ/dm^3	29.9
Charcoal	29.5	MJ/kg	29.9
Other solid biomass	11.6	MJ/kg	29.9
Other solid waste	1.00	MJ/MJ	17.2
Industrial wastes	1.00	MJ/MJ	18.9
Liquefied petroleum gases	46.15	MJ/kg	19.5
Motor gasoline	44.59	MJ/kg	20.2
Jet kerosene	44.10	MJ/kg	20.2
Diesel oil	42.71	MJ/kg	21.1
Light distillate oil	42.71	MJ/kg	21.1
Heavy fuel oil, S < 1%	40.19	MJ/kg	20.0
Heavy fuel oil, S ≥ 1%	40.19	MJ/kg	22.0
Lubricants	33.50	MJ/kg	27.5
Bitumen	33.50	MJ/kg	20.0
Petroleum coke	31.00	MJ/kg	27.5
Other oil derivatives	40.19	MJ/kg	20.0

Fossil fuel	CO_2 emission factor (kg /TJ)
Brown coal	96 100
Lignite	99 176
Wood and wood waste	107 440
Liquefied petroleum gases	62 436
Motor gasoline	68 607
Jet kerosene	70 785
Diesel oil	73 326
Diesel oil	76 593
Light distillate oil	76 593
Heavy fuel oil, S < 1%	76 593
Petroleum coke	98 817

TABLE 16: Default CO_2 emission factors for fuels

Fossil fuel	CO_2 emission factor (kg /TJ)
Wood and wood waste	107 440
Charcoal	112 000
Other solid biomass	100 000
Jet kerosene	70 785

To calculate the N_2O and CH_4 emissions, the default emissions factors from the IPCC methodology were used (Table 17).

TABLE 17: Emission factors for CH_4 and N_2O from energy subsectors

SUBSECTOR	Fossil fuel	CH_4 emission factor (kg/TJ)	N_2O emission factor (kg/TJ)
1A1a – Energy and heat production	Brown coal	10	1.5
	Lignite	10	1.5
1A2 – Manufacturing industries and construction	Wood and wood waste	30	4
	Liquefied petroleum gas	3	0.1
	Diesel oil	3	0.6
	Motor gasoline	3	0.6
	Light distillate oil	3	0.6
	Petroleum coke	3	0.6
	Other solid biomass	30	4
	Charcoal	200	4
1A3ai– International aviation (international bunkers)	Jet kerosene	0.5	2
1A3aii – Domestic aviation			
1A3b – Road transportation	Motor gasoline	33	3.2
	Diesel oil	3.9	3.9
	Liquefied Petroleum Gas (LPG)	62	0.2
1A3c – Railways	Diesel oil	4.15	28.6

1A3di – Domestic water-borne navigation	Motor gasoline	7	2
	Diesel oil	7	2
	Light distillate oil	7	2
1A4cii – Off-road vehicles and other machinery	Motor gasoline	10	0.6
	Diesel oil	10	0.6
	Light distillate oil	10	0.6
1A4ci – Stationary	Light distillate oil	10	0.6
1A4b – Residential	Light distillate oil	10	0.6
	LPG	5	0.1
	Brown coal	300	1.5
	Lignite	300	1.5
	Other solid biomass	30	4
	Charcoal	300	4
1A4a – Commercial/ institutional	Light distillate oil	10	0.6
	LPG	5	0.1
	Lignite	10	1.5
	Other solid biomass	30	4
	Charcoal	300	4
	Wood and wood waste	300	4
1A5biii – Mobile (other)	Diesel oil	7	2

TABLE 18: Emission factors for CH_4 – Fugitive emissions

SUBSECTOR Fugitive emissions	CH_4 emission factor (m^3/t)	N_2O emission factor (kg/TJ)
1B1ai1 – Coal mining – underground mines	18	-
1B1ai2 – Post-mining seam gas emissions	2.5	-
1B1aii1 – Coal mining – surface mines	1.2	-
1B1aii2 – Post-mining seam gas emissions	0.1	-

Table 19 features the data on fossil-fuel consumption used to calculate emissions from the energy sector, following Common Reporting Format (CRF) categories.

TABLE 19: Fossil-fuel consumption in energy sector, 1990–2015 (Gg)

CRF category	Fuel (Gg)	1990	1991	1992	1993	1994	1995	1996	1997
1A1ai – Electricity generation	Light distillate oil	4.6	4.4	1.9	1.6	1.4	0	1.8	2.4
	Lignite	1 185	1 204	996	930	739	36	1 054	970.3
1A1aiii – Heat plants	Light distillate oil	95.05	76	46	35	38	39	37	61.2
	Lignite	7	9	8	8	9	8	9	2
1A1ci – Manufacture of solid fuels	Diesel oil	2.4	2.3	1	1	1	1	1	2
1A2a – Iron and steel	LPG	0	0	0	0	0	0	0	0
	Light distillate oil	26.8	40	25	21	20	19	22	14.1
	Petroleum coke	0	0	0	0	0	0	0	0.8
	Lignite	25	21	19	16	16	17	21	34
1A2b – Non-ferrous metals	Diesel oil	4.9	3	2	1	1	1	1	2.1
	Light distillate oil	31.2	60	35	23	30	28	27	16.6
	LPG	0.2	0	0	0	0	0	0	0
1A2c – Chemicals	LPG	0	0	0	0	0	0	0	0
	Brown coal	0	0	0	0	0	0	0	0
1A2d – Pulp, paper and print	Brown coal	0	0	0	0	0	0	9	12
	Lignite	0	0	0	0	0	0	0	0
1A2e – Food processing, beverages and tobacco	Light distillate oil	0	0	0	0	0	0	0	0
	LPG	0.5	0.5	0	0	0	0	0	0.8
	Petroleum coke	0	0	0	0	0	0	0	0.8
	Brown coal	1	0	1	1	1	1	1	1
	Lignite	1	0	1	1	1	1	2	1
1A2f – Non-metallic minerals	Light distillate oil	0	0	0	0	0	0	0	0
	Brown coal	0	0	0	0	0	0	0	0
1A2i – Mining (excl. fuels) and quarrying	Light distillate oil	0	0	0	0	0	0	0	0
1A2j – Wood and wood products	LPG	0	0	0	0	0	0	0	0
	Brown coal	0	0	0	0	0	0	0	0
	Wood and wood waste	0	0	0	0	0	0	0	0
1A2k – Construction	Light distillate oil	4.8	0	0	0	0	0	0	0
	Brown coal	0	0	0	0	0	0	0	0
1A2l – Textile and leather	Brown coal	0	0	0	1	1	2	2	2
	Lignite	19	15	14	11	11	11	15	8
1A2m – Non-specified industry	Light distillate oil	0	5	5	4	2	3	4	
	LPG	1.1	1	0	0	0	0	0	1.1
	Petroleum coke	0	0	0	0	0	0	0	0
	Brown coal	2	2	2	2	1	1	1	2
	Lignite	15	15	13	10	10	9	15	15
1A3ai – International aviation (bunkers)	Jet fuel	12.5	14.3	2	1	1	1	1	0.5
1A3aii – Domestic aviation	Jet fuel	0	0	0	0	0	0	0	0
1A3b – Road transportation	Gasoline	68.4	76	50.8	37	41	43	52	57.6
	Diesel oil	37.6	47	26	22	25	28	36	35.3
	LPG	0	0	0	0	0	0	0	0
1A3c – Railways	Diesel oil	1.3	1	1	1	1	1	1	1.1
1A3dii – Domestic water-borne navigation	Gasoline	0	0	0	0	0	0	0	0
	Diesel fuel	1	1	1	1	1	1	1	1
	Light distillate oil	0	0	0	0	0	0	0	0

1A4a – Commercial/ institutional	Light distillate oil	17.5	16	9	11	9	12	7	12.1
	LPG	1.7	0	0	0	0	0	0	0.1
	Lignite	40.9	36	31	22	21	22	32	48.1
	Wood and wood waste	0	0	0	0	0	0	0	0
1A4b – Residential	Light distillate oil	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.6
	LPG	8.5	11	1	1	0	1	2	0.5
	Petroleum coke	0	0	0	0	0	0	0	0.5
	Brown coal	0	0	0	0	0	0	0	0
	Lignite	25	23	22	21	21	20	26	32
	Wood and wood waste	777.9	665.2	719.6	793.4	547.72	622.13	590.7	534.3
1A4ci – Stationary	Light distillate oil	1	1	1	1	1	1	1	1
1A4cii – Off-road vehicles and other machinery	Gasoline	0	0	0	0	0	0	0	0
	Diesel fuel	8	7	6	5	6	7	6	7.2
	Light distillate oil	0	0	0	0	0	0	0	0
1A5biii – Mobile (other)	Diesel fuel	5.8	6	3	2	2	3	3	6.7
	Petroleum coke	0	0	0	0	0	0	0	0
CRF category	**Fuel (Gg)**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
1A1ai – Electricity generation	Light distillate oil	3.1	3.2	3.5	2.5	1.3	1.6	1.3	2.2
	Lignite	1 302	1 258	1 381	1 001	1598.4	1 480	1 394	1 200
1A1aiii – Heat plants	Light distillate oil	55.7	63.2	63.4	71.8	67.9	71.4	77.6	0
	Lignite	2	2	2	2	3	4	4	4.1
1A1ci – Manufacture of solid fuels	Diesel oil	3.9	3.2	5.7	3.1	3	4.6	2.7	3.4
1A2a – Iron and steel	LPG	0.9	1	1	1	1	0	0	1
	Light distillate oil	12.9	9.8	7.3	9.9	6.7	4.8	12.2	9.6
	Petroleum coke	0.9	0	0	0	0	0	0	0
	Lignite	27	32	26	22	33	33	28	25
1A2b – Non-ferrous metals	Diesel oil	1.5	1.8	2.8	3	2.3	2	2.2	0
	Light distillate oil	16	16.7	26.4	27.1	29.8	29.5	27	95.8
	LPG	0.2	0	0	0	0	0	0	0
1A2c – Chemicals	LPG	0	0	0	0	0	0	0	0
	Brown coal	0	0	0	0	0	0	0	2
1A2d – Pulp, paper and print	Brown coal	0	0	0	0	0	0	0	0
	Lignite	15	12	7	6	3	2	2	2
1A2e – Food processing, beverages and tobacco	Light distillate oil	0	0	0	0	0	0	0	4.8
	LPG	0	0	0	0	0	0	0	0
	Petroleum coke	0.6	0.6	0	0	0	0	0	0
	Brown coal	0	2	0	1	2	1	1	2
	Lignite	2	2	2	1	1	0	0	0
1A2f – Non-metallic minerals	Light distillate oil	0	0	0	0	0	0	0	1
	Brown coal	0	0	0	0	0	0	0	1
1A2i – Mining (excl. fuels) and quarrying	Light distillate oil	0	0	0	0	0	0	0	1
1A2j – Wood and wood products	LPG	0	0	0	0	0	0	0	0
	Brown coal	0	0	0	0	0	0	0	0
	Wood and wood waste	0	0	0	0	0	0	0	0
1A2k – Construction	Light distillate oil	0	0	0	0	0	0	0	0
	Brown coal	0	2	0	3	2	2	2	1

1A2l – Textile and leather	Brown coal	0	2	0	2	3	0	0	14
	Lignite	9	7	5	3	3	1	0	0
1A2m – Non-specified industry	Light distillate oil	0	0	0	0	0	0	0	3.7
	LPG	0.6	1	0	1	1	1	1	4
	Petroleum coke	1	0	0	0	0	0	0	0
	Brown coal	0	2	0	0	1	0	0	0
	Lignite	28	22	23	19	13	7	6	6
1A3ai –International aviation (bunkers)	Jet fuel	4.4	13	12.9	14	10.6	8.3	7.3	13
1A3aii – Domestic aviation	Jet fuel	0.6	0.3	0.4	1.9	4.2	4.7	0	2.4
1A3b – Road transportation	Gasoline	79	91.7	78.2	65.9	50.4	61.5	61.6	52
	Diesel oil	51.8	69.1	81.4	70.8	57.7	51.4	71.8	65.7
	LPG	0	0	0	0	0.1	0.1	0.1	3
1A3c – Railways	Diesel oil	1.1	0.8	1.2	1.1	1	1	1.2	2
1A3dii – Domestic water-borne navigation	Gasoline	0	0	0	0	0	0	0	0
	Diesel fuel	1	0.8	1.3	1.6	1.8	1.9	1.8	3
	Light distillate oil	0	0	0	0	0	0	0	0
1A4a – Commercial / institutions	Light distillate oil	12.7	13.4	15.4	15.3	17.6	17	17.9	15.7
	LPG	0	0	0	0	0	0	0	0
	Lignite	48.7	53.2	30	30	35	32.5	27	12
	Wood and wood waste	0	0	0	0	0	0	0	0
1A4b – Residential	Light distillate oil	0.7	0.7	0.8	0.9	1	1.1	1.2	2.4
	LPG	1.1	0	0	0	0.9	2	3	0
	Petroleum coke	1.1	0.5	0	0	0	0	0	0
	Brown coal	0	0	0	0	0	0	0	0
	Lignite	35.3	41.8	24	26.7	34	33	29	18
	Wood and wood waste	484	503	526	441	642	663	676	649
1A4ci – Stationary	Light distillate oil	1.1	0.5	0	0	0	0	0	0
1A4cii – Off-road vehicles and other machinery	Gasoline	0.3	0	1	0	0	0	0	0
	Diesel fuel	6.7	6	6.1	5.9	6	6	6	6
	Light distillate oil	0	0	0	0	0	0	0	0
1A5biii – Mobile (other)	Diesel oil	8	7.4	9	6	9.3	9	6	9
	Petroleum coke	1.3	0.5	0	0	0	0	0	0

CRF category	Fuel (Gg)	2006	2007	2008	2009	2010	2011	2012	2013
1A1ai – Electricity generation	Light distillate oil	1.4	3.2	2.7	1.4	3	3	3.3	0
	Lignite	1 363	1 065	1 636	875	1 856	1 900	1 900	1 648
1A1aiii – Heat plants	Light distillate oil	0	0	0	0	0	0	0	0
	Lignite	4	4	4	2	2	0	0	0
1A1ci – Manufacture of solid fuels	Diesel oil	4.5	4.4	5.3	4.9	5.5	5.9	5.4	0
1A2a – Iron and steel	LPG	0	2.1	0	4	2	2	2	2
	Light distillate oil	9.7	11.1	13.6	0	7.6	0	0	3
	Petroleum coke	0	0	0	0	0	0	0	0
	Lignite	22	14	16	13	9	12	12	10
1A2b – Non-ferrous metals	Diesel oil	0	0	0	0	0	0	0	0
	Light distillate oil	101.4	99.6	95.2	37.4	4.2	0	0	0
	LPG	0	0	0	0	0	0	0	0
1A2c – Chemicals	LPG	0	0	0	0	0	5	4	0
	Brown coal	1	2	1	0	0	0	0	0
1A2d – Pulp, paper and print	Brown coal	0	0	0	0	0	0	0	0
	Lignite	1	1	2	0	0	0	0	0

1A2e – Food processing, beverages and tobacco	Light distillate oil	1.7	4.2	5.3	1.3	1.3	0	0	0
	LPG	0	0	1	0	0	0	0	1
	Petroleum coke	0	0	0	0	0	0	0	0
	Brown coal	1	4	2	0	0	0	0	0
	Lignite	0	0	0	0	0	2	2	1
1A2f – Non-metallic minerals	Light distillate oil	1	1	1	1.1	1	0	0	1
	Brown coal	1	2	2	0	0	0	0	0
1A2i – Mining (excl. fuels) and quarrying	Light distillate oil	1	1	1	1.3	1	0	0	0
1A2j – Wood and wood products	LPG	0	0	0	0	0	0	0	2
	Brown coal	0	0	4	0	0	0	0	0
	Wood and wood waste	0	0	0	0	0	28.2	30.1	28.2
1A2k – Construction	Light distillate oil	0	0	0	0	0	0	0	0
	Brown coal	0	0	0	0	0	0	0	0
1A2l – Textile and leather	Brown coal	6.5	2	1	0	0	0	0	0
	Lignite	0	0	0	0	0	0	0	0
1A2m – Other industry	Light distillate oil	1.8	9.2	8.6	0	0	0	0	5
	LPG	7	6	8	4	7	6	4	7
	Petroleum coke	0	0	0	0	0	0	0	0
	Brown coal	3	7	4	3	0	0	0	0
	Lignite	7	0	0	2	2	1	1	2
1A3ai –International aviation (bunkers)	Jet fuel	15	10.6	14	1.8	2	10	12	13
1A3aii – Domestic aviation	Jet fuel	1.5	0	0	0	0	0	0	0
1A3b – Road transportation	Gasoline	54	54	50	64	57	40	34	31
	Diesel oil	71.5	101.4	128.5	145.2	123.1	159	155	156.6
	LPG	5	5.2	5	6.1	6.3	6	7	0
1A3c – Railways	Diesel oil	2.1	2	2.2	2.2	3	0	0	0
1A3dii – Domestic water-borne navigation	Gasoline	0	0	0	0	0	2	2	0
	Diesel oil	3.3	3.4	3.5	3.3	4	1	1	1
	Light distillate oil	0	0	0	0	0	0	2	3
1A4a – Commercial / institutions	Light distillate oil	2	33	35	26	29	33	23	0
	LPG	0	0	0	0	0	0	0	0
	Lignite	27	13	11	18	0	0	0	0
	Wood and wood waste	0	0	0	0	0	26.94	26.54	29.08
1A4b – Residential	Light distillate oil	2.1	2.7	2.7	3	2.7	2	2	2
	LPG	1	0	0	0	0	0	0	0
	Petroleum coke	0	0	0	0	0	0	0	0
	Brown coal	0	0	1	0	0	0	0	0
	Lignite	26	15	16	22	25	14	14	11
	Wood and wood waste	657	662	662	695	726	745	755	715
1A4ci – Stationary	Light distillate oil	0	4	4	0	0	0	0	0
1A4cii – Off-road vehicles and other machinery	Gasoline	0	0	0	0	0	1	1	1
	Diesel fuel	6	7	7	7	7	8	2	3
	Light distillate oil	1	0	0	0	0	0	0	0
1A5biii – Mobile (Other)	Diesel fuel	7	9	8	9	10	1	2	1
	Petroleum coke	0	0	0	0	0	0	0	0

CRF category	Fuel(Gg)	2014	2015						
1A1ai – Electricity generation	Light distillate oil	0	0						
	Lignite	1 597	1 669						
1A1aiii – Heat plants	Light distillate oil	0	0						
	Lignite	0	0						
1A1ci – Manufacture of solid fuels	Diesel oil	0	0						
1A2a – Iron and steel	LPG	0.3	0.9						
	Light distillate oil	0.2	0.8						
	Petroleum coke	0.00	0.00						
	Lignite	9.6	23.5						
1A2b – Non-ferrous metals	Diesel oil	0.00	0.00						
	Light distillate oil	0.2	0.2						
	LPG	0.00	0.00						
	Wood and wood waste	0.02	0.02						
	Other solid biomass	0.04	0.00						
1A2c – Chemicals	Diesel oil	0.3	0.5						
	Light distillate oil	0.3	1.1						
	Wood and wood waste	4.37	11.3						
1A2e – Food processing, beverages and tobacco	Light distillate oil	0.3	0.3						
	LPG	2.8	2.8						
	Diesel oil	6.7	4.1						
	Light distillate oil	1.6	2.8						
	Lignite	3.7	2.1						
	Wood and wood waste	31.4	26.5						
	Other solid biomass	0.012	0.01						
	Charcoal	0.002	0.002						
	Brown coal	0.00	1.1						
1A2f – Non-metallic minerals	Light distillate oil	0.1	0.5						
	Diesel oil	1.4	1.1						
	Wood and wood waste	0.7	0.75						
	Other solid biomass	0.00	0.04						
1A2i – Mining (excl. fuels) and quarrying	Light distillate oil	0.2	4.2						
	Diesel oil	4.3							
1A2j – Wood and wood products	Diesel oil	6.9	9.5						
	Light distillate oil	0.4							
	Motor gasoline	0.5							
	Lignite		0.9						
	Wood and wood waste	0.54	0.70						
1A2k – Construction	Light distillate oil								
	Brown coal								
1A2l – Textile and leather	Wood and wood waste	0.357	0.357						
	Other solid biomass		0.019						
	Light distillate oil		0.2						
	Diesel oil	0.2							

1A2m – Other industry	Light distillate oil	0.5	3.9						
	LPG	2.8	3.3						
	Diesel oil	10	8.6						
	Motor gasoline	0.5	1.1						
	Other solid biomass	0.5	0.60						
1A3ai – International aviation (bunkers)	Jet kerosene	17.2	18.1						
1A3aii – Domestic aviation	Jet fuel								
1A3b – Road transport	Gasoline	33.4	34						
	Diesel oil	118	135						
	LPG	6.8	8						
	Light distillate oil	6.2							
1A3c – Railways	Diesel oil								
1A3dii – Domestic water-borne navigation	Gasoline								
	Diesel oil	1.9	2						
	Light distillate oil	1	0.8						
1A4a – Commercial / institutional	Light distillate oil	0.3	2.1						
	LPG	1.2	1.4						
	Diesel oil	5.8	4.9						
	Lignite	5.9	6.8						
	Wood and wood waste	18.5	20.1						
	Other solid biomass	1.36	3.61						
	Charcoal	0.26	0.27						
1A4b – Residential	Gasoline	0.2							
	LPG	0.8	0.9						
	Petroleum coke								
	Other solid biomass	36.984	2.47						
	Lignite	13.9	14.5						
	Wood and wood waste	653.3	704.2						
	Charcoal	0.54	0.54						
1A4ci – Stationary	Light distillate oil								
1A4cii – Off-road vehicles and other machinery	Gasoline	0.5	0.8						
	Diesel oil	4	4						
	Light distillate oil	1	1.3						
1A5biii – Mobile (other)	Diesel oil								
	Petroleum coke								

Table 20 shows the data on coal mining.

TABLE 20: Coal mining in Montenegro, 1990–2015 (t)

Category	Coal quantity (t)							
1B1ai – Underground coal mines	1990	1991	1992	1993	1994	1995	1996	1997
	25 000	4 000	3 000	51 000	43 000	27 100	43 000	20 900
1B1aii – Surface coal mines	1 728 000	1 732 000	1 720 000	1 400 000	1 194 000	1 750 000	1 194 000	1 290 000
1B1ai – Underground coal mines	1998	1999	2000	2001	2002	2003	2004	2005
	NO	7 300	NO	9 900	55 000	NO	10 000	8 800
1B1aii – Surface coal mines	1 600 000	1 510 000	1 564 700	1 179 500	1 750 700	1 617 800	1 514 300	1 300 000
1B1ai – Underground coal mines	2006	2007	2008	2009	2010	2011	2012	2013
	9700	7000	NO	NO	NO	NO	NO	NO
1B1aii – Surface coal mines	1 502 000	1 195 500	1 740 000	957 000	1 938 000	1 972 700	1 785 000	1 692 500
1B1ai – Underground coal mines	2014	2015						
	NO	17 900						
1B1aii – Surface coal mines	1 655 037	1 734 772						

TABLE 21: CO_2 emissions, reference and sector-based approaches, 1990, 2014 and 2015

Year	Type of fuel	Reference approach		Sector-based approach		Difference	
		Fuel consumption (except non-energy) (TJ)	CO_2 emissions (Gg)	Fuel consumption (except non-energy) (TJ)	CO_2 emissions (Gg)	Fuel consumption (except non-energy) (%)	CO_2 emissions (%)
1990	Liquid	13 600	1 011	13 530	1 005	0.5	0.5
	Solid	12 177	1 223	12 192	1 233	–0.12	–0.11
	Total	25 776	2 243	25 721	2 239	0.21	0.18
2014	Liquid	10 963	756	9 669	702	13.4	7.6
	Solid	15 017	1 520	15 017	1 520	0	0
	Total	25 980	2 276	24 686	2 222	5.24	2.42
2015	Liquid	11 782	861	10 467	761	12.6	13.2
	Solid	15 848	1 604	15 848	1 604	0	0.0033
	Total	27 629	2 464	26 315	2 364	4.99	4.23

Uncertainty assessment in the energy sector

For the needs of the present report, the uncertainties in the inventory assessment for 2014 and 2015 were estimated. The calculation was done using the IPCC methodology[1]. The uncertainties were calculated for all sectors using the Tier-1 approach with the default methodologies for calculating the uncertainties for each gas.

For assessing input data and emission factor uncertainties we used the IPCC default values.

The values used for the activity data and emission factors uncertainties in the energy sector are given in Table 22 below.

TABLE 22: Uncertainties in input data and emission factors, 2014 and 2015 (%)

Category	Gas	Activity data uncertainties (%)	Emission data uncertainties (%)	Aggregate uncertainty (%)
1 A – Fuel combustion activities				
1A1ai – Electricity generation – liquid fuels	CO_2	5	5	7.07
1A1ai – Electricity generation – liquid fuels	CH_4	5	50	50.3
1A1ai – Electricity generation – liquid fuels	N_2O	5	200	200
1A1ai – Electricity generation – solid fuels	CO_2	5	5	7.07
1A1ai – Electricity generation – solid fuels	CH_4	5	50	50.3
1A1ai – Electricity generation – solid fuels	N_2O	5	200	200.06
1A1ci – Manufacture of solid fuels – liquid fuels	CO_2	5	5	7.07
1A1ci – Manufacture of solid fuels – liquid fuels	CH_4	5	50	50.3
1A1ci – Manufacture of solid fuels – liquid fuels	N_2O	5	200	200
1A2a – Iron and steel – liquid fuels	CO_2	5	5	7.07
1A2a – Iron and steel – liquid fuels	CH_4	5	50	50.3
1A2a – Iron and steel – liquid fuels	N_2O	5	200	200
1A2a – Iron and steel – solid fuels	CO_2	5	5	7.07
1A2a – Iron and steel – solid fuels	CH_4	5	50	50.3
1A2a – Iron and steel – solid fuels	N_2O	5	200	200
1A2c – Chemicals – liquid fuels	CO_2	5	5	7.07
1A2c – Chemicals – liquid fuels	CH_4	5	5	7.07
1A2c – Chemicals – liquid fuels	N_2O	5	5	7.07
1A2e – Food processing, beverages and tobacco – solid fuels	CO_2	5	5	7.07

[1] IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories.

1A2e – Food processing, beverages and tobacco – solid fuels	CH_4	5	50	50.3
1A2e – Food processing, beverages and tobacco – solid fuels	N_2O	5	200	200
1A2j – Wood and wood products – wood and wood waste	CO_2	5	5	7.07
1A2j – Wood and wood products – wood and wood waste	CH_4	5	5	7.07
1A2j – Wood and wood products – wood and wood waste	N_2O	5	5	7.07
1A2m – Other industry – liquid fuels	CO_2	5	5	7.07
1A2m – Other industry – liquid fuels	CH_4	5	50	50.3
1A2m – Other industry – liquid fuels	N_2O	5	200	200
1A2m – Other industry – solid fuels	CO_2	5	5	7.07
1A2m – Other industry – solid fuels	CH_4	5	50	50.3
1A2m – Other industry – solid fuels	N_2O	5	200	200
1A3ai – International aviation (bunkers) – liquid fuels	CO_2	5	5	7.07
1A3ai – International aviation (bunkers) – liquid fuels	CH_4	5	50	50.3
1A3ai – International aviation (bunkers) – liquid fuels	N_2O	5	200	200
1A3b – Road transportation – liquid fuels	CO_2	5	5	7.07
1A3b – Road transportation – liquid fuels	CH_4	5	50	50.3
1A3b – Road transportation – liquid fuels	N_2O	5	200	200
1A3dii – Domestic water-borne navigation – liquid fuels	CO_2	5	5	7.07
1A3b – Road transport – liquid fuels	CH_4	5	50	50.3
1A3b – Road transport – liquid fuels	N_2O	5	200	200
1A3dii – Domestic water-borne navigation – liquid fuels	CO_2	5	5	7.07
1.A.3.d.ii – Domestic water-borne navigation – liquid fuels	CH_4	5	50	50.3
1A3dii – Domestic water-borne navigation – liquid fuels	N_2O	5	200	200
1A4a – Commercial/Institutional – liquid fuels	CO_2	5	5	7.07
1A4a – Commercial/Institutional – liquid fuels	CH_4	5	50	50.3
1A4a – Commercial/Institutional – liquid fuels	N_2O	5	200	200
1A4a – Commercial/Institutional – wood and wood waste	CO_2	5	5	7.07
1A4a – Commercial/Institutional – wood and wood waste	CH_4	5	50	50.3

1A4a – Commercial/Institutional – wood and wood waste	N_2O	5	200	200
1A4b – Residential – liquid fuels	CO_2	5	5	7.07
1A4b – Residential – liquid fuels	CH_4	5	50	50.3
1A4b – Residential – liquid fuels	N_2O	5	200	200
1A4b – Residential – solid fuels	CO_2	5	5	7.07
1A4b – Residential – solid fuels	CH_4	5	50	50.3
1A4b – Residential – solid fuels	N_2O	5	200	200
1A4b – Residential – wood and wood waste	CO_2	5	5	7.07
1A4b – Residential – wood and wood waste	CH_4	5	50	50.3
1A4b – Residential – wood and wood waste	N_2O	5	200	200
1A4cii – Off-road vehicles and other machinery - liquid fuels	CO_2	5	5	7.07
1A4cii – Off-road vehicles and other machinery - liquid fuels	CH_4	5	50	50.3
1A4cii – Off-road vehicles and other machinery – liquid fuels	N_2O	5	200	200
1A5biii – Mobile (other) – liquid fuels	CO_2	5	5	7.07
1A5biii – Mobile (other) – liquid fuels	CH_4	5	50	50.3
1A5biii – Mobile (other) – liquid fuels	N_2O	5	200	200
1B1ai – Underground coal mines	CH_4	5	200	200
1B1aii – Surface coal mines	CH_4	5	200	200

INDUSTRIAL PROCESSES

The main industrial processes in Montenegro are in the mining and metal industry. In the metal industry sector, the most prominent processes are aluminium and steel production. Other industrial facilities involve the processing of food, beverages, tobacco, textiles, agricultural lime, leather products, paper, medications, and rubber and plastic products.

Pre-1991, the economic development of Montenegro was characterized by intensive industrial production and the share of GHG emissions from industrial processes accounted for 49.6% of the total in 1991. After that, industrial production saw a steady decline, with total emissions from this sector accounting for 11.7% of the total in 2014, and not more than 10% in 2015.

Data sources

The data concerning industrial processes was reported by: MONSTAT, the national power company EPCG, the Power Transmissions System, the Agency for Nature and Environmental Protection, KAP, Nikšić Steel Plant, and Pljevlja Coal Mines.

Official MONSTAT statistics were used for estimating the emissions from this sector, while for verification of the inventory, the records of industrial producers, provided for information purposes alone, were used.

Emission trends

The estimation of direct GHG emissions from industrial processes was done according to the 2006 IPCC methodology and the 2000 IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories.

GHG emissions expressed as CO_2eq

The estimated CO_2eq emissions from industrial processes for the reporting period are shown in Table 23 and Figure 22. It is noticeable that in the industrial subsectors the level of GHG emissions is proportionate to their respective production outputs over the period 1990–2015.

TABLE 23: CO_2eq emissions from industrial processes, 1990–2015 (Gg)

Category	1990	1991	1992	1993	1994	1995	1996	1997
2 – Industrial processes and product use	2 603	3 343	2 166	810	103	363	332	1 772
2A – Mineral industry	24.8	23.3	16.5	0.00	0.00	24.8	3.00	6.00
2A2 – Lime production	24.8	23.3	16.5	0.00	0.00	24.8	3.00	6.00
2C – Metal industry	2 575	3 316	2 147	808	101	336	326	1 763
2C1 – Iron and steel production	16.7	15.8	11.5	9.28	9.00	16.6	7.09	10.62
2C3 – Aluminium production	2 558	3 300	2 135	799	91.8	319	319	1 752
2D – Non-energy products from fuels and solvent use	2.21	2.21	1.62	0.98	1.18	1.52	1.67	1.67
2D1 – Lubricant use	2.21	2.21	1.62	0.98	1.18	1.52	1.67	1.67
2G – Other product manufacture and use	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
2G1 – Electrical equipment	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
2H – Other	0.56	0.64	0.49	0.32	0.45	0.56	0.50	0.48
2H2 – Food and beverages industry	0.56	0.64	0.49	0.32	0.45	0.56	0.50	0.48

Category	1998	1999	2000	2001	2002	2003	2004
2 – Industrial processes and product use	1 685	1 889	2 348	2 490	2 548	2 109	1 898
2A – Mineral industry	6.00	6.00	5.33	9.74	8.34	6.10	7.94
2A2 – Lime production	6.00	6.00	5.33	9.74	8.34	6.10	7.94
2C – Metal industry	1 676	1 880	2 339	2 477	2 536	2 099	1 886
2C1 – Iron and steel production	11.3	7.06	6.78	8.81	6.63	4.72	12.05
2C3 – Aluminium production	1 664	1 873	2 333	2 468	2 529	2 094	1 874
2D – Non-energy products from fuels and solvent use	1.77	1.77	1.82	1.87	1.87	1.92	1.97
2D1 – Lubricant use	1.77	1.77	1.82	1.87	1.87	1.92	1.97
2G – Other product manufacture and use	0.84	0.84	0.92	0.92	0.97	1.15	1.33
2G1 – Electrical equipment	0.84	0.84	0.92	0.92	0.97	1.15	1.33
2H – Other	0.53	0.65	0.72	0.72	0.45	0.63	0.60
2H2 – Food and beverages industry	0.53	0.65	0.72	0.72	0.45	0.63	0.60

Category	2005	2006	2007	2008	2009	2010	2011
2 – Industrial processes and product use	1 760	1 869	2 029	1 064	671	851	864
2A – Mineral industry	4.51	6.09	5.32	7.38	3.37	0.63	2.59
2A2 – Lime production	4.51	6.09	5.32	7.38	3.37	0.63	2.59
2C – Metal industry	1 751	1 854	2 010	1 036	640	813	813
2C1 – Iron and steel production	8.18	13.0	13.9	16.1	8.28	3.86	4.89
2C3 – Aluminium production	1 743	1 841	1 996	1 020	631	809	808
2D – Non-energy products from fuels and solvent use	0.49	1.87	0.59	0.54	0.44	0.39	0.49
2D1 – Lubricant use	0.49	1.87	0.59	0.54	0.44	0.39	0.49
2F – Product uses as substitutes for ozone depleting substances	1.85	5.42	10.6	17.4	25.6	35.1	45.9
2F1 – Refrigeration and air-conditioning	1.85	5.42	10.6	17.4	25.6	35.1	45.9
2G – Other product manufacture and use	1.43	1.49	1.49	1.52	1.54	1.55	1.60
2G1 – Electrical equipment	1.43	1.49	1.49	1.52	1.54	1.55	1.60
2H – Other	0.64	0.66	0.67	0.69	0.59	0.56	0.52
2H2 – Food and beverages industry	0.64	0.66	0.67	0.69	0.59	0.56	0.52

Category	2012	2013	2014	2015
2 – Industrial processes and product use	444	316	386	411
2C – Metal industry	380	240	294	310
2C1 – Iron and steel production	2.25	1.58	1.15	2.91
2C3 – Aluminium production	378	238	293	307
2D – Non-energy products from fuels and solvent use	0.49	0.49	4.52	4.67
2D1 – Lubricant use	0.49	0.49	4.52	4.67
2F – Product uses as substitutes for ozone-depleting substances	61.3	73.3	85.4	94.0
2F1 – Refrigeration and air-conditioning	61.3	73.3	85.4	94.1
2G – Other product manufacture and use	2.00	2.19	2.23	1.88
2G1 – Electrical equipment	2.00	2.19	2.23	1.88
2H – Other	0.53	0.49	0.48	0.48
2H2 – Food and beverages industry	0.53	0.49	0.48	0.48

The share of CO_2eq emissions from aluminium production is predominant in total emissions from industrial processes over the reporting period and ranges from 70% to more than 90%.

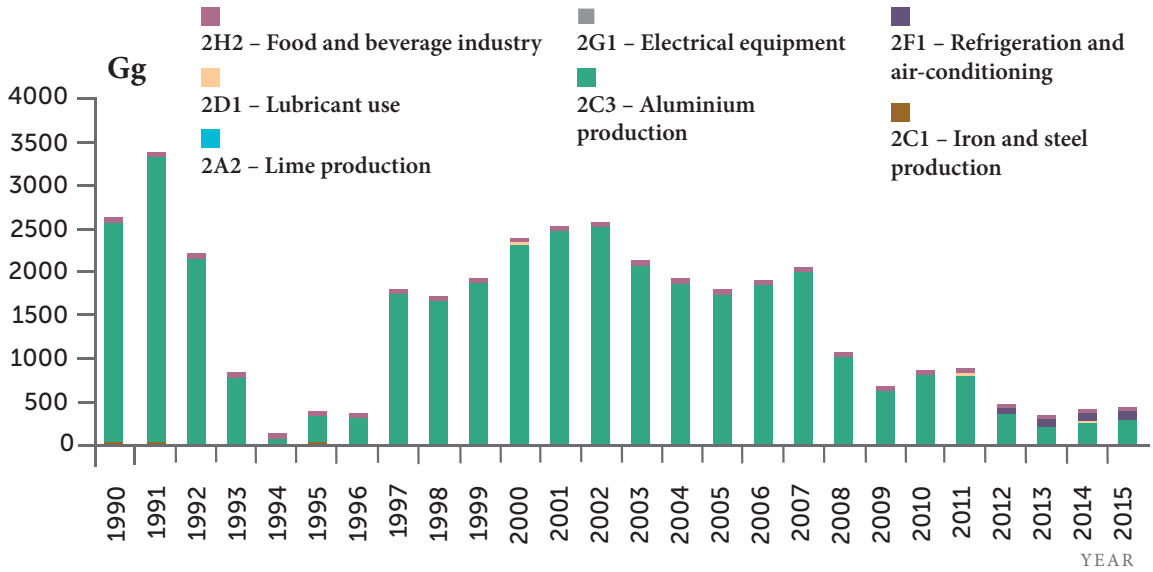


FIGURE 22: Total CO_2eq emissions from industrial processes, 1990–2015 (Gg)

CO_2 emissions

Over the reporting period, CO_2 emissions from industrial processes are shown in Table 24 and Figure 23.

TABLE 24: CO_2 emissions from industrial subsectors, 1990–2015 (Gg))

Category	1990	1991	1992	1993	1994	1995	1996	1997
2 – Industrial processes and product use	213	206	173	71.5	29.0	85.2	54.0	148
2A – Mineral industry	24.8	23.3	16.5	0.00	0.00	24.8	3.00	6.00
2A2 – Lime production	24.8	23.3	16.5	0.00	0.00	24.8	3.00	6.00
2C – Metal industry	185	179	154	70.2	27.3	58.3	48.8	140
2C1 – Iron and steel production	16.6	15.7	11.4	9.22	8.95	16.6	7.09	10.6
2C3 – Aluminium production	169	164	143	61.0	18.4	41.7	41.7	129
2D – Non-energy products from fuels and solvent use	2.21	2.21	1.62	0.98	1.18	1.52	1.67	1.67
2D1 – Lubricant use	2.21	2.21	1.62	0.98	1.18	1.52	1.67	1.67
2G – Other product manufacture and use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2G1 – Electrical equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2H – Other	0.56	0.64	0.49	0.32	0.45	0.56	0.50	0.48
2H2 – Food and beverage industry	0.56	0.64	0.49	0.32	0.45	0.56	0.50	0.48

Category	1998	1999	2000	2001	2002	2003	2004
2 – Industrial processes and product use	142	145	168	194	204	206	216
2A – Mineral industry	6.00	6.00	5.33	9.74	8.34	6.10	7.94
2A2 – Lime production	6.00	6.00	5.33	9.74	8.34	6.10	7.94
2C – Metal industry	134	137	160	182	193	197	205
2C1 – Iron and steel production	11.3	7.04	6.78	8.78	6.63	4.72	12.0
2C3 – Aluminium production	122	129	153	173	186	192	193
2D – Non-energy products from fuels and solvent use	1.77	1.77	1.82	1.87	1.87	1.92	1.97
2D1 – Lubricant use	1.77	1.77	1.82	1.87	1.87	1.92	1.97
2G – Other product manufacture and use	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2G1 – Electrical equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2H – Other	0.53	0.65	0.72	0.72	0.45	0.63	0.60
2H2 – Food and beverage industry	0.53	0.65	0.72	0.72	0.45	0.63	0.60

Category	2005	2006	2007	2008	2009	2010	2011
2 – Industrial processes and product use	206	216	219	203	114	138	158
2A – Mineral industry	4.51	6.09	5.32	7.38	3.37	0.63	2.59
2A2 – Lime production	4.51	6.09	5.32	7.38	3.37	0.63	2.59
2C – Metal industry	201	208	213	194	110	13	154
2C1 – Iron and steel production	8.18	12.9	13.9	16.1	8.28	3.86	4.89
2C3 – Aluminium production	193	195	199	178	101	132	149
2D – Non-energy products from fuels and solvent use	0.49	1.87	0.59	0.54	0.44	0.39	0.49
2D1 – Lubricant use	0.49	1.87	0.59	0.54	0.44	0.39	0.49
2F – Product uses as substitutes for ozone-depleting substances	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2F1 – Refrigeration and air-conditioning	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2G – Other product manufacture and use	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2G1 – Electrical equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2H – Other	0.64	0.66	0.67	0.69	0.59	0.56	0.52
2H2 – Food and beverage industry	0.64	0.66	0.67	0.69	0.59	0.56	0.52

Category	2012	2013	2014	2015
2 – Industrial processes and product use	122	79.9	75.3	75.6
2C – Metal industry	121	78.9	70.3	70.4
2C1 – Iron and steel production	2.25	1.58	1.15	2.90
2C3 – Aluminium production	119	77.3	69.2	67.5
2D – Non-energy products from fuels and solvent use	0.49	0.49	4.52	4.67
2D1 – Lubricant use	0.49	0.49	4.52	4.67
2F – Product uses as substitutes for ozone-depleting substances	0.00	0.00	0.00	0.00
2F1 – Refrigeration and air-conditioning	0.00	0.00	0.00	0.00
2G – Other product manufacture and use	0.00	0.00	0.00	0.00
2G1 – Electrical equipment	0.00	0.00	0.00	0.00
2H – Other	0.53	0.49	0.48	0.48
2H2 – Food and beverage industry	0.53	0.49	0.48	0.48

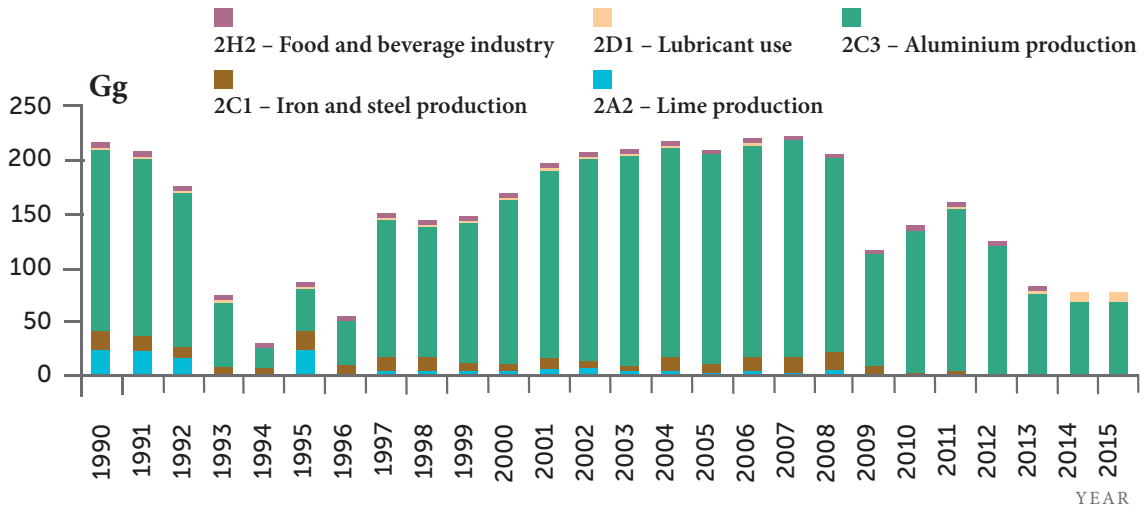


FIGURE 23: Total CO_2 emissions from the industrial processes and product use, 1990–2015 (Gg)

The share of CO_2 emissions from aluminium production is predominant in total emissions from industrial processes over the reporting period and ranges from 50% to more than 97%. The remainder is accounted for by steel, agricultural lime and food production.

CH_4 emissions

The CH_4 emissions from the industrial subsector over the reporting period are shown in Table 25 and Figure 24. Total estimated methane emissions come from iron and steel production.

TABLE 25: CH_4 emissions from industrial subsectors, 1990–2015 (Gg)

Category	1990	1991	1992	1993	1994	1995	1996	1997
2 – Industrial processes and product use	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0013
2C – Metal industry	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0013
2C1 – Iron and steel production	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0013
Category	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
2 – Industrial processes and product use	0.0014	0.0009	0.0008	0.0011	0.0008	0.0006	0.0015	0.001
2C – Metal industry	0.0014	0.0009	0.0008	0.0011	0.0008	0.0006	0.0015	0.001
2C1 – Iron and steel production	0.0014	0.0009	0.0008	0.0011	0.0008	0.0006	0.0015	0.001
Category	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**		
2 – Industrial processes and product use	0.0016	0.0017	0.0020	0.001	0.0005	0.0006		
2C – Metal industry	0.0016	0.0017	0.0020	0.001	0.0005	0.0006		
2C1 – Iron and steel production	0.0016	0.0017	0.0020	0.001	0.0005	0.0006		
Category	**2012**	**2013**	**2014**	**2015**				
2 – Industrial processes and product use	0.0006	0.002076	0.00014	0.00036				
2C – Metal industry	0.0006	0.002076	0.00014	0.00036				
2C1 – Iron and steel production	0.0006	0.002076	0.00014	0.00036				

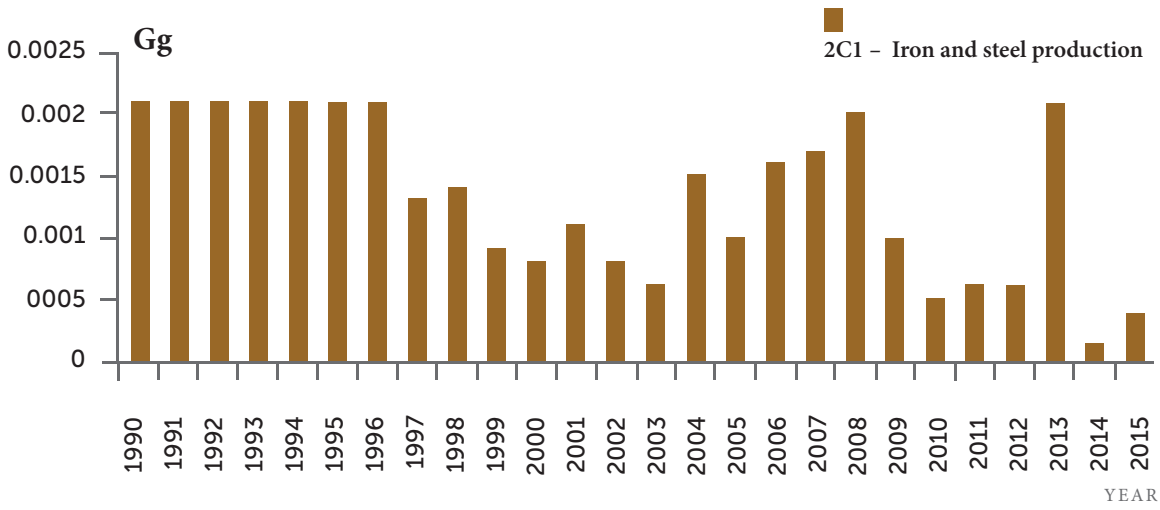


FIGURE 24: Total CH_4 emissions from the industrial processes and product use, 1990–2015 (Gg)

Emissions of PFC, SF_6 and HFC

Over the reporting period the estimated PFC, SF_6 and HFC emissions from industrial subsectors are shown in Tables 26, 27 and 28, and Figures 25, 26 and 27.

TABLE 26: PFC emissions expressed in CO_2eq from industrial subsectors, 1990–2015 (Gg)

Category	1990	1991	1992	1993	1994	1995	1996	1997
2 – Industrial processes and product use	2 389	3 136	1 993	738	73.4	277	277	1 623
2C – Metal industry	2 389	3 136	1 993	738	73.4	277	277	1 623
2C3 –Aluminium production	2 389	3 136	1 993	738	73.4	277	277	1 623
Category	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
2 – Industrial processes and product use	1 542	1 743	2 180	2 295	2 343	1 902	1 681	1 550
2C – Metal industry	1 542	1 743	2 180	2 295	2 343	1 902	1 681	1 550
2C3 –Aluminium production	1 542	1 743	2 180	2 295	2 343	1 902	1 681	1 550
Category	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
2 – Industrial processes and product use	1 646	1 797	842	530	677	658	259	161
2C – Metal industry	1 646	1 797	842	530	677	658	259	161
2C3 –Aluminium production	1 646	1 797	842	530	677	658	259	161
Category	**2014**	**2015**						
2 – Industrial processes and product use	223	240						
2C – Metal industry	223	240						
2C3 –Aluminium production	223	240						

As shown in Figure 25, the total estimated PFC emissions from this sector stem from the aluminium industry (electrolysis plant).

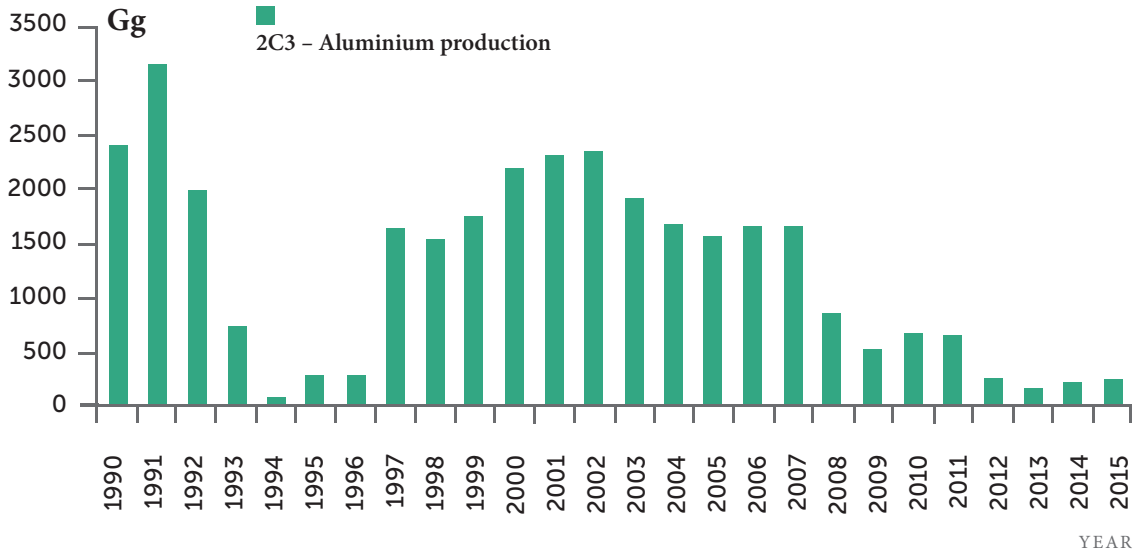


FIGURE 25: Total PFC (CO_2eq) emissions from industrial processes and product use, 1990–2015 (Gg)

TABLE 27: SF_6 emissions expressed in CO_2eq from industry subsectors, 1990–2015 (Gg)

Category	1990	1991	1992	1993	1994	1995	1996	1997
2 – Industrial processes and product use	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
2G – Other product manufacture and use	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
2G1 – Electrical equipment	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Category	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
2 – Industrial processes and product use	0.84	0.84	0.92	0.92	0.97	1.15	1.33	1.43
2G – Other product manufacture and use	0.84	0.84	0.92	0.92	0.97	1.15	1.33	1.43
2G1 – Electrical equipment	0.84	0.84	0.92	0.92	0.97	1.15	1.33	1.43
Category	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
2 – Industrial processes and product use	1.49	1.49	1.52	1.54	1.55	1.60	2.00	2.19
2G – Other product manufacture and use	1.49	1.49	1.52	1.54	1.55	1.60	2.00	2.19
2G1 – Electrical equipment	1.49	1.49	1.52	1.54	1.55	1.60	2.00	2.19
Category	**2014**	**2015**						
2 – Industrial processes and product use	2.23	1.88						
2G – Other product manufacture and use	2.23	1.88						
2G1 – Electrical equipment	2.23	1.88						

As shown in Figure 26, the total estimated SF_6 emissions from this sector stem from the use of electrical equipment, where such substances are used as refrigerants.

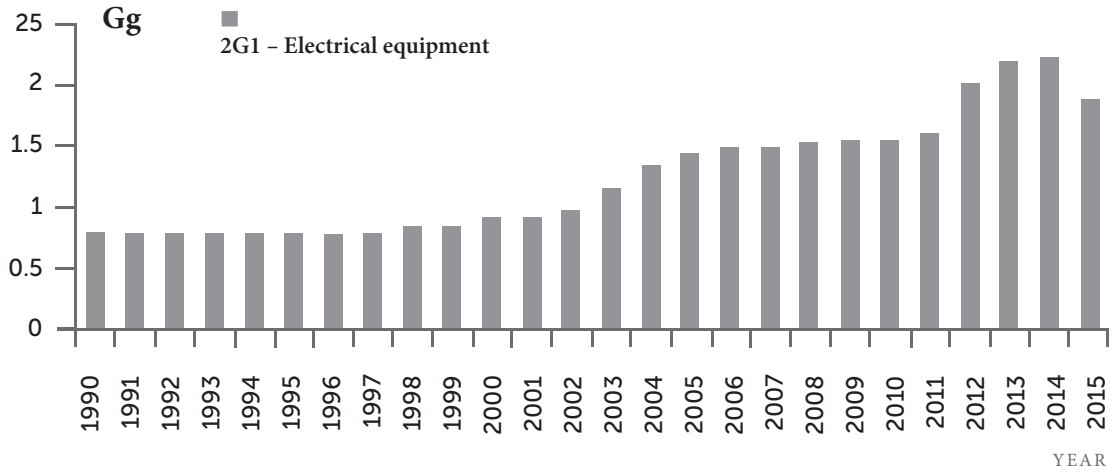


FIGURE 26: Total SF_6 (CO_2eq) emissions from industrial processes and product use, 1990–2015 (Gg)

TABLE 28: HFC emissions expressed in CO_2eq from industrial subsectors, 1990–2015 (Gg)

Category	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
2F – Product uses as substitutes for ozone-depleting substances	1.85	5.42	10.64	17.38	25.57	35.11	45.92	61.25	73.25	85.36	94.06
2F1 – Refrigeration and air-conditioning	1.85	5.42	10.64	17.38	25.57	35.11	45.92	61.25	73.25	85.36	94.06

HFC emissions were estimated for the period 2005–2015 according to the data available. For the period 2011–2015 we had available the records of the Agency for Nature and Environmental Protection on imports of substitutes for ozone-depleting substances and statistical data on imports of refrigerators and air-conditioning equipment (MONSTAT). For the period 2005–2010, the calculation was generated automatically using the IPCC 2006 software tool.

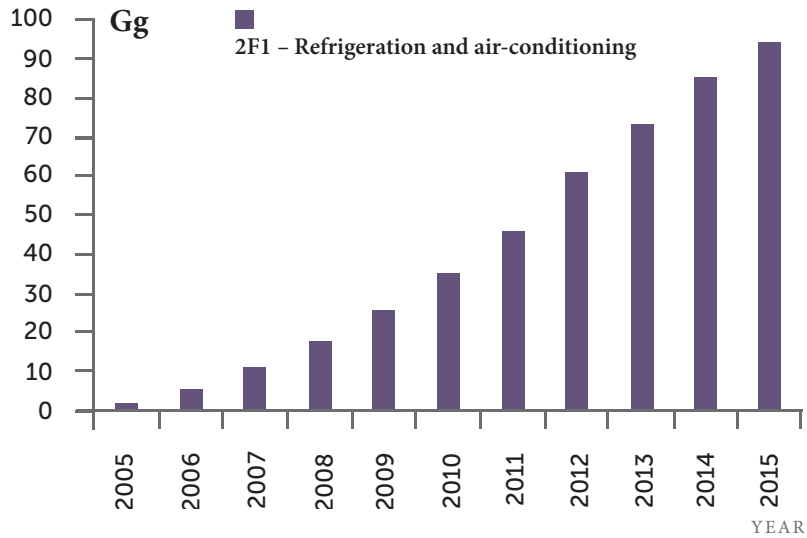


FIGURE 27: Total HFC (CO_2eq) emissions from industrial processes and product use, 1990–2015 (Gg)

Activity indicators and emission factors

Given the availability of national data, it was possible to use the Tier-2 approach in assessing emissions from the aluminium industry. The assessment of other GHG emissions from industrial processes was done following the Tier-1 approach. Table 29 shows the activity indicators for industrial processes, and Table 30 shows the emission factors used.

TABLE 29: Activity indicators for industrial processes and product use, 1990–2015

Category	Unit	1990	1991	1992	1993	1994	1995	1996	1997
2A2 – Lime production	t	33 000	31 000	22000	0	0	33 000	4 000	8 000
2C1 – Iron and steel production	t	207 642	196 365	142775	115 301	111 821	207 642	88 591	132 362
2C3 – Aluminium production	t	105 417	102 328	89 164	38 104	11 496	105 417	26 071	80 600
2H2 – Food and beverages industry – Beer	hl	662 000	607 000	418 000	217 000	365 000	662 000	421 000	398 000
2H2 – Food and beverages industry – Bread	t	0	21 823	21 838	21 853	21 869	0	21 884	21 914
2H2 – Food and beverage industry – Wine	hl	33 230	24 166	25 222	17 261	26 788	33 230	35 374	28 759
Category	**Unit**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
2A2 – Lime production	t	8 000	8 000	7 113	12 989	11 123	8 136	10 591	6 008
2C1 – Iron and steel production	t	141 445	88 002	84 789	109 757	82 832	59 036	150 165	102 247
2C3 – Aluminium production	t	76 557	80 916	95 526	108 123	116 482	120 213	120 797	120 379
2H2 – Food and beverage industry – Beer	hl	453 000	594 000	675 532	675 532	301 213	553 282	491 189	515 332

2H2 – Food and beverage industry – Bread	t	21 929	21 944	21 053	21 053	20 247	18 640	20 746	22 787
2H2 – Food and beverage industry – Wine	hl	35 989	49 202	66 249	66 249	100 269	86 517	93 872	100 704
Category	**Unit**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
2A2 – Lime production	t	8 118	7 089	9 839	4 497	839	3448	0	0
2C1 – Iron and steel production	t	161 333	173 913	201 690	103 479	48 272	61 164	28 161	19 723
2C3 – Aluminium production	t	121 798	124 230	111 344	63 379	82 560	93 242	74 385	48 324
2H2 – Food and beverages industry – Beer	hl	516 942	534 386	556 521	456 896	423 799	404 396	433 880	400 720
2H2 – Food and beverages industry – Bread	t	24 166	25 229	25 246	22 733	21 596	17 858	16 335	15 407
2H2 – Food and beverage industry – Wine	hl	121 701	110 158	111 381	105 916	105 586	104 436	102 966	93 011
Category	**Unit**	**2014**	**2015**						
2A2 – Lime production	t	0	0						
2C1 – Iron and steel production	t	14 330	36 280						
2C3 – Aluminium production	t	4 325	42 210						
2H2 – Food and beverages industry – Beer	hl	364 511	357 804						
2H2 – Food and beverages industry – Bread	t	15 229	16 210						
2H2 – Food and beverage industry – Wine	hl	109 981	113 241						

TABLE 30: Emission factors for industrial processes and product use, 1990–2015

Industrial processes	CO_2 emission factor	Unit	CH_4 emission factor	Unit
2A2 – Lime production	0.75	t/t	NA	
2C1 – Iron and Steel production	0.08	t/t	0.01	kg/t
2C3 – Aluminium production	1.6	t/t	NA	
2D1 – Lubricant use	20	t C/TJ	NA	
2H2 – Food and beverage industry – Beer	8×10^{-9}	t/t	NA	
2H2 – Food and beverage industry – Bread	6.15×10^{-6}	t/t	NA	
2H2 – Food and beverage industry – Wine	8.3×10^{-9}	t/t	NA	

TABLE 31: Emission factors for PFC from 2C3 – Aluminium production (electrolysis), 1990–2015 (kg/t)

Category	1990	1991	1992	1993	1994	1995	1996	1997
PFC-14 (CF_4) emission factor	2.63	3.56	2.60	2.25	0.74	2.63	1.24	2.34
PFC-116 (C_2F_6) emission factor	0.26	0.36	0.26	0.22	0.07	0.26	0.12	0.23
Category	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
PFC-14 (CF_4) emission factor	2.34	2.50	2.65	2.47	2.34	1.84	1.62	1.50
PFC-116 (C_2F_6) emission factor	0.23	0.25	0.27	0.25	0.23	0.18	0.16	0.15
Category	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
PFC-14 (CF_4) emission factor	1.57	1.68	0.88	0.97	0.95	0.82	0.40	0.40
PFC-116 (C_2F_6) emission factor	0.16	0.17	0.09	0.10	0.10	0.08	0.04	0.03
Category	**2014**	**2015**						
PFC-14 (CF_4) emission factor	0.6	0.66						
PFC-116 (C_2F_6) emission factor	0.06	0.066						

Uncertainty assessment in industrial processes and product use

For the needs of the present report, the uncertainties of the inventory assessment for industrial processes and product use (IPPU) for 2014 and 2015 were estimated. The calculation was done using the IPCC methodology[1]. Uncertainties were calculated for all sectors using the Tier-1 approach with the default values for calculating the uncertainties for each gas.

For assessing the input data and emission factor uncertainties, we used the IPCC default values.

The values used for the activity data and emission factors uncertainties in IPPU are given in Table 32 below.

[1] IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories.

TABLE 32: Activity data and emission factors uncertainties for 2014 and 2015 (%)

Category	Gas	Activity data uncertainty (%)	Emission factor uncertainty (%)	Aggregate uncertainty (%)
2C1 – Iron and steel production	CO_2	10	25	26.9
2C1 – Iron and steel production	CH_4	10	25	26.9
2C3 – Aluminium production	CO_2	2	10	10.2
2C3 – Aluminium production a	CF_4	2	30	30.1
2C3 – Aluminium production a	C_2F_6	2	30	30.1
2D1 – Lubricant use	CO_2	10	50	51.0
2F1a – Refrigeration and air-conditioning	CH_2F_2	50	50	70.7
2F1a – Refrigeration and air-conditioning	CHF_2CF_3	50	50	70.7
2F1a – Refrigeration and air-conditioning	CH_2FCF_3	50	50	70.7
2F1a – Refrigeration and air-conditioning	CF_3CH_3	50	50	70.7
2G1b – Use of electrical equipment	SF_6	30	30	42.4

AGRICULTURE AND LAND USE

For estimating sinks, use has been made of the data from statistical yearbooks (MONSTAT), records of the Forestry Administration of Montenegro and data from the 2013 National Forest Inventory (NFI).

Montenegro's NFI is the first expert basis providing a wealth of forest-related information for Montenegrin territory following the standards set by countries with a long-standing tradition in forest management and stewardship, including data on growing stock and living biomass.

The NFI's most significant quantitative findings show that forests cover 59.9% of the total territory, forest land covers 9.8% of the territory, and forests and forest land, put together, cover 69.7% of Montenegrin territory.

For this report the Corine Land Cover for 1990, 2000, 2006 and 2012, interpolation and extrapolation data, and the NFI data were used for the first time to cover the total land area of 1 381 200 ha. The GIS analysis provides a graphical presentation and records the changes in land use, which then can be entered into the 2006 IPCC software to calculate emissions.

The only remaining large state-owned agricultural enterprise is 13. jul Plantaže a.d., with vineyards and peach plantations, together with processing plants.

Data sources

To assess the GHG emissions from agriculture, MONSTAT and Corine Land Cover data was used, following the 2006 IPCC Guidelines. The introductory part of the statistical yearbook details the methodology for agricultural production including livestock and plant production, data collection and processing.

The category "Cropland" accounted for 205 819 ha in 1990, with only 38 296 ha used for cultivation (annual or perennial crops), while in 2015, out of the total of 195 996 ha, only 12 023 ha was cultivated. Other land from the "Cropland" category was registered as "Unmanaged land" under the "Grassland" category, since it most often refers to meadows or shrubs, which is irrelevant to the final calculation of emissions. This approach is in line with the data for Corine Land Cover database.

In late 2012 MONSTAT started developing a new methodology and reporting formats for statistical data collection and processing. The new methodology brought about substantial changes in the data for 2012 and 2013, while the recalculation of data for the time series from the 2010 Agricultural Census is planned for the upcoming period.

To assess sinks, the data from statistical yearbooks (MONSTAT), records of Forestry Administration and the 2013 NFI were used, as well as the data from the Analysis and Projections of Climate Change Impacts by Using the Regional Climate Model for Future Distribution and Growth of Main Tree Species in Montenegro (UNDP, 2013). The data for animal populations was split into subcategories (since 2009 using MONSTAT data and continuing the series backwards by extrapolation). The input data classified in such a way is useful for the Tier-2 approach in assessing emissions, i.e. more advanced calculation methodology.

Emission trends

Over the reporting period (1990–2015), GHG emissions from agriculture had a downward trend for almost all categories due to declining crop and livestock production (by some 60%) and the total animal population.

Sources and sinks of GHG emissions expressed as CO_2eq

Total emissions with sinks from the agriculture and land use sector range between −904 Gg CO_2eq in 1990 and −2 052 Gg in 2015.

The high level of sinks expressed in CO_2eq results from the good forest coverage of Montenegrin territory, but also the fact that not all emissions from the agricultural sector were captured, due to incomplete statistics.

The 2010 Agriculture Census used the EU methodology, with MONSTAT undertaking to recalculate the whole time series. When developing the 1990–2013 GHG inventory, the recalculated statistical data on land use change was not available.

The data for liming and urea application was taken from the MONSTAT Narrative Report for II BUR (2017) for the years 2012–2015 (compared with the FAO data) and extrapolated for the entire time series (based on the ratio of applied vs. available arable land in hectares). As for several subcategories (land-use change, wetlands, burning in croplands, etc.) data was obtained from recent years and Montenegro will make the necessary efforts and steps to include information and estimations in future submissions.

Table 33 and Figure 28 show the sources and sinks of GHG emissions from agriculture and land use, expressed as CO_2eq.

TABLE 33: Sources and sinks of GHG emissions, expressed as CO_2eq from agriculture and land use, 1990–2013 (Gg)

Category	1990	1991	1992	1993	1994	1995	1996	1997	1998
3 – Agriculture, forestry and other land use	–819	–838	–1 608	–2 204	–1 974	–1 230	–1 608	–1 957	–2 673
3A – Livestock	603	601	565	544	554	571	569	555	548
3A1 – Enteric fermentation	484	483	453	436	444	458	456	444	439
3A2 – Manure management	119	119	112	108	110	113	112	111	109
3B – Land	–1 532	–1 546	–2 273	–2 840	–2 620	–1 903	–2 276	–2 603	–3 309
3B1 – Forest land	–1 422	–1 436	–2 163	–2 729	–2 510	–1 793	–2 165	–2 491	–3 197
3B2 – Cropland	–110	–110	–110	–110	–110	–110	–110	–111	–112
3C – Aggregate sources and non-CO_2 emissions sources on land	110	107	100	91.9	92.5	103	99.2	90.6	88.5
3C1 – GHG emissions from biomass burning	3.05	1.83	3.98	3.74	2.29	3.71	4.01	1.54	4.31
3C2 – Liming	0.06	0.06	0.00	0.06	0.06	0.06	0.06	0.06	0.06
3C3 – Urea application	0.43	0.42	0.00	0.42	0.42	0.42	0.42	0.42	0.42
3C4 – Direct N_2O emissions from managed soils	66.0	64.2	58.1	52.8	54.2	60.3	57.6	52.7	49.1
3C5 – Indirect N_2O emissions from managed soils	24.1	23.3	21.2	19.2	19.7	21.8	20.8	19.1	17.8
3C6 – Indirect N_2O emissions from manure management	16.3	17.3	16.3	15.6	15.9	16.4	16.3	16.7	16.8

Category	1999	2000	2001	2002	2003	2004	2005	2006	2007
3 – Agriculture, forestry and other land use	−2 646	−1 768	−2 468	−2 635	−1 989	−1 822	−1 673	−926	−531
3A – Livestock	551	537	526	538	530	513	367	355	332
3A1 – Enteric fermentation	442	431	421	431	424	410	294	285	267
3A2 – Manure management	110	107	105	107	106	103	72.5	69.8	65.6
3B – Land	−3 284	−2 411	−3 080	−3 254	−2 611	−2 420	−2 102	−1 340	−964
3B1 – Forest land	−3 171	−2 298	−2 977	−3 151	−2 507	−2 315	−1 985	−1 216	−839
3B2 – Cropland	−113	−113	−103	−103	−104	−105	−117	−124	−125
3C – Aggregate sources and non-CO_2 emissions sources on land	85.8	105	86.3	81.6	92.3	84.4	61.6	59.2	101.2
3C1 – GHG emissions from biomass burning	0.76	18.3	1.51	1.28	9.81	3.55	0.49	0.74	43.8
3C2 – Liming	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
3C3 – Urea application	0.42	0.42	0.41	0.41	0.41	0.39	0.38	0.37	0.37
3C4 – Direct N_2O emissions from managed soils	49.8	51.4	49.9	47.4	48.8	47.5	37.0	35.4	34.5
3C5 – Indirect N_2O emissions from managed soils	17.9	18.4	17.8	17.0	17.5	17.0	13.1	12.5	12.2
3C6 – Indirect N_2O emissions from manure management	16.9	16.7	16.6	15.5	15.8	15.9	10.6	10.2	10.3

Category	2008	2009	2010	2011	2012	2013	2014	2015	
3 – Agriculture, forestry and other land use	−1 521	−2 163	−1 559	−971	−1 148	−1 975	−1 808	−2 012	
3A – Livestock	325	262	256	274	269.95	285	294	292	
3A1 – Enteric fermentation	261	209	205	219	215.30	223	234	230	
3A2 – Manure management	64.3	53.24	50.90	55.0	54.66	62.06	60.1	62.1	
3B – Land	−1 907	−2 480	−1 867	−1 306	−1 481	−2 312	−2 152	−2 363	
3B1 – Forest land	−1 782	−2 354	−1 741	−1 180	−1 450	−2 276	−2 113	−2 325	
3B2 – Cropland	−125	−125	−126	−126	−31.3	−36.0	−38.2	−37.8	
3C – Aggregate sources and non-CO_2 emissions sources on land	61.0	54.3	52.4	62.0	63.1	52.2	49.8	59.4	
3C1 – GHG emissions from biomass burning	4.37	0.46	1.70	12.4	13.8	0.60	0.73	6.70	
3C2 – Liming	0.05	0.05	0.05	0.05	0.04	0.06	0.06	0.04	
3C3 – Urea application	0.37	0.37	0.36	0.35	0.28	0.31	0.31	0.34	
3C4 – Direct N_2O emissions from managed soils	34.2	33.3	31.5	30.0	29.8	31.2	28.6	32.1	
3C5 – Indirect N_2O emissions from managed soils	12.0	11.9	10.9	10.6	10.5	11.0	10.7	11.3	
3C6 – Indirect N_2O emissions from manure management	10.0	8.28	7.84	8.61	8.69	8.99	9.45	8.99	

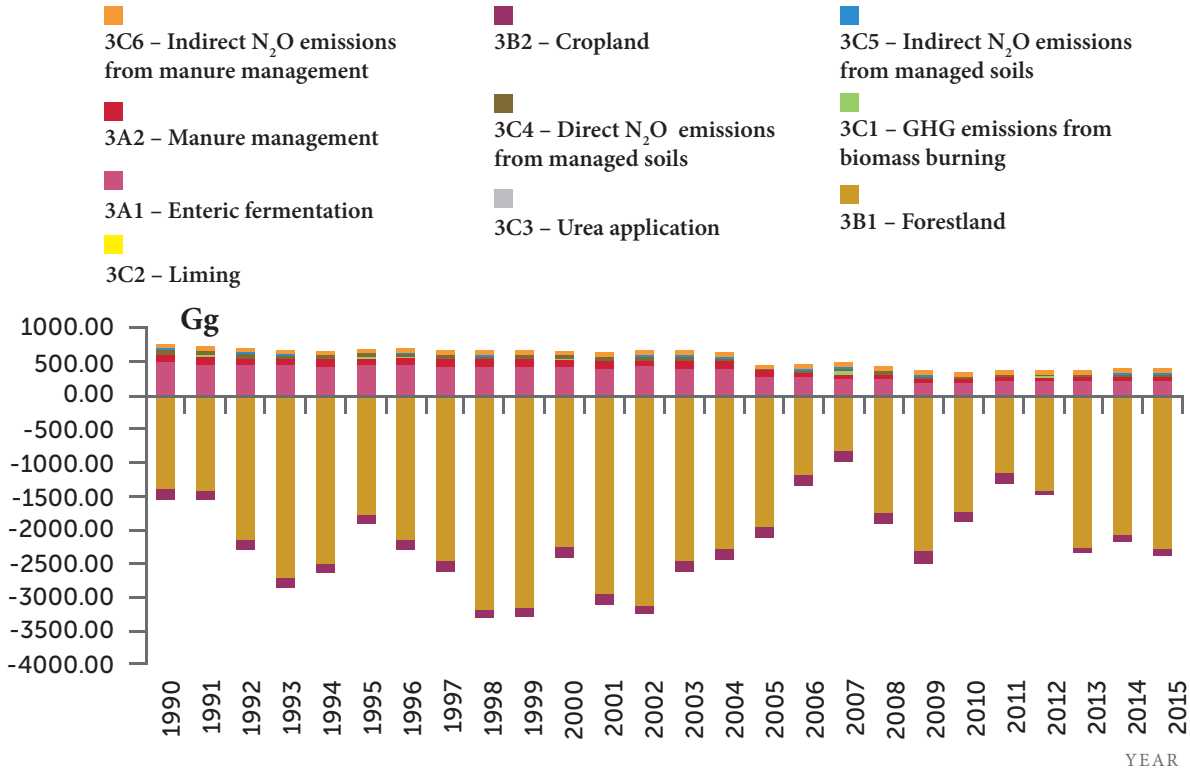


FIGURE 28: Sources and sinks of GHG emissions, expressed as CO_2eq from agriculture and land use, 1990–2015 (Gg)

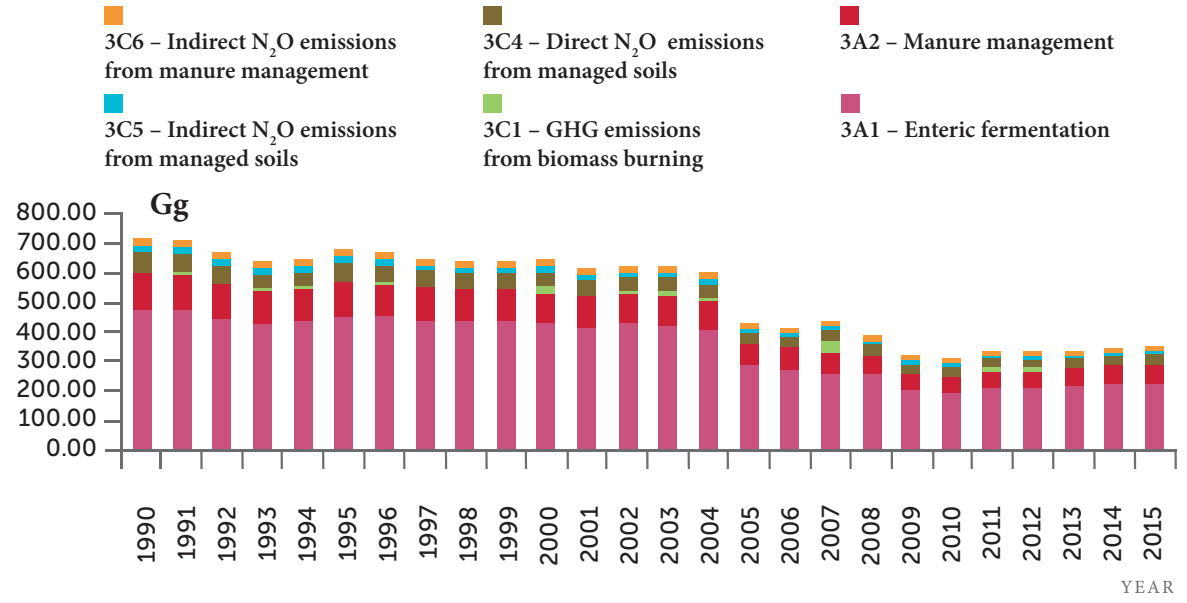


FIGURE 29: Emissions CO_2eq from agriculture and land use, 1990–2015 (Gg)

The highest share of total emissions from agriculture is accounted for by enteric fermentation (58.8%–68.9%) and manure management (15.4%–18.3%) (Figure 29).

CH_4 emissions

Table 34 and Figure 30 show CH_4 emissions from agriculture and land use. The highest is the share of emissions due to enteric fermentation generated by livestock ranging between 72% and 84.8 % of total CH_4 emissions, followed by manure management ranging from12.9% to 15.5%, and biomass burning with 0.2% to 15.1%.

TABLE 34: CH_4 emissions from agriculture and land use, 1990–2015 (Gg)

Category	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
3A – Livestock	22.7	22.7	21.3	20.5	20.9	21.5	21.5	20.9	20.7	20.9	20.4
3A1 – Enteric fermentation	19.4	19.3	18.1	17.5	17.8	18.3	18.3	17.8	17.6	17.7	17.2
3A2 – Manure management	3.36	3.35	3.16	3.05	3.11	3.19	3.19	3.15	3.16	3.21	3.11
3C – Aggregate sources and non-CO_2 emissions sources on land	0.07	0.05	0.09	0.08	0.05	0.08	0.08	0.04	0.09	0.02	0.36
3C1 – GHG emissions from biomass burning	0.07	0.05	0.09	0.08	0.05	0.08	0.08	0.04	0.09	0.02	0.36
Category	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
3A – Livestock	20.0	20.4	22.7	22.7	13.9	20.5	20.9	21.5	21.5	20.9	20.7
3A1 – Enteric fermentation	16.86	17.23	19.4	19.3	11.8	17.5	17.8	18.3	18.3	17.8	17.6
3A2 – Manure management	3.09	3.17	3.36	3.35	2.08	3.05	3.11	3.19	3.19	3.15	3.16
3C – Aggregate sources and non-CO_2 emissions sources on land	0.03	0.03	0.07	0.05	0.01	0.08	0.05	0.08	0.08	0.04	0.09
3C1 – GHG emissions from biomass burning	0.03	0.03	0.07	0.05	0.01	0.08	0.05	0.08	0.08	0.04	0.09
Category	**2012**	**2013**	**2014**	**2015**							
3A – Livestock	20.9	20.4	20.0	20.4							
3A1 – Enteric fermentation	17.7	17.2	16.9	17.2							
3A2 – Manure management	3.21	3.11	3.09	3.17							
3C – Aggregate sources and non-CO_2 emissions sources on land	0.02	0.36	0.03	0.03							
3C1 – GHG emissions from biomass burning	0.02	0.36	0.03	0.03							

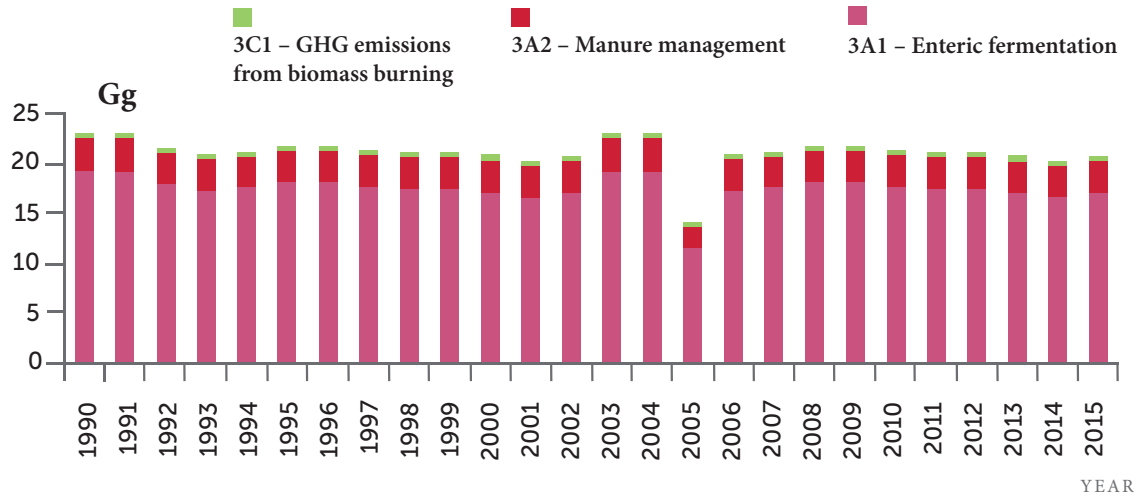


FIGURE 30: CH_4 emissions from agriculture and land use, 1990–2015 (Gg)

N_2O emissions

Table 35 and Figure 31 show N_2O emissions from agriculture and land use. The highest share is accounted for by direct emissions from managed soils and ranges between 27.8% and 32.3% of total N_2O emissions.

TABLE 35: N_2O emissions from agriculture and land use, 1990–2015 (Gg)

Category	1990	1991	1992	1993	1994	1995	1996	1997
3A – Livestock	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11
3A2 – Manure management	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11
3C – Aggregate sources and non-CO_2 emissions sources on land	0.36	0.35	0.33	0.30	0.30	0.34	0.32	0.30
3C1 – GHG emissions from biomass burning	0.004	0.002	0.006	0.006	0.003	0.006	0.006	0.002
3C4 – Direct N_2O emissions from managed soils	0.22	0.22	0.19	0.18	0.18	0.20	0.19	0.18
3C5 – Indirect N_2O emissions from managed soils	0.08	0.08	0.07	0.06	0.07	0.07	0.07	0.06
3C6 – Indirect N_2O emissions from manure management	0.05	0.06	0.05	0.05	0.05	0.05	0.05	0.06
Category	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
3A – Livestock	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.07
3A2 – Manure management	0.10	0.10	0.10	0.09	0.09	0.09	0.09	0.07
3C – Aggregate sources and non-CO_2 emissions sources on land	0.29	0.28	0.32	0.29	0.27	0.29	0.28	0.20

3C1 – GHG emissions from biomass burning	0.16	0.17	0.17	0.17	0.16	0.16	0.16	0.12
3C4 – Direct N_2O emissions from managed soils	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.04
3C5 – Indirect N_2O emissions from managed soils	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.04
3C6 – Indirect N_2O emissions from manure management	0.16	0.17	0.17	0.17	0.16	0.16	0.16	0.12
Category	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
3A – Livestock	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.07
3A2 – Manure management	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.07
3C – Aggregate sources and non-CO_2 emissions sources on land	0.20	0.27	0.19	0.18	0.17	0.19	0.19	0.17
3C1 – GHG emissions from biomass burning	0.001	0.076	0.000	0.001	0.003	0.021	0.024	0.001
3C4 – Direct N_2O emissions from managed soils	0.12	0.12	0.11	0.11	0.11	0.10	0.10	0.10
3C5 – Indirect N_2O emissions from managed soils	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
3C6 – Indirect N_2O emissions from manure management	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Category	**2014**	**2015**						
3A – Livestock	0.06	0.07						
3A2 – Manure management	0.06	0.07						
3C – Aggregate sources and non-CO_2 emissions sources on land	0.16	0.19						
3C1 – GHG emissions from biomass burning	0.001	0.011						
3C4 – Direct N_2O emissions from managed soils	0.10	0.11						
3C5 – Indirect N_2O emissions from managed soils	0.04	0.04						
3C6 – Indirect N_2O emissions from manure management	0.03	0.03						

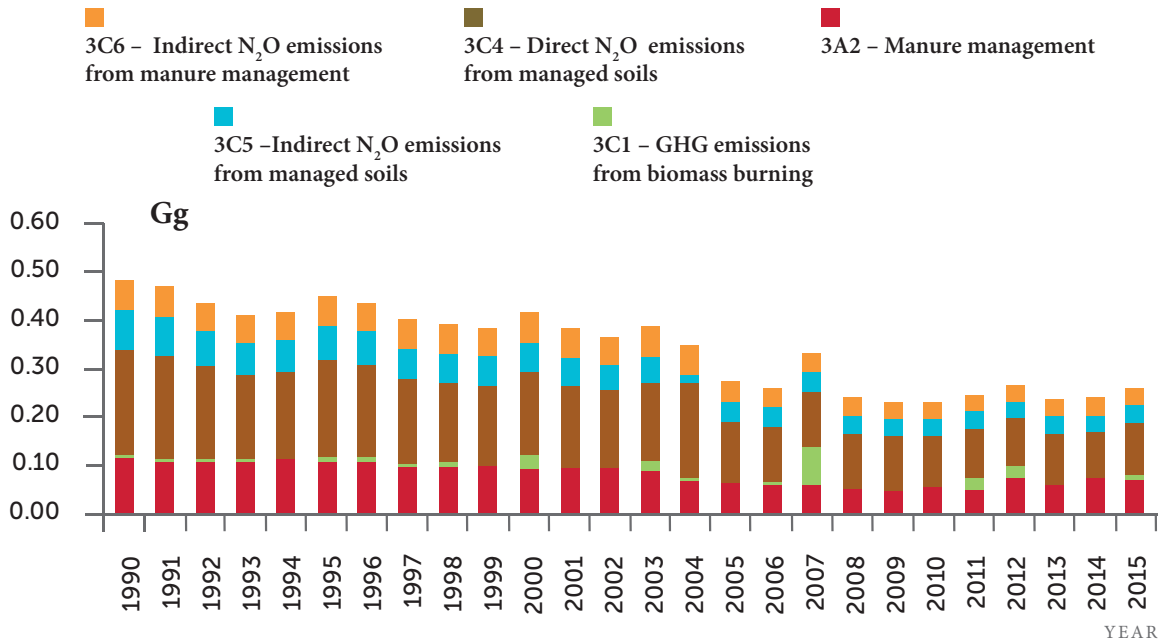


FIGURE 31: N_2O emissions from agriculture and land use, 1990–2015 (Gg)

Activity indicators and emission factors

To assess GHG emissions from agriculture and land use, MONSTAT data and the records of the Ministry of Agriculture and Rural Development (MARD), Forestry Administration and the 2013 NFI were used.

The assessment of GHG emissions and sinks from agriculture and land use was done in line with the 2006 IPCC methodology, the 2000 IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, and the 2003 Good Practice Guidelines for Land Use, Land Use Change and Forestry (GPG-LULUCF). Given the data available, the appropriate approach for assessing emissions was Tier 1. The activity indicator for enteric fermentation and manure management is the livestock population.

Table 36 features data on livestock populations over the period 1990–2015.

TABLE 36: Livestock population for enteric fermentation and manure management calculations, 1990–2015 (head of cattle)

Head /yr.	1990	1991	1992	1993	1994	1995	1996	1997
Heifers	13 225	13 203	12 475	12 164	12 469	12 658	12 647	12 547
Calves	39 605	39 251	36 487	32 367	32 447	37 001	37 184	34 772
Oxen (bulls)	5 535	5 526	5 221	5 091	5 219	5 298	5 293	5 251
Cattle total	58 365	57 980	54 183	49 622	50 135	54 957	55 124	52 570
Dairy cows	130 144	129 926	122 763	119 702	122 704	124 567	124 457	123 473
Goats	54 431	53 201	51 971	50 741	49 511	48 281	47 051	45 821
Old goats (≥1 year)	50 000	49 004	48 008	47 012	46 016	45 020	44 024	43 028
Young goats (<1 year)	4 431	4 197	3 963	3 729	3 495	3 261	3 027	2 793
Sheep	486 634	487 500	448 543	430 498	430 847	447 909	438 881	392 058
Lambs	67 214	67 334	61 953	59 461	59 509	61 866	60 619	54 152
Breeding ewes	386 295	386 983	356 058	341 734	342 011	355 555	348 389	311 220
Rams	33 124	33 183	30 531	29 303	29 327	30 488	29 874	26 687
Horses	19 914	19 318	16 864	16 160	16 209	16 327	15 812	14 997
Swine	22 831	21 941	21 779	20 624	20 510	20 219	20 855	22 107
Nursery pigs (<50kg)	16 283	15 648	15 532	14 709	14 627	14 420	14 873	15 766
Young swine (≥50kg)	4 551	4 970	4 470	4 338	4 121	4 194	4 360	4 812
Mature swine (≥110kg)	1 997	1 323	1 777	1 577	1 762	1 605	1 622	1 529
Poultry	917 084	953 273	859 543	794 435	80 6196	781 265	770 826	750 074
Head /yr.	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**
Heifers	12 639	13 025	12 302	12 238	12 553	12 904	13 495	15 612
Calves	35 392	33 050	40 560	40 278	41 339	29 662	28 162	13 989
Oxen (bulls)	5 290	5 451	5 149	5 122	5 254	5 401	5 648	5 390
Cattle total	53 320	51 527	58 011	57 637	59 146	47 967	47 305	34 991
Dairy cows	124 373	128 179	121 060	120 427	123 534	126 987	85 496	82 851
Goats	44 591	43 361	42 131	35 001	32 656	30 311	27 966	25 621
Old goats (≥1 year)	42 032	41 036	40 040	32 933	30 588	28 243	25 898	23 553
Young goats (<1 year)	2 559	2 325	2 091	2 068	2 068	2 068	2 068	2 068
Sheep	332 795	305 707	293 197	243 524	240 531	252 007	254 406	254 898
Lambs	45 966	42 225	40 497	33 636	33 222	34 808	35 139	35 207
Breeding ewes	264 176	242 674	232 743	193 312	190 936	200 046	201 950	202 341
Rams	22 653	20 809	19 957	16 576	16 372	17 154	17 317	17 350
Horses	14 182	12 474	10 703	9 967	9 568	9 028	7 447	7 119
Swine	21 078	19 852	17 896	19 663	20 548	22 094	25 165	9 142
Nursery pigs (<50kg)	15 032	14 158	12 763	14 023	14 654	15 757	17 947	6 520
Young swine (≥50kg)	4 482	4 030	3 763	4 428	4 525	4 552	5 142	1 067
Mature swine (≥110kg)	1 564	1 664	1 370	1 212	1 369	1 785	2 076	1 555
Poultry	813 358	745 017	790 577	817 445	837 542	890 045	799 839	462 149

Head /yr.	2006	2007	2008	2009	2010	2011	2012	2013
Heifers	15 884	15 871	16 299	13 633	12 046	21 722	18 989	20 454
Calves	14 484	14 991	11 676	7 579	3 786	2 667	3 090	3 762
Oxen (bulls)	5 001	5 374	5 042	4 339	3 832	3 252	2 650	3 012
Cattle total	35 369	36 236	33 017	25 551	19 664	27 641	24 729	27 228
Dairy cows	79 553	73 142	73 477	70 467	67 259	59 532	59 972	61 830
Goats	23 276	21 077	18 932	16 175	14 427	23 660	23 273	29 675
Old goats (≥1 year)	21 208	18 863	16 518	13 561	11 613	20 646	20 205	26 414
Young goats (<1 year)	2 068	2 214	2 414	2 614	2 814	3 014	3 068	3 261
Sheep	249 281	222 244	209 354	199 764	198 165	208 771	207 047	190 843
Lambs	34 431	35 935	32 438	26 451	28 076	23 786	24 391	24 067
Breeding ewes	197 882	169 926	160 912	159 905	158 503	172 924	169 295	153 450
Rams	16 968	16 383	16 004	13 408	11 586	12 061	13 361	13 326
Horses	6 260	5 463	5 124	4 342	7 904	4 035	3 905	4 858
Swine	13 294	10 374	10 017	12 377	11 205	21 085	18 451	20 572
Nursery pigs (<50kg)	9 481	7 306	7 295	9 126	8 280	12 676	10 454	13 953
Young swine (≥50kg)	1 228	1 408	989	1 240	914	5 607	5 599	4 872
Mature swine (≥110kg)	2 585	1 660	1 733	2 011	2 011	2 802	2 398	1 747
Poultry	448 502	505 355	432 264	416 737	506 520	449 058	732 090	620 364

Head /yr.	2014	2015						
Heifers	23 748	23 887						
Calves	3 216	2 631						
Oxen (bulls)	2 697	2 673						
Cattle total	29 661	29 191						
Dairy cows	63 889	63 262						
Goats	32 997	29 678						
Old goats (≥1 year)	28 347	25 224						
Young goats (<1 year)	4 650	4 454						
Sheep	204 404	194 636						
Lambs	27 025	28 518						
Breeding ewes	165 351	155 543						
Rams	12 028	10 575						
Horses	4 968	4 927						
Swine	19 432	24 951						
Nursery pigs (<50kg)	10 544	12 579						
Young swine (≥50kg)	5 647	9 550						
Mature swine (≥110kg)	3 241	2 822						
Poultry	595 675	606 225						

The tables below show forestlands and croplands (ha), the decrease in harvest (m^3) and losses due to forest fires used for land for the reporting period.

The land-use categories used in the inventory are: Forest land – Deciduous forests, Needle-like coniferous tree forests, Mixed forests and non-managed forestland; Grassland; Other land (including transitional) and settlements; Wetlands (flooded and unmanaged) and Cropland to Arable land – annuals and perennials and other (unmanaged) cropland. Removals were estimated only for deciduous forests, coniferous tree forests, mixed forests, arable land (cropland) and grassland. Growing stock calculations were estimated using data from the NFI (national circumstances). The National Forestry Report contains more information on the methods and calculation.

TABLE 37: Land categories (ha) by Corine Land Cover (data for 1990, 2000, 2006, 2012 and further on by extrapolation), 1990–2015

Category	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Cropland	205 819	206 350	206 880	207 411	207 941	208 471	209 002	209 532	207 941	205 917	203 894
Forestland	836 731	836 555	836 379	836 202	836 026	835 850	835 674	835 498	836 026	834 576	833 126
Deciduous	518 773	518 663	518 554	518 445	518 336	518 227	518 118	518 009	518 336	517 437	516 538
Needle-like coniferous tree forests	154 795	154 762	154 730	154 697	154 665	154 632	154 599	154 567	154 665	154 397	154 128
Mixed forests	163 162	163 128	163 093	163 059	163 025	162 991	162 956	162 922	163 025	162 742	162 460
Non-managed forestland	59 695	59 680	59 664	59 649	59 634	59 618	59 603	59 588	59 634	59 562	59 491
Grassland	155 418	154 900	154 383	153 866	153 348	152 831	152 314	151 796	153 348	149 294	145 240
Other	71 656	71 931	72 206	72 482	72 757	73 032	73 308	73 583	72 757	78 980	85 204
Settlement	11 975	11 952	11 930	11 908	11 885	11 863	11 841	11 818	11 885	13 256	14 627
Wetland	11 712	11 627	11 542	11 457	11 371	11 286	11 201	11 116	11 371	11 338	11 304
Wetland – other	28 195	28 205	28 216	28 226	28 237	28 247	28 258	28 268	28 237	28 276	28 315
Category	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Cropland	201 870	199 846	197 822	195 799	195 817	195 835	195 853	195 871	195 889	195 907	195 924
Forestland	831 675	830 225	828 774	827 324	827 256	827 189	827 121	827 053	826 985	826 918	826 850
Deciduous	515 639	514 739	513 840	512 941	512 899	512 857	512 815	512 773	512 731	512 689	512 647
Needle-like coniferous tree forests	153 860	153 592	153 323	153 055	153 042	153 030	153 017	153 005	152 992	152 980	152 967
Mixed forests	162 177	161 894	161 611	161 328	161 315	161 302	161 289	161 275	161 262	161 249	161 236
Non-managed forestland	59 420	59 349	59 278	59 206	59 194	59 182	59 170	59 157	59 145	59 133	59 120
Grassland	141 186	137 132	133 078	129 023	128 974	128 925	128 875	128 826	128 776	128 727	128 677
Other	91 427	97 650	103 873	110 097	110 160	110 223	110 287	110 350	110 414	110 477	110 540
Settlement	15 997	17 368	18 739	20 109	20 157	20 204	20 251	20 298	20 346	20 393	20 440
Wetland	11 270	11 237	11 203	11 170	11 170	11 170	11 170	11 170	11 170	11 170	11 170
Wetland – other	28 354	28 394	28 433	28 472	28 473	28 474	28 474	28 475	28 476	28 477	28 478

Category	2012	2013	2014	2015
Cropland	195 942	195 960	195 978	195 996
Forestland	826 782	826 714	826 646	826 579
Deciduous	512 605	512 563	512 521	512 479
Needle-like coniferous tree forests	152 955	152 942	152 930	152 917
Mixed forests	161 223	161 209	161 196	161 183
Non-managed forestland	59 108	59 096	59 084	59 071
Grassland	128 628	128 578	128 529	128 480
Other	110 604	110 667	110 731	110 794
Settlement	20 487	20 535	20 582	20 629
Wetland	11 170	11 170	11 170	11 170
Wetland – other	28 479	28 480	28 481	28 481

Table 38 shows the forest decrease in harvest and losses due to fires over the reporting period.

TABLE 38: Decrease in harvest and losses due to fires (m3/yr), 1990–2015

	1990	1991	1992	1993	1994	1995	1996	1997	1998
Decrease in harvest (m^3/yr)									
Deciduous harvesting	551 695	590 574	443 559	361 174	371 862	484 837	436 598	442 971	306 788
Needle-like coniferous tree forests harvesting	164 619	176 220	132 352	107 770	110 959	144 669	130 275	132 177	91 541
Mixed-forest harvesting	173 517	185 745	139 507	113 595	116 957	152 489	137 317	139 321	96 490
TOTAL (m^3/yr)	889 830	952 539	715 418	582 539	599 777	781 995	704 191	714 469	494 819
Losses due to fires (m^3/yr)									
Deciduous harvesting	273 295	237 344	219 294	186 925	231 483	254 217	223 609	168 709	139 432
Needle-like coniferous tree forests harvesting	81 548	70 820	65 435	55 776	69 071	75 855	66 722	50 341	41 605
Mixed-forest harvesting	85 956	74 649	68 972	58 791	72 805	79 955	70 329	53 062	43 854
TOTAL (m^3/yr))	440 798	382 813	353 700	301 492	373 359	410 027	360 660	272 112	224 891

	1999	2000	2001	2002	2003	2004	2005	2006	2007
Decrease in harvest (m^3/yr)									
Deciduous harvesting	317 355	364 070	390 431	324 821	395 720	466 956	533 668	660 541	483 413
Needle-like coniferous tree forests harvesting	94 695	108 634	116 500	96 922	118 078	139 334	159 240	197 097	144 244
Mixed-forest harvesting	99 813	114 506	122 797	102 161	124 460	146 865	167 847	207 751	152 041
TOTAL (m^3/yr)	511 862	587 210	629 727	523 905	638 259	753 155	860 756	1 065 388	779 698
Losses due to fires (m^3/yr)									
Deciduous harvesting	155 653	166 730	157 472	142 010	142 974	151 645	173 121	202 056	163 548
Needle-like coniferous tree forests harvesting	46 445	49 750	46 988	42 374	42 662	45 249	51 657	60 291	48 801
Mixed-forest harvesting	48 955	52 439	49 527	44 665	44 968	47 695	54 449	63 550	51 438
TOTAL (m^3/yr)	251 053	268 919	253 987	229 049	230 604	244 588	279 228	325 896	263 787
	2008	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	
Decrease in harvest (m^3/yr)									
Deciduous harvesting	516 585	496 646	586 872	608 405	575 631	487 300	214 968	249 312	
Needle-like coniferous tree forests harvesting	154 142	148 193	175 115	181 540	171 761	145 404	342 381	374 546	
Mixed-forest harvesting	162 474	156 203	184 581	191 353	181 045	153 264	325 045	99 241	
TOTAL (m^3/yr)	833 202	801 042	946 568	981 299	928 437	785 968	882 394	723 099	
Losses due to fires (m^3/yr)									
Deciduous harvesting	174 381	134 259	161 046	182 115	191 174	233 767	191 174	233 767	
Needle-like coniferous tree forests harvesting	52 033	40 061	48 054	54 341	57 044	69 753	57 044	69 753	
Mixed-forest harvesting	54 846	42 226	50 652	57 278	60 127	73 523	60 127	73 523	
TOTAL (m^3/yr)	281 260	216 546	259 752	293 734	308 345	377 043	308 345	377 043	

TABLE 39: Forest fires, 1990–2015

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Deciduous	496	236	905	838	390	864	958	257	1 079	86.7
Needle-like coniferous tree forests	118	56.0	215	199	92.5	205	227	60.9	256	20.6
Mixed forests	107	51.0	195	181	84.3	187	207	55.5	233	18.7
TOTAL	720	343	1 315	1 217	567	1 255	1 392	373	1 568	126
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Deciduous	5163	328	275	2 749	947.0	70.9	130.2	12 602	2 497	55
Needle-like coniferous tree forests	1 224	77.7	65.1	652	224.5	16.8	38.85	2 987	592	16
Mixed forests	1 115	70.8	59.3	594	205	15.3	41.0	2 722	539	17.0
TOTAL	7 502	476	399	3 995	1376	103	210	18 311	3 628	88
	2010	**2011**	**2012**	**2013**	**2014**	**2015**				
Deciduous	382	3 156	3 546	84.9	30.7	1 058				
Needle-like coniferous tree forests	114	942	1 058	25.3	9.15	316				
Mixed forests	120	993	1 115	26.7	9.65	333				
TOTAL	616	5 091	5 719	137	49.5	1 707				

Table 40 shows emission factors for enteric fermentation and manure management for the reporting period.

TABLE 40: Emission factors for subsectors 3A1 – Enteric fermentation and 3A2 – Manure management, 1990–2015 (kg CH_4/head)

Activity	CH_4 emission factor (kg CH_4/head)	Activity	CH_4 emission factor (kg CH_4/head)	Activity	N_2O emission factor (kg N_2O/head)*
3A1 – Enteric fermentation		3A2 – Manure management		3A2 – Manure management	
3A1ai – Dairy cows	99	3A2ai – Dairy cows	20	3A2ai – Dairy cows	0.005–0.02
3A1aii – Other cattle	58	3A2aii – Other cattle	9	3A2aii – Other cattle	0.005–0.02
3A1c – Sheep	5	3A2c – Sheep	0.15	3A2c – Sheep	0.002–0.005*
3A1d – Goats	5	3A2d – Goats	0.17	3A2d – Goats	0.02
3A1f – Horses	18	3A2f – Horses	1.64	3A2f – Horses	0.005–0.02*
3A1h – Swine	1	3A2h – Young swine	4	3A2h – Young swine	0.002–0.005*
		3A2h – Mature swine	6	3A2h – Mature swine	0.002–0.005*
		3A2i – Poultry	0.02	3A2i – Poultry	0.005

*N_2O emission factor depends on manure management

Tables 41 and 42 show N_2O emission factors for: biomass burning – forest land, direct and indirect N_2O emissions from managed soils and indirect N_2O emissions from manure management for the reporting period.

TABLE 41: Emission factors for biomass burning – forest land, direct N_2O emissions from managed soils and indirect N_2O emissions from managed soils, 1990–2015

Activity	Unit	Emission factor
3C1a – Biomass burning – Forest land	N_2O emission factor (g GHG / (kg burnt dry matter))	0.06
3C4 – Direct N_2O emissions from managed soils – cattle, poultry and swine	kg N_2O–N / kg N input	0.02
3C4 – Direct N_2O emissions from managed soils – sheep and other animals	kg N_2O–N / kg N input	0.01
3C5 – Indirect N_2O emissions from managed soils	kg N_2O–N/(kg NH_3–N+NO_X–N)	0.01

TABLE42: Emission factors for indirect N_2O emissions from manure management, 1990–2015

	Manure management system	Emission factor (kg N_2O–N / (kg NH_3–N + NO_X–N volatilized)
3C6 – Indirect N2O emissions from manure management	Daily spread	0.01
	Solid storage	0.01
	Liquid/slurry	0.01
	Other systems	0.01
	Pit storage below animal confinements	0.01
	Dry lot	0.01
	Uncovered anaerobic lagoon	0.01

Uncertainty assessment in agriculture

To assess the uncertainties of the input data and emission factors, the IPCC default values were used. The uncertainties for activity data and emission factors in agriculture sector referring to enteric fermentation and manure management are given in Table 43.

TABLE 43: Uncertainties in assessing activity data and emission factors: enteric fermentation and manure management 1990–2015 (%)

Category	Gas	Uncertainties of activity data (%)	Uncertainties of emission factors (%)	Aggregate uncertainties (%)
3A1ai – Dairy cows	CH_4	20	40	44.7
3A1aii–Other cattle	CH_4	20	40	44.7
3A1c – Sheep	CH_4	20	40	44.7
3A1d – Goats	CH_4	20	40	44.7
3A1f – Horses	CH_4	20	40	44.7
3A1h – Swine	CH_4	20	40	44.7
3A1ai – Dairy cows	N_2O	20	50	53.9
3A1aii–Other cattle	N_2O	20	50	53.9
3A1c – Sheep	N_2O	20	50	53.9
3A1d – Goats	N_2O	20	50	53.9
3A1f – Horses	N_2O	20	50	53.9
3A1h – Swine	N_2O	20	50	53.9
3A2i – Poultry	N_2O	20	50	53.9
3A1ai – Dairy cows	CH_4	20	30	36.1
3A1aii–Other cattle	CH_4	20	30	36.1
3A1c – Sheep	CH_4	20	30	36.1
3A1d – Goats	CH_4	20	30	36.1
3A1f – Horses	CH_4	20	30	36.1
3A1h – Swine	CH_4	20	30	36.1
3A2i – Poultry	CH_4	20	30	36.1

WASTE

The GHG emissions from the waste sector result from solid municipal waste (SMW) disposal and treatment, wastewater treatment and discharge and the incineration and open burning of waste. Categories 4A – Solid waste disposal and 4D – Wastewater treatment and discharge are included in the GHG inventory for sector 4 – Waste.

The assessments have been done for methane (CH_4) emissions resulting from SMW disposal and treatment, and nitrous oxide (N_2O) from wastewater treatment and discharge.

In Montenegro there are no activities falling under categories 4B – Biological treatment of solid waste and 4C – Incineration and open burning of waste.

The method used to calculate CH_4 emissions in line with the 2006 IPCC Guidelines is the kinetic First-Order Decay (FOD), factoring in the time component, thus enabling the monitoring of emissions for the longer period of time over which the organic carbon content of waste degrades. The proposed Tier-2 methodology was used, since the calculation includes national data for the quantities of waste generated and disposed, then the composition of waste, while all other parameters used are the default values under the 2006 IPCC Guidelines, Volume 5, Chapter 3, Figure 3.

CH_4 emissions from domestic wastewater (particularly in rural areas where septic tanks are used) were calculated by using the Tier-1 methodology recommended by the 2006 IPCC Guidelines.

Indirect N_2O emissions from wastewater treatment and discharge were calculated by using the Tier-1 methodology recommended by the 2006 IPCC Guidelines.

Given the use of a kinetic model, the quantities of SMW generated and disposed and its composition were included in the calculation covering the period 1950–2015.

Data sources

To assess the emissions from the waste sector the recalculated statistical data (MONSTAT) was used and extrapolated based on the new demographic data, waste generation and waste composition data.

Emission trends

For the needs of the present report the period 1990–2015 was covered.

Annual GHG emissions from the waste sector (categories 4A and 4D), expressed in Gg CO_2eq for the period 1990–2015 are shown in Table 44 and Figure 30. Out of the total GHG emissions (Gg CO_2eq) from the waste sector, emissions from category 4A – Solid waste disposal account for 88%–90%, while the emissions from category 4D – Wastewater treatment and discharge account for 10%–12%. Out of the total GHG from the waste sector expressed in CO_2eq, CH_4 emissions range from 93% to 95%, while N_2O emissions range from 5% to 7%.

TABLE 44: Total GHG emissions from sector 4 – Waste, 1990–2015 (Gg CO_2eq)

Year	4A – Solid waste disposal CH_4 (Gg CO_2eq)	4D – Wastewater treatment and discharge CH_4+N_2O (Gg CO_2eq)	4 – Waste TOTAL (Gg CO_2eq)
1990	158.5	20.1	178.6
1991	161.7	20.3	182.1
1992	164.7	20.5	185.3
1993	167.5	20.7	188.2
1994	170.1	20.9	191.0
1995	173.1	21.1	194.2
1996	176.3	21.3	197.6
1997	179.8	21.5	201.3
1998	183.2	21.7	204.9
1999	186.6	21.9	208.5
2000	189.8	22.1	211.9
2001	192.0	22.3	214.4
2002	193.5	22.5	216.0

Year	4A – Solid waste disposal CH_4 (Gg CO_2eq)	4D – Wastewater treatment and discharge CH_4+N_2O (Gg CO_2eq)	4 – Waste TOTAL (Gg CO_2eq)
2003	194.3	22.7	217.0
2004	194.3	22.9	217.2
2005	193.8	23.0	216.8
2006	192.7	22.7	215.4
2007	192.2	23.3	215.6
2008	190.5	23.9	214.4
2009	188.3	23.8	212.1
2010	187.2	24.0	211.3
2011	186.9	24.1	211.0
2012	187.3	23.6	210.9
2013	184.3	24.2	208.5
2014	178.2	24.3	202.6
2015	178.4	24.5	202.8

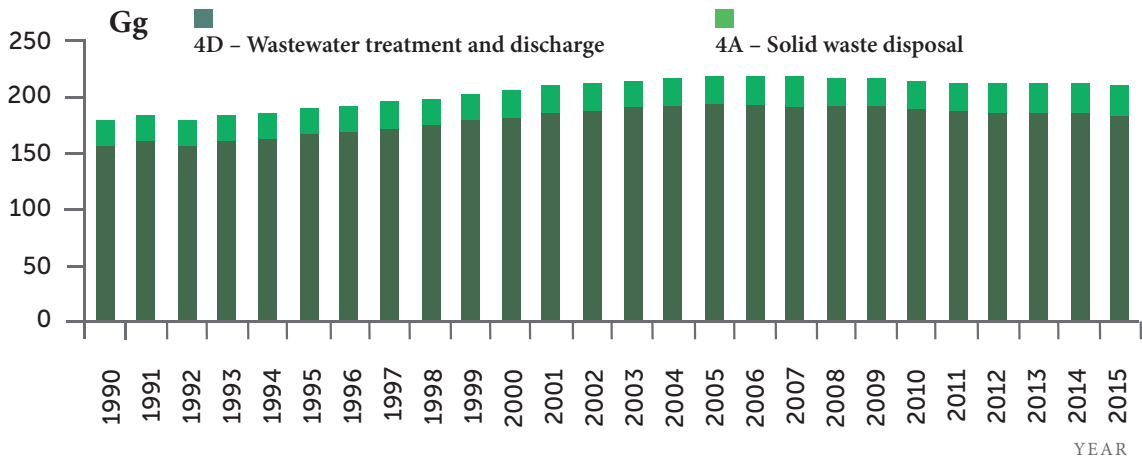


FIGURE 32: GHG emissions expressed as CO_2eq from the waste subsectors, 1990–2015 (Gg)

CH_4 emissions

Out of the total CH_4 emissions from sector 4 – Waste, the emissions from category 4A – Solid waste disposal account for 94%–95%, while the emissions from category 4D – Wastewater treatment and discharge account for 5%–6%. Annual CH_4 emissions from sector 4 – Waste (categories 4A and 4D), expressed in Gg for the period 1990–2015 are shown in Table 45 and Figure 33.

TABLE 45: CH_4 emissions from sector 4 – Waste, 1990–2015 (Gg CH_4)

Year	4A – Solid waste disposal CH_4 (Gg)	4D – Wastewater treatment and discharge CH_4 (Gg)	4 – Waste TOTAL CH_4 (Gg)
1990	6.34	0.42	6.75
1991	6.47	0.42	6.89
1992	6.59	0.42	7.01
1993	6.70	0.42	7.12
1994	6.80	0.42	7.23
1995	6.92	0.42	7.35
1996	7.05	0.43	7.48
1997	7.19	0.43	7.62
1998	7.33	0.43	7.76
1999	7.46	0.43	7.89
2000	7.59	0.43	8.03
2001	7.68	0.44	8.12
2002	7.74	0.44	8.18
2003	7.77	0.44	8.21
2004	7.77	0.44	8.21
2005	7.75	0.44	8.19
2006	7.71	0.44	8.15
2007	7.69	0.44	8.13
2008	7.62	0.44	8.06
2009	7.53	0.44	7.97
2010	7.49	0.44	7.93
2011	7.48	0.44	7.92
2012	7.49	0.44	7.94
2013	7.37	0.45	7.82
2014	7.13	0.45	7.57
2015	7.13	0.45	7.58

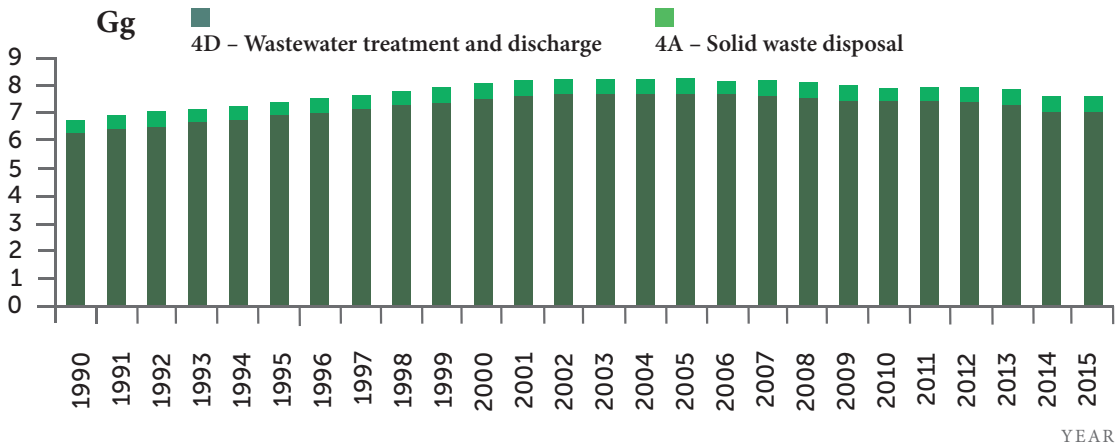


FIGURE 33: CH_4 emissions from sector 4 – Waste, 1990–2015 (Gg CH_4)

N_2O emissions

Apart from negligible demographical fluctuations and changes in the sewerage infrastructure, N_2O emissions show a slight increase over the reporting period, as presented in Table 46 and Figure 34.

Out of the total N_2O emissions from sector 4 – Waste, the emissions from category 4D – Wastewater treatment and discharge account for 100% of the total.

TABLE 46: N_2O emissions from sector 4 – Waste, 1990–2015 (Gg N_2O)

Year	4.D – Wastewater treatment and discharge N_2O (Gg)	4 – Waste TOTAL N_2O (Gg)
1990	0.033	0.033
1991	0.033	0.033
1992	0.034	0.034
1993	0.034	0.034
1994	0.035	0.035
1995	0.035	0.035
1996	0.036	0.036
1997	0.036	0.036
1998	0.037	0.037
1999	0.037	0.037
2000	0.038	0.038
2001	0.038	0.038
2002	0.039	0.039
2003	0.039	0.039
2004	0.040	0.040
2005	0.040	0.040
2006	0.039	0.039
2007	0.041	0.041
2008	0.043	0.043
2009	0.043	0.043
2010	0.043	0.043
2011	0.043	0.043
2012	0.042	0.042
2013	0.044	0.044
2014	0.044	0.044
2015	0.045	0.045

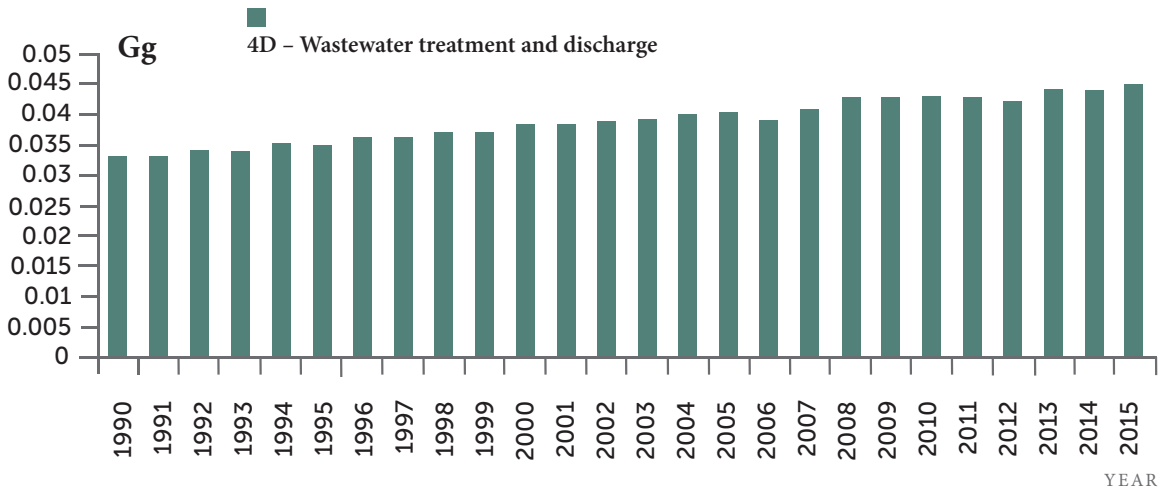


FIGURE 34: N_2O emissions from sector 4 – Waste, 1990–2015 (Gg N_2O)

Activity indicators and emission factors

SOLID WASTE DISPOSAL

For the needs of updating the 1990–2015 GHG inventory, following the 2006 IPCC methodology, the data on the total population and SMW generation per capita (kg/pc/yr) was used.

Compared to the previous calculation (1990–2013), changes were made to the following data on kinetic model activities and parameters:

- Population data for the period 1950–1988.
- Historical data for SMW generated per capita for the period 1950–1988 was determined, and the values for 2011–2013 revised accordingly.
- Historic data for SMW disposal for the period 1950–1988 was defined, and the values for the period 1989–2010 corrected in line with the recommended values, and for the period 2011–2013 in line with the revised data.
- Historical data on the shares of biodegradable waste disposed at SMW disposal sites over the period 1950–1988 was determined, and the values for the period 2011–2013 revised accordingly.
- The previously determined climate zone Northern and Moderate Dry was recategorized as Northern and Moderate Humid, according to Montenegro's climate features, which caused a change in the constant k for different waste streams.
- The previously defined OX = 0.1 was changed to OX = 0.

In line with the above changes, the CH_4 emissions were recalculated for the previously calculated period 1990–2013. The calculation included the following types of biodegradable waste disposed at SMW disposal sites: food, green waste from gardens and parks, paper, textiles, plastics and other inert waste. The shares of each waste stream were determined for each year (the total being 100%).

The main source of the population data and data on SMW generation and shares of biodegradable waste disposed at SMW disposal sites is MONSTAT. For the period 1989–2010 data from Montenegro's First Biennial Update Report on Climate Change (FBUR) was used, which contains information on the total population, the generated SMW per capita and the biodegradable waste streams disposed at SMW disposal sites. For the period 2011–2015, the revised data on the total population, the SMW generated per capita and the biodegradable waste streams disposed at SMW disposal sites was used. Alongside statistical survey data on collected SMW included in FBUR, this document features the findings of new studies on SMW disposal, waste collection and treatment. In order to align the methodology used in the above surveys with the data assessment methods used in FBUR, a similar survey should cover the period 1990–2010.

The historical population, SMW generated per capita and biodegradable waste streams data for the period 1950–1988 were determined using interpolation and extrapolation methods. The total population data for the years 1948, 1953, 1961, 1971 and 1981 was taken from statistical yearbooks. Interpolation was used to assess the population data in the years between 1948 and 1953, 1953 and 1961, 1961 and 1971, 1971 and 1981, and between 1981 and 1991. The total population over the period 1950–1988 was estimated on the basis of the statistics and interpolation values.

In line with the data on SMW generated per capita over the period 1989–1993, the data on the SMW generated per capita over the period 1950–1988 was determined by extrapolation. The interpolated values were compared with the recommended values for Eastern Europe, under the 2006 IPCC Guidelines, Volume 5, Chapter 2, Table 2.1. In line with the opinions of inventory experts, it was concluded that the results obtained by extrapolation are less uncertain than the recommended values.

The growing trend of SMW generation was recorded until 1999. Between 1999 and 2006 the quantity of waste generated decreased, and then the trend fluctuated until 2015.

The share of SMW disposed at disposal sites for the period 1950–2010 was determined by using the recommended values for Eastern Europe in line with the 2006 IPCC Guidelines, Volume 5, Chapter 2, Table 2.1. This amounts to 0.9, or 90%. For the period 2011–2015 the data on coverage of population by waste collection services (assuming that the total waste collected was disposed at SMW disposal sites).

The total disposed waste is calculated by multiplying the total SMW generated with the share disposed of at SMW disposal sites. There is a growing trend of SMW disposal being commensurate to its generation.

By comparing the national data available on shares of biodegradable waste streams disposed at SMW disposal sites for the period 1989–2015 with the recommended values for Eastern Europe, in terms of the 2006 IPCC Guidelines, Volume 5, Chapter 2, Table 2.3, significant deviations were noted for some data. Hence, extrapolation was used to assess the missing data. Based on the trend of fractions of certain types of degradable waste disposed at SMW disposal sites over the period 1989–1991, the fractions of different types of degradable waste disposed at SMW disposal sites over the period 1950–1988 were estimated by extrapolation.

Table 47 shows the data on total population, generated SMW, shares of different waste types and the total SMW disposed included in the calculations for the reporting period 1990–2015. Historical data for the period 1950–1989 is not shown here, but is stored in the calculation tables of the IPCC Inventory Software and working drafts in Excel spreadsheets.

Table 48 features the data on fractions of degradable waste by type included in the calculations for the period 1990–2015. Historical data for the period 1950–1989 is not shown here, but is stored in calculation tables of the IPCC Inventory Software and working drafts in Excel spreadsheets.

TABLE 47: Population, SMW generation and disposal data, 1990–2015

Year	Population (millions)	SMW generated per capita (kg/pc/yr)	Total SMW generated (Gg)	Share of SMW disposed (%)	Total SMW disposed (Gg)
1990	0.58	416	241	90.0	217
1991	0.58	421	245	90.0	217
1992	0.58	424	248	90.0	221
1993	0.59	430	253	90.0	223
1994	0.59	447	264	90.0	227
1995	0.59	464	275	90.0	237
1996	0.59	479	285	90.0	247
1997	0.59	491	293	90.0	257
1998	0.60	501	301	90.0	264
1999	0.60	511	308	90.0	271
2000	0.60	498	301	90.0	277
2001	0,61	488	296	90,0	271
2002	0.61	476	290	90,0	267
2003	0.61	464	284	90,0	261
2004	0.61	451	276	90,0	256
2005	0.61	440	270	90.0	249
2006	0.62	428	263	90.0	243
2007	0.62	475	292	90.0	237
2008	0.62	443	273	90.0	263
2009	0.62	453	280	90.0	246
2010	0.62	422	262	90.0	252
2011	0.62	524	325	75.9	235
2012	0.62	494	307	75.9	247
2013	0.62	497	309	79.7	233
2014	0.62	484	301	79.9	246
2015	0.62	503	313	79.9	240

TABLE 48: Municipal waste streams, 1990–2015 (%)

Year	Food (%)	Green garden and park waste (%)	Paper (%)	Textiles (%)	Plastics and other inert waste (%)
1990	31.2	13.8	27.3	2.9	24.8
1991	30.4	13.6	27.2	2.9	25.9
1992	29.7	13.4	27.1	2.8	27.0
1993	28.9	13.2	27.0	2.8	28.1
1994	28.2	13.1	26.9	2.7	29.1
1995	27.4	12.9	26.8	2.7	30.2
1996	26.7	12.7	26.7	2.6	31.3
1997	25.9	12.5	26.6	2.6	32.4
1998	25.2	12.3	26.5	2.5	33.5
1999	24.4	12.1	26.4	2.5	34.6
2000	23.7	11.9	26.3	2.4	35.7
2001	22.9	11.8	26.1	2.4	36.8
2002	22.2	11.5	26.1	2.3	37.9
2003	21.4	11.4	26.0	2.3	38.9
2004	20.7	11.2	25.9	2.2	40.0
2005	19.9	11.0	25.8	2.2	41.1
2006	19.9	11.0	25.8	2.2	41.1
2007	18.4	12.2	23.7	3.7	42.0
2008	18.7	13.2	22.8	4.1	41.2
2009	17.9	12.7	22.5	4.3	42.6
2010	17.2	13.9	22.4	5.0	41.5
2011	15.4	15.7	22.8	4.7	41.4
2012	14.7	11.2	22.8	2.9	48.4
2013	13.9	13.1	21.4	2.0	49.6
2014	13.8	11.0	21.6	1.8	51.8
2015	13.8	11.1	21.6	1.3	52.2

According to the data available, industrial waste similar to municipal waste (e.g. construction waste containing degradable organic carbon) and similar to sludge from wastewater treatment facilities is not being placed in landfills in Montenegro, which requires further investigation. If such waste is placed in landfills together with SMW, it should be included in the calculations for the whole period 1950–2015.

The data on the shares of waste by mass for each type of SMW disposal site (unmanaged shallow, unmanaged deep, managed and uncategorized) and total average weighted methane correction factor (MCF) for the period 1990–2015 are shown in Table 49.

TABLE 49: Average weighted MCF, 1990–2015

Year	Unmanaged shallow (%)	Unmanaged deep (%)	Managed (%)	Uncategorized (%)	MCF (share)
1990				100	0.60
1991				100	0.60
1992				100	0.60
1993				100	0.60
1994				100	0.60
1995				100	0.60
1996				100	0.60
1997				100	0.60
1998				100	0.60
1999				100	0.60
2000				100	0.60
2001				100	0.60
2002				100	0.60
2003				100	0.60
2004				100	0.60
2005				100	0.60
2006	60	5	35		0.63
2007	60	5	35		0.63
2008	60	5	35		0.63
2009	60	5	35		0.63
2010	60	5	35		0.63
2011	60	5	35		0.63
2012	60	5	35		0.63
2013	40	5	55		0.75
2014	40	5	55		0.75
2015	35	5	60		0.78

The data on recovered CH_4 and CH_4 combusted in a flare is included in the calculations for the period 2008–2015, while it is determined that there is no recovered (combusted) CH_4 for the previous period.

The data was obtained from the "Livade" landfill where landfill gas was combusted between 2008 and 2015. The 2014 and 2015 values are the same and may require further verification and correction. Landfill gas is not used for power generation.

The data on the quantities of combusted CH_4 is shown in Table 50.

TABLE 50: Combusted CH_4 (Gg), 2008–2015

Year	Combusted CH_4 (Gg)
2008	0.107
2009	0.195
2010	0.238
2011	0.217
2012	0.202
2013	0.229
2014	0.519
2015	0.519

BIOLOGICAL TREATMENT OF SOLID WASTE

According to the data available, biological treatment of solid waste (composting and anaerobic digestion in biogas plants) is not being done in Montenegro. It is advisable to investigate this for more information on the above activities. If such activities exist, data needs to be collected in line with the Data Collection Programme to be developed for this category.

INCINERATION AND OPEN BURNING OF WASTE

According to the data available, there is no incineration or open burning of waste in Montenegro.

Hazardous waste is exported from Montenegro and medicinal waste is sterilized and disposed of in SMW landfills. It should be verified whether the sterilized medicinal waste disposed of in SMW landfills is included in the calculation of category 4A – Solid waste disposal (according to information available so far, it is presumed that sterilized medicinal waste is not included in calculation for category 4A).

It is advisable to investigate for more information on the incineration or open burning of waste in Montenegro. If such activities exist, data needs to be collected in line with the Data Collection Programme to be developed for this category.

WASTEWATER TREATMENT AND DISCHARGE

Aerobic biological processes are most commonly used in treating domestic waste water. The discharge of domestic waste water, particularly in rural areas where septic tanks are used, is partly anaerobic, without the combustion of CH_4, resulting in CH_4 emissions. Domestic wastewater also results in indirect N_2O emissions due to protein consumption.

Anaerobic processes are applied in the treatment of industrial wastewater. So far, the data needed to calculate CH_4 emissions from industrial wastewater (e.g. food and beverages industry) has not been collected.

Compared to the previous calculations (1990–2013), the following data and parameters were modified:

- The data on the total population covered by the individual collection system used for calculating CH_4 emissions was corrected for 1990 and 1992, due to an error in entering the data into the IPCC Inventory Software;
- The MCF parameter value for determining CH_4 emissions was corrected due to an error in selecting the system – previously anaerobic deep lagoons (>2m) were used, while this calculation used a septic tank system, which resulted in a changed EF value for calculating CH_4 emissions;
- The total population data used for calculating N_2O emissions was corrected for the period 1992–1996 due to an error in entering the data into the IPCC Inventory Software;
- The previously used PIV, for which no source had been cited, was replaced by the official values taken from the FAOSTAT statistical database (last updated on 12 December 2017). The data is available for the period 2006–2013. The unavailable data for the periods 1990–2005 and 2014–2015 was determined by extrapolation, taking into account the 2006–2013 trends.

In line with the above changes, the CH_4 and N_2O emissions were recalculated for the period 1990–2013.

The CH_4 and N_2O emissions from domestic wastewater management were included in the calculation of emissions for the period 1990–2015. The CH_4 emissions from domestic waste water (particularly in rural areas using septic tanks) were calculated by using the Tier-1 methodology recommended by the 2006 IPCC Guidelines.

The data on population covered by individual collections were calculated based on the total population of Montenegro. The population data source is MONSTAT. The assumption was made that 42% of Montenegrin households use septic tanks. Given that the same assumption was made for the whole reporting period (1990–2015), further verification is needed.

So far, no data has been collected for calculating degradable organic material (kg BPK/pc/yr). Therefore, over the whole reporting period 1990–2015, the recommended value from the IPCC Inventory Software was used. The 2006 IPCC Guidelines, in Volume 5, Chapter 6, Table 6.4, provide the recommended values for specific regions and countries, and given that none is comparable to Montenegro, the value recommended in the IPCC Inventory Software was used.

The total degradable organic material in domestic waste water (kg BPK/yr) is calculated by multiplying the total population covered by individual collection with the degradable organic material (kg BPK/pop/yr). The data is shown in Table 51 below.

TABLE 51: Data on population covered by individual collection system and degradable organic material, 1990–2015

Year	Population covered by individual collection	Degradable organic material (kg BPK/pc/yr)	Total degradable organic material in wastewater (kg BPK/yr)
1990	243 555	21.9	5 333 855
1991	244 860	21.9	5 362 434
1992	245 884	21.9	5 384 860
1993	246 908	21.9	5 407 285
1994	247 933	21.9	5 429 733
1995	248 957	21.9	5 452 158
1996	249 981	21.9	5 474 584
1997	251 006	21.9	5 497 031
1998	252 030	21.9	5 519 457
1999	253 055	21.9	5 541 905
2000	254 079	21.9	5 564 330
2001	255 103	21.9	5 586 756
2002	256 128	21.9	5 609 203
2003	257 152	21.9	5 631 629
2004	257 608	21.9	5 641 615
2005	257 990	21.9	5 649 981
2006	258 311	21.9	5 657 011
2007	258 668	21.9	5 664 829
2008	259 127	21.9	5 674 881
2009	259 683	21.9	5 687 058
2010	260 160	21.9	5 697 504
2011	260 433	21.9	5 703 483
2012	260 652	21.9	5 708 279
2013	260 907	21.9	5 713 863
2014	261 160	21.9	5 719 404
2015	261 307	21.9	5 722 623

The data for Montenegro on the protein intake value (PIV) for the period 2006–2013 was taken from the FAOSTAT statistical database (last updated on 12 December 2017). For the unavailable data for the periods 1990–2005 and 2014–2015, extrapolation was done, taking into account the value trends for 2006–2013.

The population and PIV data for the period 1990–2015 are shown in Table 52.

TABLE 52: Population and protein intake data, 1990–2015

Year	Population	PIV (kg/pc/year)
1990	579 892	32.6
1991	582 999	32.9
1992	585 438	33.3
1993	587 877	33.7
1994	590 316	34.0
1995	592 755	34.4
1996	595 194	34.7
1997	597 633	35.1
1998	600 072	35.5
1999	602 511	35.8
2000	604 950	36.2
2001	607 389	36.5
2002	609 828	36.9
2003	612 267	37.3
2004	613 353	37.6
2005	614 261	38.0
2006	615 025	36.9
2007	615 875	38.7
2008	616 969	40.3
2009	618 294	40.1
2010	619 428	40.6
2011	620 079	40.5
2012	620 601	38.9
2013	621 207	40.9
2014	621 810	41.2
2015	622 159	41.6

INDUSTRIAL WASTEWATER

No activity data required for the CH_4 emissions calculation was provided.
It is advisable to do a survey to gather the necessary data to be included in the inventory.

UNCERTAINTY ASSESSMENT IN THE WASTE SECTOR

To assess uncertainties of input data and the emission factors, the IPCC 2006 default values have been used.

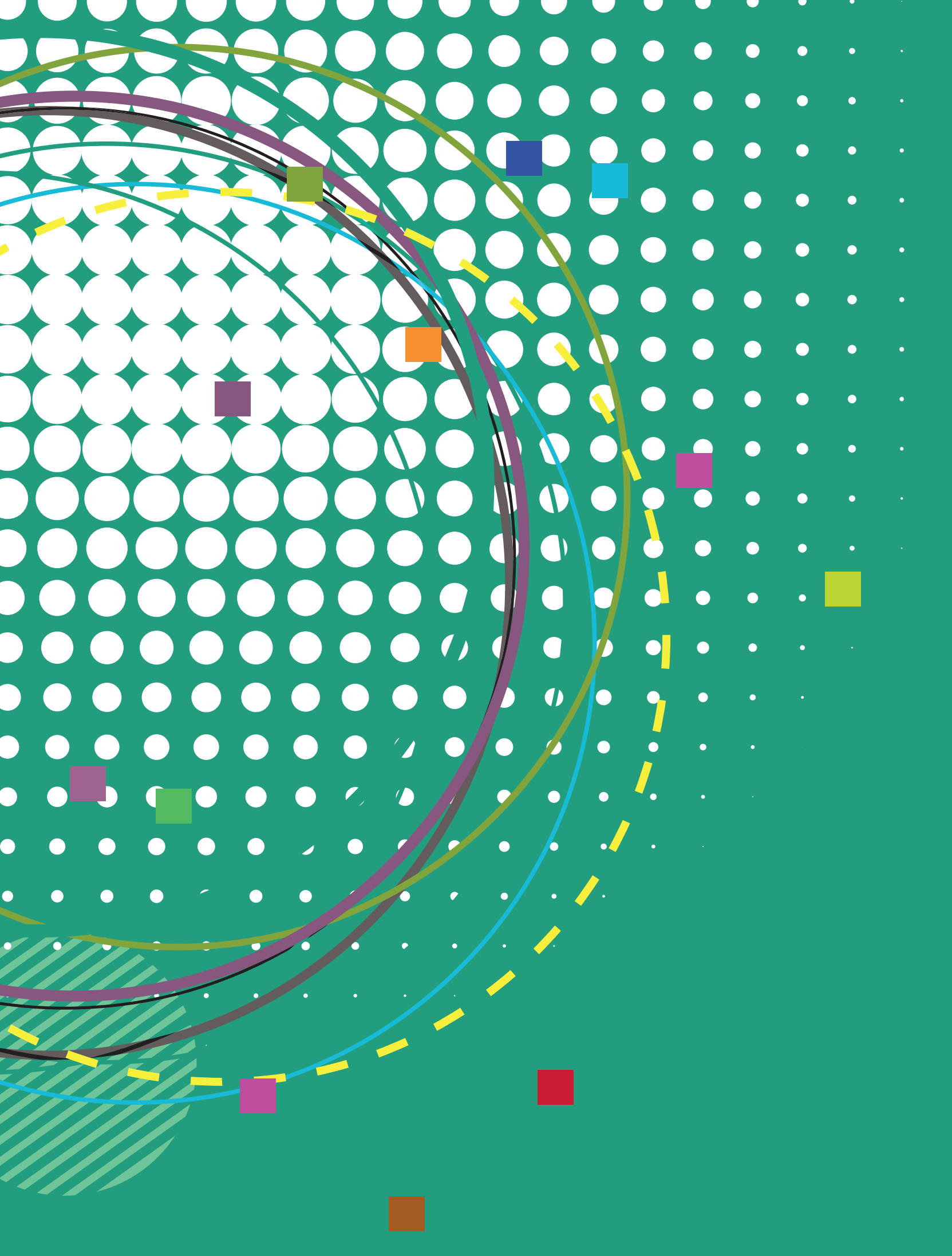
The values of uncertainties in activity data and emissions factors from the waste sector referring to SMW disposal and wastewater treatment and discharge are shown in Table 53.

TABLE 53: Uncertainties in assessments of activity data and emission factors for SMW disposal and wastewater treatment and discharge 1990–2015 (%)

Category	Gas	Uncertainties of activity data (%)	Uncertainties of emission factors (%)
4A – Solid waste disposal	CH_4	50	50
4D – Wastewater treatment and discharge	CH_4	50	30
4D – Wastewater treatment and discharge	N_2O	50	50

CHAPTER

Climate Change Mitigation and Action Plan



INTRODUCTION

The analysis of potentials for CC mitigation conducted for the SBUR is a continuation of the similar mitigation polices, actions and measures done previously, primarily for the needs of the FBUR, as well as for the Second National Communication (SNC), the National Climate Change Strategy to 2030 (NCCS) and the Technical Document for the INDC. The analysis covered key IPCC sectors, through sector-specific actions, under two predefined scenarios (scenario 1 with existing measures - WEM and scenario 2 with additional measures – WAM). No new modelling was done for the needs of this analysis; rather, the existing models, developed for the needs of the above-mentioned documents, were used. For the first time, all the actions covered have been classified depending on whether or not they fall under a sector that is to be a part of the European Union Emissions Trading Scheme (EU ETS) once Montenegro becomes a member state.

As a party to the UNFCCC, Montenegro is endeavouring to reduce its emissions within its means and taking into account the national circumstances. This chapter deals with the country's commitment to addressing CC by reducing emissions in the context of sustainable development (SD) and the actions taken in 2018 to mitigate anthropogenic emissions and to increase carbon removal. The mitigation actions and their impact were documented to the extent that this was practicable, following the BUR development guidelines, including the associated methodologies and assumptions.

Most of the CC mitigation actions are being undertaken in the energy sector. Unfortunately, there are far fewer emission-reduction initiatives regarding IPPU, agriculture, forestry and land use, and waste, as well as regarding energy sub-sector-transport, in relation to e-mobility in public transport. Obviously, this chapter features a non-finite list of actions, meaning that the mitigation potential is even greater, requiring greater efforts be invested into investigating new possible actions the country may take to combat CC.

Currently there is no methodology for monitoring the progress achieved by the actions. This SBUR itself, however, includes the concept of a national system for improving data collection and management, and a formalized institutional framework supporting long-term data collection, the analysis of emission projections, and reporting on mitigation measures. In addition, there is a need to build up national capacities to improve monitoring and reporting on sector-specific mitigation actions.

For the purpose of the present analysis, all mitigation actions were systematized in such a way as to identify for each action the sector it belongs to, the implementing body, the sources of funding, the timeframe for its implementation, the estimated energy savings and the emission reduction (where possible), investment costs and maintenance costs, as well as whether the action refers to facilities that are to be part of the EU ETS once Montenegro becomes a member state.

INSTITUTIONAL FRAMEWORK

Montenegro is a Non-Annex-I party to the UNFCCC and a party to the Kyoto Protocol. In 2016, Montenegro signed and subsequently ratified in 2017 the Paris Agreement. This reconfirms the government's commitment to join international efforts to combat CC by undertaking activities to reduce GHG emissions and limit global warming to a maximum of 2°C by the end of this century. With a view to this ratification, Montenegro previously submitted its INDC to the UNFCC Secretariat, in which the country committed itself to reducing emissions by at least 30% by 2030 compared to 1990, as the baseline year. Towards ratification of the Paris Agreement, the country made a socio-economic analysis of the investments needed to achieve the emission-reduction target by 2030. So far Montenegro has submitted to the UNFCCC Secretariat two National Communications and the FBUR, and is currently preparing the Third National Communication (TNC). Montenegro is a candidate country for EU accession, and as such it has undertaken to transpose the EU climate and energy package into its domestic legislation. Moreover, it is also a party to the treaty establishing the Energy Community (EnCT), undertaking to rapidly endorse EU rules on the monitoring, reporting and inventorying of GHGs and the actions undertaken to address CC, and to develop integrated a National Energy and Climate Plan (NECP) in line with the European Commission (EC)[1] proposal. The EnCT Secretariat drafted the Recommendation 2018/01/MC-EnC on preparing for the development of integrated national energy and climate plans, as well as guidance for NCEP development[2].

[1] Recommendation of the Ministerial Council of the Energy Community 2018/01/MC-EnG on preparing for the development of integrated national energy and climate plans by the Contracting Parties of the Energy Community.

[2] Policy Guidelines by the Energy Community Secretariat on the development of National Energy and Climate Plans under Recommendation 2018/01/MC-En.

TABLE 54: Different organizations and their responsibilities

Organization	Acronym	Responsibilities
Ministry for Sustainable Development and Tourism (Climate Change Division of the Climate Change and Mediterranean Affairs Directorate)	MSDT	In charge of climate policy adoption, implementation and monitoring. The Climate Change Division is a focal point for the UNFCCC and the Green Climate Fund (GCF). It also deals with waste as a part of its remit.
Agency for Nature and Environmental Protection	EPA	Works under the MSDT and has an important role in inventorying GHG emissions.
Ministry of the Economy	MoE	In charge of energy and industrial policy. Additional possibilities in CC mitigation also exist.
Ministry of Agriculture and Rural Development	MARD	In charge of agricultural and forestry policy. Additional possibilities in CC mitigation also exist.
Ministry of Transport and Maritime Affairs	MTMA	Important role in CC policy making.
Ministry of Internal Affairs (Directorate for Emergencies)	MIA	Important role in CC policy making.
National Council for Sustainable Development, Climate Change and Integral Coastal Zone Management	NCSDCCICM	Responsible for monitoring development and implementing national sustainable development and CC policies. Also involved in planning, alignment of development policies for sustainable development and CC requirements, and the implementation of EU sustainable development frameworks under the Energy and Climate Package.
Mitigation and Adaptation Working Group		Offers support and guidance for the national climate policy to implement mitigation, i.e. emissions reduction, and adaptation measures to adverse CC impacts. The working group is an inter-governmental body composed of the representatives of all relevant authorities, civil society, business alliances and academia.

Montenegro has not yet put in place a system nor designated a body to be in charge of GHG emission projections and carbon removal as a baseline for determining and assessing the possibilities for GHG emission reduction, adopting policies and measures for cost-effective GHG emission reduction, or the relevant performance monitoring. This report is expected to offer the best option for overcoming the problem, to be used as a basis of the future system.

Given the absence of a national system for MRV, the country has not designated a national NAMA coordinator, or a body to collect and approve NAMA projects and submit them to the UNFCCC NAMA Register, which would open up opportunities for their funding.

LEGAL FRAMEWORK

The CC legal framework is provided by the Air Protection Law[1], which governs monitoring and provides details on developing the national GHG Inventory. The method of development, contents, list of GHG emissions, method of obtaining information, data quality control and deadlines for making the GHG Inventory and the accompanying reports are set forth in the Rulebook on the Methodology for Development and Contents of GHG Inventory[2]. Under the Rulebook, in 2017 the first 2018 Plan for Data Collection for GHG Inventory was adopted[3], which envisages sector-specific categories of sources, data on activities, sources of data and the reporting institution.

The Environment Law[4] envisages the adoption of the Climate Change Strategy, Low-Carbon Development Strategy, and the CC Adaptation Plan. The 2016–2020 National Strategy with the Action Plan for Transposition, Implementation and Enforcement of the EU Acquis on the Environment and Climate Change (NEAS) is an important document putting in place the strategic framework for reaching full alignment of the national legal and institutional framework with the EU Acquis for enhancing the state of the environment, addressing CC and sustainable management of water resources. Currently the Climate Protection Law is being drafted as an umbrella law to define the set of measures and EU standards to be applied and has got as far as addressing the challenges of CC, then setting up the system for MRV of CC-relevant data, GHG emissions projection as a key assumption for sustainable planning and GHG emission reduction, and CC adaptation. The adoption of the Climate Law is one of Montenegro's international commitments under the Paris Agreement and serves the function of legal harmonization with the EU Acquis.

A number of other laws, regulations and strategies relevant for CC mitigation have also been adopted. The most important ones include: the National Sustainable Development Strategy (NSDS) to 2030 with the accompanying Action Plan (AP); the Energy Development Strategy (EDS) to 2030 with the accompanying 2016–2020 AP; the Programme for Development and Use of Renewable Energy (PDURE) to 2020; and the Third Energy Efficiency Action Plan (2016–2018), while the Low-Carbon Development Strategy is planned for 2019. The NSDS incorporated the Addis Ababa Action Agenda and the UN 2030 Agenda requirements through the actions envisaged by the AP to 2030. In line with the INDC to global GHG emission reductions, Montenegro's target is to reduce GHG emissions by 30% until 2030, compared to 1990 as the baseline year. This is directly linked with the sustainable development goal (SDG) 13 – "Take urgent action to combat climate change and its impacts" – noting that this primarily takes place through participation in the Global Climate Action within the UNFCCC framework. The NSDS is underpinned by the idea of introducing a green economy following the

[1] Official Gazette of Montenegro, 43/15.
[2] Official Gazette of Montenegro, 66/17.
[3] Official Gazette of Montenegro, 92/17.
[4] Official Gazette of Montenegro, 52/16.

approach defined by UNEP[5], according to which a green economy is low-carbon, resource-efficient and socially inclusive, pursuing the strategic goals set in the following priority areas: CC mitigation, resource efficiency, waste management following the principles of a circular economy, sustainable management of coastal resources and fostering a blue economy; sustainable production and consumption and social responsibility; and increased competitiveness of the Montenegrin economy.

NATIONAL GHG INVENTORY

Examining the National GHG Inventory, specifically from 2015, it becomes apparent that the total CO_2 emissions from energy (2 528 Gg CO_2eq), are similar to the CO_2 sinks from agriculture, forestry and other land use (AFOLU) (–2 012 Gg CO_2eq). Emissions in the energy sector account for some 70% of the total (2015).

Scenarios

For the needs of this analysis, two scenarios were used which had already been developed for prior analyses:

• SCENARIO WITH EXISTING MEASURES (WEM SCENARIO)

The WEM scenario includes all the measures in line with the EU Acquis and national strategies/policies.

• SCENARIO WITH ADDITIONAL MEASURES (WAM SCENARIO)

The WAM scenario includes the WEM scenario, as well as the measures that go beyond the EU requirements or measures using the flexibility of certain EU requirements.

SECTOR-BASED APPROACH TO EMISSION REDUCTION ACTIONS

Each sector is considered in turn here, with a summary of the actions provided, followed by details of the actions already taken and that are planned. Further details of these actions are listed in Annex I.

[5] UNEP has defined a green economy as "one that results in improved human wellbeing and social equity, while significantly reducing environmental risks and ecological scarcities. A green economy is based on investments that reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevent the loss of biodiversity and ecosystem services".

Energy

In the field of energy, the legislation relevant for GHG emission reduction includes the Energy Law[6] and the Energy Efficiency Law[7]. The Energy Law is compliant with the EU Acquis on energy, transposing the following:

- Directive 2009/72/EC concerning common rules for the internal market in electricity;
- Directive 2009/73/EC concerning common rules for the internal market in natural gas;
- Directive 2009/28/EC on the promotion of the use of energy from renewable sources;
- Directive 2005/89/EC concerning measures to safeguard the security of the electricity supply and infrastructure investment;
- Directive 2012/27/EU on energy efficiency in the part referring to energy efficiency in generation, transmission and distribution;
- Directive 2009/119/EC imposing an obligation on member states to maintain minimum stocks of crude oil and/or petroleum products;
- Guidelines on State Aid for Environmental Protection and Energy 2014–2020;
- Commission Decision of 20 December 2011 on the application of Article 106(2) of the Treaty on the Functioning of the European Union to state aid in the form of public-service compensation granted for certain undertakings entrusted with the operation of services of general economic interest; and
- Council Regulation (EC) No. 659/1999 of 22 March 1999, laying down detailed rules for the application of Article 93 of the EC Treaty.

The Energy Efficiency (EE) Law is aligned with the following core EU directives on energy efficiency:

- Directive 2012/27/EU on energy efficiency;
- Directive 2010/31/EU on the energy performance of buildings;
- Directive 2010/30/EU on the indication by labelling and standard product information of the consumption of energy; and
- Directive 2009/125/EC establishing a framework for the setting of eco-design requirements for energy-related products.

[6] Official Gazette of Montenegro, 5/16 and Official Gazette of Montenegro, 51/17.
[7] Official Gazette of Montenegro, 57/14.

The above legal framework and the international commitments stemming from the Energy Community decision set the following targets:

- A 9% saving in final energy consumption by 2018 compared to the average consumption over the period 2002–2006 (excluding the consumption of the KAP); and
- A 33% share of renewable energy in final consumption by 2020[8] (26.3% in 2009).

TABLE 55: Actions already taken and planned for energy generation

No.	Name	Scenario	Timeframe	EU ETS	Budget	Potential for GHG reduction/ CO_2 sink increase
1	Eco upgrade of TPP Block 1	WEM	2018–2021	Yes	€64.5 m	Not quantified
2	Revitalization of existing large HPPs	WEM	2018–2020	No	€106.7 m	23.6 $ktCO_2/yr$
3	Revitalization of exiting small HPPs	WEM	2018–2020	No	€20.25 m	6.68 $ktCO_2/yr$
4	Construction of new HPPs	WEM	2019–2025	No	€671 m	337.2 $ktCO_2/yr$
5	Construction of small HPPs	WEM	2018–2020	No	€106.7 m	130 $ktCO_2/yr$
6	Construction of wind power plants	WEM	2019–2021	No	€165 m	50 $ktCO_2/yr$ (additional potential in the case of constructing a 75 MW WPP)
7	Construction of photovoltaic power plants	WEM	2019–2022	No	Not quantified	8 $ktCO_2/yr$ (additional potential in the case of constructing power plants in excess of 200 MW and 50 MW)
8	Construction of power plants using landfill biogas	WEM	2019	No	€1.2 m	0.35 $ktCO_2/yr$
9	Construction of biomass-fuelled cogeneration plants	WEM	2021–2030	No	€67 m	55.5 $ktCO_2/yr$
10	District heating for Pljevlja	WEM	2019–2023	No	€23 m	Not quantified

[8] Under the Decision of the Ministerial Council to the Energy Community to apply the Directive 2009/28/EU on the promotion of the use of energy from renewable sources.

The energy sector is the largest source of emissions in the country. Energy is a strategic resource, since the country is a net importer of liquid and gas fossil fuels for energy needs. The only domestic fossil fuel source in the country is lignite, used in power and heat energy generation. Hence, CC mitigation in this sector plays a major role in achieving positive impacts for the environment, economy and the wider society through cleaner energy and reduced consumption.

Although burning of fossil fuels for power and heat generation is the single most significant source of emissions, not only in Montenegro, but also globally, the country remains determined to use the energy resources trapped in the form of its coal deposits – hence the reconstruction of the existing TPP Pljevlja and the construction of a new power station at the same site. This constitutes strategic energy policy goals to ensure the long-term stability of the power system and a reliable power supply. In 2016, a contract was signed with a foreign partner to build TPP Block 2, which covers the generation of heat energy and the construction of a district heating system for the nearby town of Pljevlja. The contract was terminated in 2017.

Once the conceptual design for the reconstruction is completed, having identified the best available technology (BAT) for the existing block, reconstruction works on TPP Block 1 will commence. The ecological upgrade of TPP Block 1 will include the construction of a desulphurization and denitrification system, an upgrade of the electro-filtering plant, construction of a wastewater treatment facility, and reconstruction of an internal system for transporting ash and slag. The TPP itself is envisaged as a heat source for the town of Pljevlja (heat removal from the turbine, heat exchangers, a pumping station and auxiliary boiler room as a backup source).

The conceptual design was planned to be developed and reviewed in 2018, with consent obtained from the Environmental Impact Assessment (EIA) study. Tendering for the main design and construction works is planned for Q4 2018, while the actual construction is envisaged for the period 2019–2021. In line with the Energy Community Treaty[9], TPP will be operating with a reduced capacity of 20 000 operating hours over the period 2018–2023. The operator of TPP received a conditional IPPC permit[10], based on a programme of measures for adapting the operation of the existing facility or the activities set forth by the conditions in the IPPC permits, valid for 5 years.

Over the last few years, substantial investments have been made, and will continue to be made, in new renewable-energy sources (wind generators and small hydroelectric power plants (HPPs)), together with planned investments in solar power plants (SPPs), biogas-powered plants, and biomass cogeneration plants. The annual reduction of emissions on account of the Krnovo wind power plant (WPP), an investment worth €120 million, is estimated at

[9] Decision of the Ministerial Council to the Energy Community to apply the Directive 2001/80/EC on the limitation of emissions of certain pollutants into the air from large combustion plants.

[10] Under the Law on Integrated Pollution and Prevention Control (2005).

around 80 $ktCO_2eq$, and for existing small HPPs at around 40 $ktCO_2eq$. In addition, a tender dossier for leasing the state-owned land of a total area of 6 621 121 m^2 was issued for the design, construction, use and maintenance of an SPP of installed capacity above 200 MW, and a call for tenderers to express interest in investing in wind generators of total installed capacity of around 75 MW by leasing state-owned land. The Capital City Podgorica put the Decision on the "Velje brdo Solar Power Plant" Draft Local Location Study of total area 69 ha for public consultation, envisaging an SPP of 151 844 modules.

The EnC Secretariat recently published the guidelines for Competitive Selection and Support for Renewable Energy through Auctions[11].

By the end of 2018 the Montenegrin Power Exchange (MEPX) have started trading.

The international IPA-funded research *Project of Offshore Wind Energy: Research, Experimentation, Development (POWERED)*[12] (2007–2013), aimed to develop a number of strategies, joint procedures and methods for the construction of offshore wind farms in all countries adjacent to the Adriatic Sea and define the most appropriate areas with least impact for building wind farms in the Adriatic Sea. It showed that the area of the Eastern Adriatic, off the border region between Albania and Montenegro is very suited to building new offshore WPPs, primarily because of the good seabed conditions and the relative proximity of ports and infrastructure.

TABLE 56: Actions already taken and planned for energy efficiency

No.	Name	Scenario	Timeframe	EU ETS	Budget	Potential for GHG reduction/CO_2 sink increase
11	Increased energy efficiency in public, residential and commercial buildings	WEM	2018–2030	No	€20 m	7.5 $ktCO_2$/yr. for public buildings
12	New buildings	WEM	2018–2030	No	Not quantified	150 $ktCO_2$ by 2020
13	Energy labelling and eco-design requirements for products affecting energy consumption	WEM	2018–2033	No	€14 m	500 $ktCO_2$ by 2033
14	Improving public street lighting	WEM	2019–2030	No	Not quantified	12 $ktCO_2$ by 2020

[11] Competitive Selection and Support for Renewable Energy, EnC and EBRD (March 2018).

[12] http://www.powered-ipa.it/.

Several years of investments in increasing energy efficiency[13] in public (healthcare, education, cultural and administrative buildings) and residential buildings has occurred through two programmes: Energy Efficiency in Montenegro (MEEP)[14] and Energy Efficiency Programme in Public Buildings (EEPPB))[15], implemented until 2022 and 2020, respectively. These programmes have already effected great savings and, by extension, emission reductions. The two programmes have covered 48 public buildings so far, reducing annual energy consumption by 49%, and emissions by 7.5 ktCO_2. By the end of the programmes, another 30 public buildings are to be covered. Apart from EE measures, the following actions are envisaged for the building sector: establishing an energy management system; development of a building maintenance concept; building an inventory, procurement of a software tool for building certification and verification of savings.

One prominent programme among subsidies targeting households is Energy Wood[16], providing interest-free loans for households for purchasing and installing heating systems using modern forms of biomass. So far, a total of €455 000 has been invested through the programme, in three phases, having installed 1 000 biomass-powered heating systems so far, reducing emissions by 1 388 tCO_2 annually.

There are also local-level EE programmes in place; thus, the capital Podgorica intends, through a number of measures over the period 2018–2020, to reduce energy consumption by 10%–15%. In addition to energy upgrades of public buildings, Podgorica is also providing subsidies for individuals for improving energy efficiency in residential buildings. Moreover, Podgorica, together with some other municipalities, is providing incentives in the form of reduced municipal fees for installing renewable energy sources (solar water heating) in new buildings or when doing reconstruction, or for low-energy or passive houses.

Promotional actions, media campaigns, education programmes, initiatives, training events, expert events, round-table discussions and conferences for different target groups, undertaken together with foreign and domestic partners, have significantly contributed to raising consumer awareness of the reasonable and efficient use of energy.

The implementation of legislation on the minimum requirements for the energy efficiency of buildings[17], certification of building energy performance and regular energy audits for heating and air-conditioning systems are already producing results and reducing building energy consumption. The new regulation for EE labelling and eco-design requirements for energy-related products, covering a wide range of consumer goods used both in households and in the commercial and public sectors, is yet to contribute to substantial additional energy savings.

[13] All energy efficiency and energy saving measures have been aligned with reaching the target of 9% of saving by the end of 2018 .
[14] See http://www.energetska-efikasnost.me.
[15] See http://www.energetska-efikasnost.me.
[16] See http://www.energetska-efikasnost.me.
[17] Directive 2010/31/EU of the European Parliament and Council of 19 May 2010 on the energy performance of buildings.

TABLE 57: Actions already taken and planned for transport

No.	Name	Scenario	Timeframe	EU ETS	Budget	Potential for GHG reduction/CO_2 sink increase
15	Use of renewable energy in transport (biodiesel and alternative fuels)	WEM	2018–2020	No	Not quantified	10 $ktCO_2$ by 2020
16	Introduction of low-carbon vehicles	WAM	2018–2030	No	Not quantified	9 $ktCO_2$
17	Sustainable Urban Mobility Plan	WAM	2021–2030	No	Not quantified	Not quantified
18	Increased use of railway transport for passengers and freight	WAM	2018–2030	No	Not quantified	Not quantified

In the transport sector, with a steady trend of increasing energy consumption, some studies[18] have been done on the prospects for the production and use of biodiesel, the potential for introducing other alternative fuels in transport sector, potentials for energy efficiency in transport and the Action Plan for sustainable use of energy in transport. Apart from increasing the use of biodiesel[19], it envisages an increase in the overall share of alternative fuels (liquefied petroleum gas – LPG and compressed natural gas – CNG) and electrical power in transport, including development of the relevant infrastructure[20].

The project *Towards Carbon-Neutral Tourism in Montenegro*[21] (TCNT) also accounted for some energy savings, and thus reduced emissions. The project aims specifically at reducing consumption in the commercial and transport sectors, as well as in the waste sector, all aimed at increasing the quality of the tourist product. The project's activities focused on development of the regulatory framework, spatial planning, public education and financial mechanisms. The project launched certification schemes, as a major tool in recognizing truly responsible companies, products or services, established around the principles of sustainable/green/eco-tourism, and as a marketing tool to attract visitors and users. The TCNT project developed a comprehensive methodology for calculating emissions, including all types of accommodation facilities, transport and waste. The methodology was internationally verified, which confirms the quality of the calculations. The year 2013 was taken as the baseline, when the total direct emissions in this sector amounted to 60 904 $ktCO_2eq$. One of the project's goals is to put in place the assumptions for mobilizing additional resources for CC mitigation in tourism, which will be achieved through introducing carbon trade-off schemes and other innovative financial tools, to compensate for

[18] IPA-funded project: Development of Sustainable Use of Energy in Montenegro, focusing on transport.
[19] The directives covering the use of biodiesel in EU, including the Renewable Energy Directive 2009/28/EC, the Fuel Quality Directive and the Biodiesel Directive.
[20] Directive 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure.
[21] http://lowcarbonmne.me.

CO_2 emissions and generate additional revenues for funding CC mitigation and adaptation in the travel and tourism sector. The project offers the opportunity of co-funding and technical support for innovative investment projects, actively contributing to CC mitigation and adaptation in tourism. A total amount of around €1 million is available as a tool to test the capacities of local actors to develop the necessary procedures and guidelines subsequently to be used as a model for a sustainable funding mechanism that will be adopted and developed at the national level. The project activities so far have helped reduce emissions by around 14 $ktCO_2eq$.

The strategy paper focusing on improving transportation systems in the coastal municipalities of Herceg Novi, Tivat and Kotor, and the Historic Royal Capital Cetinje entitled "Polycentric plan for sustainable urban mobility in Boka Kotorska Bay and in Cetinje (2016–2020)"[22] was developed within the framework of the low-carbon tourism project focusing on improving the transport infrastructure in light of the development of sustainable tourism. What is specific about this planning document is the innovative methodology developed by the EC, promoting the designing of solutions in interactions between experts and the stakeholders from the affected area.

The plan consists of a detailed presentation of the current state of development of the transport system and functionality in the area of Boka Kotorska Bay and Cetinje, with a particular focus on the environmental impacts, then a review of the institutional and legal frameworks, and the assessment of opportunities and barriers for development. The proposed solution includes the basic components of a strategic plan and includes a vision statement and objectives for developing sustainable urban mobility, scenarios and measures, description of individual measures, the Action Plan and monitoring guidelines. A special feature of the plan is the provision of model terms of reference and the contents of some studies and surveys, CO_2 savings, proposed measures for the period covered by the plan, and a detailed description of the measures. The implementation of the measures over 15 years would reduce emissions by some 30% compared to 2015 levels.

The Open Regional Forum for South-East Europe – Energy Efficiency (ORF-EE), supported by the German development organization GIZ, launched a new regional project on Sustainable Urban Mobility in South-East European (SEE) Countries' cities together towards sustainable and energy-efficient transport (SUMSEEC) in late 2017. The adverse effects that transport has in capital cities and cities of South-East Europe pose a major challenge and thus greening of the transport system in the region is key. The objective of the project is to bring together, through regional networks, political and civil-sector representatives from SEE who are crucial for the implementation of energy-efficient and sustainable urban mobility solutions. More precisely, the project goal is to support SEE countries directly by strengthening the capacities of SEE cities and important actors for an effective implementation of relevant measures in line with the EU energy and climate requirements. In the long run, ORF-EE support provided to the region would contribute to climate and urban congestion mitigation.

[22] http://lowcarbonmne.me/files/pdf/PolySUMP_2016_PRINT_v2.pdf.

TABLE 58: Actions already taken and planned for energy in industry, construction and mining

No.	Name	Scenario	Timeframe	EU ETS	Budget	Potential for GHG reduction/CO_2 sink increase
19	Establishing energy management in the industrial sector	WAM	2018–2030	No	Not quantified	Not quantified
20	Subsidies for energy savings	WAM	2018–2030	No	Not quantified	1.39 $ktCO_2$/yr

Regarding energy consumption in industry, construction and mining, there have been no major actions to reduce emissions, given their downward trend which is due to reduced industrial activity in the country. The best effect of reduced emissions in the industrial production subsector would come from changing the type of fuel used (switch from heavy fuel to LPG in KAP and the Steel Company). However, given the uncertainties surrounding the metal processing industry, this issue is not covered by the present analysis.

The transfer of technologies via vehicles, industrial plants and home appliances from other, mostly developed countries, has a major positive impact on greater energy efficiency. This process is quite spontaneous, through marketing efforts by manufacturers and the market tools available and is not necessarily a result of any predetermined regulatory or institutional efforts, policy incentives or sector-based regulations.

Finally, it is noteworthy that the Master Plan for the Development of the Gas Transport System (Gasification) was developed in 2015, and in 2017 the country signed a contract of concessions for the exploration and production of hydrocarbons in Montenegrin waters with a foreign partner. The present analysis will not cover the intended gas pipelines or hydrocarbon exploration or production, given that the relevant activities are still in their early stages.

Industrial processes and product use

TABLE 59: Actions already taken and planned for industrial processes and product use

No.	Name	Scenario	Timeframe	EU ETS	Budget	Potential for GHG reduction/CO_2 sink increase
21	Introducing BAT into technological processes in KAP	WEM	2018–2025	Yes	€300 m	500 $ktCO_2$ by 2020
22	Introducing BAT into other facilities	WEM	2018–2030	Yes (No)	Not quantified	Not quantified

The single most relevant activity in this sector is to draft the plan of implementation of the EU Directive on industrial emissions, to draft the Industrial Emissions Law and the plan for full transposition of the Industrial Emissions Directive.

This sector accounts for some 11% of total emissions (2015). Of these, 75% comes from KAP.

The largest share of emissions is generated during electrolysis and takes the form of synthetic gases[23]: tetrafluoromethane (CF_4) and hexafluoroethane (C_2F_6), with very high GWPs. The emissions of synthetic gases amounted to 1 549 $ktCO_2eq$ in 2007, while the total national GHG emissions without sinks amounted to 3 965 $ktCO_2eq$. In addition, KAP emitted 213 $ktCO_2$ in 2007. Following 2007, KAP downscaled its production, introducing at the same time technological upgrades by having automatic controls of the anode effect in the electrolysis plant, thus substantially reducing the emissions of synthetic gases, with a constant downward trend since 2008 (down from 725 $ktCO_2eq$ in 2008 to 240 $ktCO_2eq$ in 2015). The same goes for CO_2 emissions (down from 178 $ktCO_2eq$ in 2008 to 67 $ktCO_2eq$ in 2015).

What is happening with KAP is largely unknown at this stage for external reasons (aluminium market) and internal reasons (ownership structure). Whatever the solution, closing KAP down is unacceptable to the government.

Given the uncertainties surrounding KAP (it has been in bankruptcy proceedings since 2013) and the high share of GHG that it accounts for, two approaches have been considered for different periods:

- operating at reduced capacity (until the end of 2020)
- operating at full capacity (post-2020).

Both approaches assume that KAP would modernize the production processes by making use of BAT[24] in terms of energy efficiency and reduced emissions. These measures include better efficien-

[23] Perfluoroucarbons or PFCs.

[24] Best Available Techniques (BAT) Reference Document for Non-Ferrous Metals Industries – Section 4, Final draft (October 2014), see: http://eippcb.jrc.ec.europa.eu/reference/BREF/NFM_Final_Draft_10_2014.pdf.

cy and process control and the application of point-dosage of alumina and aluminium fluoride. When making GHG projections, such measures that greatly reduce emissions are factored in gradually. In case of the "business-as-usual" scenario, the emissions in the IPPU sector would reach 1 649 $ktCO_2eq$ by the end of 2020, still below the 1990 value. When all measures are done in KAP, the GHG emissions in this sector could be reduced down to a level of 1 012 $ktCO_2eq$ or, in case of the reduced-capacity scenario, to as low as 392 $ktCO_2eq$ in 2020.

In the electrolysis "B" series, the number of anode effects is 0.82 anode effects/cells/day. The duration of the anode effect on the electrolysis cell in "B" series is 0.60 min. KAP plans the construction of the electrolysis plant to be designed and constructed in line with BAT.

The KAP operator has not yet received the IPPC permit and has not submitted the Plan of Measures for adapting the existing plant or the activities to the stipulated conditions to define measures and timeframes for the application of BAT in KAP facilities.

In addition to KAP, the second largest industrial plant Tosçelik Alloyed Engineering Steel Nikšić is also in bankruptcy proceedings. At the same time, it is the second largest source of GHG emissions. Notwithstanding its very low direct GHG emissions (CO_2), this plant does have a certain amount of indirect GHG emissions, as well as other pollutants (dust). The plant operator has not obtained an IPPC permit yet.

It is noteworthy that under the IPPC Law all plants should have been operating under an IPPC permit by no later than 1 January 2018. This only adds to the uncertainty regarding the continued operation of both plants with obsolete technological processes.

Agriculture, forestry and land use

TABLE 60: Actions already taken and planned for agriculture, forestry and land use

No.	Name	Scenario	Timeframe	EU ETS	Budget	Potential for GHG reduction/CO_2 sink increase
23	Support for organic agricultural production	WAM	2018–2030	No	€7.6 m	Not quantified
24	Support to manure management	WAM	2018–2030	No	€1.2 m	Not quantified
25	Improve the state of forests and additional afforestation	WEM	2018–2023	No	€0.2 m	Sinks 200 $ktCO_2/yr$

Agriculture is a source of methane (CH_4) and nitrous oxide (N_2O), stemming from livestock and the use of fertilizers. The national GHG inventory shows that these two gases are most prevalent in agriculture, while CO_2 emissions are negligible. This sector accounts for 10% of total emissions.

Agriculture is an important economic sector with rapid development through enhanced production and increased food safety, as well as alignment with the Common Agricultural Policy and through implementing the Action Plan accompanying the 2014–2020 Strategy for the Development of Agriculture and Rural Areas. Every year the appropriations in the agro budget have been increasing for support to holdings investing in new or the upgrading of existing processing plants, most of it funded through IPA.

The first measure funded from the agro budget refers to the construction and/or reconstruction of manure storage facilities or the purchase of specialized manure storage tanks to prevent adverse environmental impacts. Improper manure storage has an adverse impact on soil, water, air and the climate; hence, to properly manage the commercial yard and prevent adverse environmental and CC impacts, support has been provided for this measure. The annual appropriation amounts to €100 000–€150 000, providing support for 50–70 beneficiaries.

The second measure receiving funding, and related to emissions reduction, is support for organic production[25]. With a view to developing Montenegro's agriculture and food industry and increasing its competitiveness and rural environmental sustainability, the 2012–2017 Action Plan for Development of Organic Production was adopted to support organic farming, processing and the consumption of organic produce in the domestic market, including the tourist sector, using the country's comparative advantages to create a coherent and market-oriented organic agriculture sector, with relevant experts in place at all levels. The objectives and specific actions include: sustainable management of natural resources; reduction of adverse impacts of agriculture on the environment; biodiversity preservation; upgrading the quality of agricultural produce and further positioning Montenegro as an ecological state. The support is calculated per hectare for growing plants, per conditional head of livestock in livestock farming, and units of poultry and number of beehives for holdings registered in the Register of Organic Producers. A total of €250 000 was appropriated for this purpose in 2016, providing support for 260 beneficiaries.

Forestry has a strong potential for CO_2 removal that could be additionally increased by upgrading the current forests and increasing the woodland area. According to the 2015 inventory data, CO_2 sinks (−2 012 Gg CO_2eq) are close to the emissions from the energy sector (2 528 Gg CO_2eq).

The National Forestry Strategy, along with the Development Plan for Forests and Forestry to 2023, sets two broad goals referring to forests as ecosystems and natural resources, and as economic resources in terms of forest assets and wood processing:

[25] Action Plan for the Future of Organic Production in the European Union, COM(2014) 179 final.

1. To improve sustainable forest management by increasing the forest stock in commercially utilized stocks from 104 to 115 million m³ of gross wood mass. Montenegro contains enough natural and healthy forests, but many of them, particularly privately owned coppice forests, are not reaching their full productivity. Planned stewardship, care and silviculture increase the quality, stability, resilience and productivity of forests, as the basis for long-term sustainable use of all forest functions. This measure leads to an increase in GHG sinks by some 10% (or 200 $ktCO_2/yr$).

2. Increased GDP share of forestry, wood processing and other activities that depend on forests from 2% to 4% of the total. Forestry and the wood processing industry are not reaching an economic output that would match their potentials. Investing in forest and rural infrastructure, developing activities complementary to forestry and wood processing, diversifying the market and cooperating within the sector would generate new jobs, improve the socio-economic position of the rural population, increase turnover and government revenues from forestry and the wood industry.

Regardless of the high proportion of territory covered by woods or woodland, there is still some potential for increasing this share, leading at the same time to more positive environmental, economic and social impacts.

As of late, with a view to improving the state of the forests[26] and tapping into this significant ecological, social and economic resource, a number of measures have been put in place that have brought about positive results, particularly regarding better capitalization on forest resources. The change in the concept of forest stewardship, or the manner in which forests are used, includes the organizational and legal framework, fiscal impact assessment and defining the method of funding in forestry. Changing the concession model will put into place assumptions for reforestation and the preservation of forest resources. The new model envisages setting up a state-owned company to manage the forests, accompanied by changes in tasks related to silviculture, aimed at putting into place an efficient stewardship system generating numerous positive economic and environmental impacts, through afforestation, suppressing forest fires and the restoration of burnt areas. The change in the concept of forest stewardship, aimed at producing better effects, refers primarily to the better preservation of forests, but also their being better capitalized on, including the availability of inputs for the wood-processing industry, with the ambition of generating green jobs and bringing added value to the sector.

Based on their state of preservation, diversity and value, Montenegro's forests rank among the best in Europe, but are faced with numerous threats which may lead to their loss. Forests are being lost due to illegal felling, the making of roads, changes in land use, with forest fires being the greatest threat for forest degradation. Given its geographical location and increasingly adverse CC impacts, Montenegro's forests are particularly vulnerable. In July and August 2017, for instance, a total of 115 forest fires were recorded, and an additional 39 in privately owned forests. The estimated burnt forest stock amounted to 96 309.13 m³, with 267 500 of the saplings replanted in 2015 and 2016 also being caught by fire.

[26] A new EU Forest Strategy: for forests and the forest-based sector {SWD(2013) 342 final}.

In 2017, a total of 273 735 saplings were planted on an area of 89.36 ha. An additional 93 500 saplings planned in 2016 were planted on an area of 26.00 ha. For privately owned forestland, 90 085 saplings were provided free of charge. In 2018, the burnt forest areas are being reforested with 448 655 saplings on an area of 136 ha. Regular reforestation and reseeding is being done on an area of 198 ha. Reforestation of burnt areas is needed to preserve the land as forests, prevent erosion and degradation; hence, regular reforestation activities are aimed at restoring the burnt areas through autumn planting. In order to preserve the forests, the excessive export of wood assortments as wood-processing inputs has been reduced, leading by extension to less illegal felling and less pressure on the forests, bringing the exporting of logs and firewood to a complete halt, substantially increasing exports of lumber and wood pellets.

A pilot project of selling wood assortments at in-forest warehouses will replace the current model of utilizing forests by selling unfelled trees. The pilot aimed at obtaining market prices for wood to eventually set up a wood exchange where providers of wood assortments (state-owned forest stewardship companies and private forest owners) and wood purchasers, primarily domestic wood processors, would meet. The pilot is aimed at introducing the private sector into the services system, contracting, felling and making of wood assortments, and their supply to forest warehouses. Wood assortments, classified according to grades, will be offered through auction sales to wood processing companies registered for making wood products.

Waste[27]

TABLE 61: Actions already taken and planned for agriculture, forestry and land use

No.	Name	Scenario	Timeframe	EU ETS	Budget	Potential for GHG reduction/CO_2 sink increase
26	Reduce the share of bio-waste in municipal waste	WEM	2018–2023	No	Not quantified	Not quantified
27	Apply sustainable production and consumption patterns	WAM	2018–2030	No	Not quantified	Not quantified

[27] Council Directive 1999/31/EC of 26 April 1999 on waste landfills, Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste, Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste, Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control).

Emissions from this sector account for some 6% of the total. Regarding the waste policy, a definite integral waste management option has not been defined yet. Consequently, no long-term solutions for proper waste management are in place. This is additionally aggravated by a low rate of recycling, an absence of data on waste quantities and poor utility infrastructure. Selective waste disposal has not been established yet, and a large number of municipalities use temporary disposal sites, in addition to a large number of unauthorized dumping sites. There is also the issue of bilge disposal. The amended State Waste Management Plan (2015–2020) identifies four waste management centres. In addition, waste generation is to be reduced through primary selection and recycling, with the intended share of recycled waste accounting for some 50% of total municipal waste in 2027.

Annex 1 features a table with detailed data and information on actions, including strategic and regulatory framework, timeframe for implementation, costs and source of funding, estimated reduction of emissions, the methodology used, the implementing body, performance indicators, and the status of implementation for ongoing action.

CAPTER

Constraints and Gaps: Technology, Financial and Capacity-Building Needs and Support Received

INTRODUCTION

In order to meet the obligations arising from the conferences of the parties held in Cancun and in Durban, and in line with decisions concerning reporting (national reports and BURs), further support is needed to continue developing and consolidating the existing technical and institutional capacities, along with efforts to integrate CC into national policies, programmes and plans.

Following accession to the Convention, Montenegro implemented a number of activities in this area at the national level in order to meet some of the requirements under the Convention, which produced good results. However, with the changes made to the Convention mechanisms, as well as Paris Agreement whose implementation in full capacity will start in 2020, and the Road Map, leading to the identification of new, modern mechanisms, methods and approaches, all of which require new expertise, it is necessary to be constantly developing capacity and upgrading expertise and skills to achieve a reduction in GHG emissions (in line with the nationally accepted obligations stemming from Paris Agreement, with the aim to limit global temperature increase to 1,5°C).

As a developing country, Montenegro has often asked for international assistance in the form of financial assistance, capacity building, technical assistance and technology transfer. This has been in order to help the country move towards meeting its obligations under the UN Framework Convention on Climate Change. The majority of the initiatives to date have addressed CC mitigation, i.e. reducing GHG emissions, and have primarily involved financial assistance, capacity building and technical assistance.

Chapter 2 on the GHG Inventory and chapter 3 on Mitigation Action identified the priority sectors, important emission trends and mitigation actions. This analysis provides a starting point for Montenegro to make decisions on effective climate action and the needs for that action to be implemented. Constraints on effective decision making have been identified and the requirements for an improved understanding of GHG trends and mitigation action, through MRV, are outlined below. Chapter 5 on the MRV System also identifies the improvements needed to sustainably monitor and support decision makers on the progress with GHG trends and the progress and options for climate action. Once identified and prioritized, mitigation actions need to be implemented. Montenegro is experiencing technological, financial and capacity constraints in implementing its identified actions.

Progress towards reducing constraints

Under the UNFCCC, Montenegro submitted its INDC to the 2015 Paris Agreement, committing itself to a GHG emission reduction of 30% by 2030, compared to the 1990 level. A number of mitigation activities have already taken place in the country. The state is still working on securing additional financial resources; thus, under IPA II, Montenegro has been allocated €37.5 million for the environment and for climate (not including the funds allocated for cross-border cooperation), as well as €32.1 million for transport for during the period 2014–2020.

Over recent years there has been an evident increase in the volume of investment in energy infrastructure development. Recent major investments have provided support for transboundary flood risk management, green business growth and energy efficiency improvements. Other major investments have addressed the reconstruction of existing hydroelectric power plants (HPPs), the construction of new wind power plants and HPPs, the introduction of Best Available Technologies at KAP, 'smart' electricity meters and various other activities.

The development of renewable energy sources has been set as a priority for the forthcoming period in line with international obligations. Consequently, further major investment is planned and is occurring for the purpose of developing this sector.

In 2018, work was undertaken to design and implement activities to enable the country to coordinate mitigation and adaptation actions, track progress and respond efficiently to the challenge of CC. In 2016, Montenegro submitted a technical analysis of the first biennial update report (submitted in 2015). In 2015, Montenegro submitted its Second National Report and drafted an NCCS and a Technical Paper on the INDC to the Reduction of GHG Emissions; thus Montenegro committed itself to reducing GHG emissions after 2020 in the context of the global international agreement adopted in Paris.

The institutional set-up and the capacity of the state have made evident progress over recent years. However, it is still possible to identify the needs, gaps and obstacles that impede further development in the area of climate-related activities. Besides the currently available financial, technical and capacity-building support, Montenegro still cannot meet the growing requirements related to the CC challenge.

Key challenges

In order to overcome its identified shortcomings in the near future, Montenegro must continue to draw support from a large number of international donors, including national governments, non-profit organizations and international organizations. In addition, bilateral technical cooperation across all sectors needs to be enhanced and expanded, and the exchange of expertise and technology needs to be promoted in order to achieve greater efficiency in mitigation activities.

It is therefore very important to identify Montenegro's technological requirements within the current economic situation and to accurately assess its financial and capacity-building needs to prevent the harmful effects of global CC.

The need to set up a permanent and binding system for drafting national reports, Biennial Updated Reports and Nationally Determined Contributions is also a challenge. This could be overcome by securing specific budgetary funding for the ongoing financing of reporting activities. Steps towards improvement are being made through a project on MRV, funded by the GEF and implemented by UNDP. This project aims to put in place an MRV system conceptual framework that will help to provide sufficient information on CC and actions and make this information and evidence available to decision makers.

The UNFCCC Guidelines for the preparation of BURs for non-Annex-I parties to the Convention (Annex III, Decision 2/CP177) served as the methodological framework for the identification of needs and support received.

The information presented under this chapter should be seen as interim and in need of constant updates.

SUPPORT NEEDED IN MRV OF GHG TRENDS AND MITIGATION ACTION

Activities to track Montenegro's GHG trends and the implementation of actions have been started. Montenegro is continuing to look for support in developing its MRV systems including its GHG inventory, analysis of mitigation actions and projections. Support includes the training of experts in data gathering and analysis, development of data management (QA/QC) and reporting systems, with the means to engage data provision and enable decision-making stakeholders in developing and improving the evidence base. Montenegro has developed a conceptual framework for its MRV system with support from UNDP and is applying for GEF funds to implement this framework into a fully functioning MRV system.

The MRV System portal (described in chapter 5) includes draft details of MRV improvement activities that require support. Support should consider in particular the following needs:

- A permanent national system for the estimation of GHG emissions by sources and sinks and reporting of the inventory and NIR. There is also a need to increase awareness about the advantages and opportunities for the country from a strong inventory framework.
- Update the existing rulebook to define concrete tasks for each contributing institution and/or data supplier. This should clearly outline the responsibilities. Work is needed to establish a sustainable data supply system for the GHG inventory, improving the annual data collection plan.

- Conduct a detailed analysis of the EU's Monitoring Mechanism Regulation (MMR) obligation and identify relevant gaps and needs. Legislation should be drafted based on the analysis of the MMR.
- Training for key representatives in MSDT DCC to enhance knowledge and capacities. Better understanding of the adaptation processes. Improved coordination of vulnerability assessments. Awareness of measures. A multi-sector approach to adaptation. A particular focus on forestry. EU and UNFCCC negotiation processes related to adaptation and loss and damage. Support in engaging with GCF readiness activities. Design and tracking of the implementation of adaptation policies. Evaluation of the NAP.
- Continuous team building and capacity building for staff working in the relevant institutions in order to be involved in the setting up and operation of a national MRV system for climate actions. There is also a need for an increase in staff numbers to accommodate future obligations.
- Training and deployment of systems relating to the GHG inventory including: systems for the calculation of emission estimates, a system for quality assurance and quality control procedures and a system for reporting on the inventory. This should include training on the generation of NIRs and uncertainty assessments.
- Capacity building for drafting a low-carbon development strategy, which should encompass all relevant sectors and should consider the development of a low-carbon economy at all levels, including in companies.

SUPPORT NEEDED FOR THE IMPLEMENTATION OF MITIGATION ACTIONS

In Chapter 3 and Annex 1, Montenegro lists the proposed and planned mitigation actions. Some of these actions have pending technology and funding needs and may not be implemented correctly, quickly or at all without the relevant external support. The application of low-carbon modern technology in the country requires continuous cooperation with international organizations and institutions, a review of best international practice and the implementation of various projects carried out with the support of international donors. A summary of the priority actions in need of support are presented below:

- ENERGY GENERATION: The hydroelectric potential of rivers could potentially ensure energy security and mitigate the effects of CC. During recent years, several small HPPs have been built and existing HPPs have been upgraded. There are plans for the further construction of small and large HPPs. There are also plans and initiatives to generate energy from wind, solar energy and biomass. Technological, finance and capacity-building support is needed in implementing a number of these actions. Montenegro's strategic framework envisages further investment in the continuous development of the energy infrastructure in-

cluding: pipelines, new transmission system facilities, upgrades of the existing transmission and distribution systems, support for entrepreneurship in the energy sector, and reductions in technical and technological losses in electricity generation and transmission/distribution.

- ENERGY EFFICIENCY: A number of activities have been launched through the Montenegro Energy Efficiency Projects (MEEP). In the area of energy efficiency technology, there is room for further support for a reduction in energy consumption through the widespread use of 'smart' systems in consumption management and in network technology. Significant steps have been taken to build the first motorway in the country and works on this started recently. This initiative needs to ensure that it does not increase the use of fossil fuel for transport without strong justification.
- OTHER MITIGATION ACTIONS: In agriculture, national and international funds have been secured to invest primarily in organic farming, along with smaller-scale investments in forestry. In the waste sector, loans have been secured from international lenders to invest in infrastructure, i.e. in solid waste, industrial waste and wastewater management facilities. No major steps forward have been achieved regarding the operation of industrial plants, except that metal-processing plants will in the near future be expected to shift towards using modern, low-emission technology in line with the BAT guidelines.

Other needs relating to actions are listed below:

- THE EXPERTISE AND SKILLS REQUIRED TO IMPLEMENT MITIGATION MEASURES HAVE BEEN IDENTIFIED AS A VERY IMPORTANT FACTOR IN CAPACITY BUILDING. For the sake of the efficient coordination of such activities, the staff of the MSDT, EPA and all those directly addressing CC (Ministry of the Economy (MoE), MARD) need to possess and constantly develop expertise in this area. It is particularly necessary to upgrade expertise concerning energy efficiency and renewable energy sources. In addition to training the staff working in public institutions, it is necessary to work with individuals, with the private sector and with local governments. Events such as round-table discussions and seminars promoting various initiatives should be held nationwide. One such activity is the promotion and installation of solar PV systems for cattle breeders and farmers at their summer pastures (katun). Scientific institutions should also assume an important role and should take an active part in activities concerning capacity building and the assessment of technological capacity, information and notification. Their staff should improve their level of expertise and skills in the area of CC. More cross-border projects need to be implemented and regional cooperation and the exchange of experience need to be strengthened. Practice has shown that the best results can be achieved if all stakeholders are involved and work together.
- ACCESS TO FUNDS: In addition to national budget funds, there is a whole range of funding sources that address CC. These range from international funds and grants, as well as loans that have relatively low interest rates (from international financial institutions and state-owned and private banks). Public institutions and organizations and local governments need to be supported in accessing these funds to enhance energy efficiency, to use

renewable energy sources, to introduce alternative modes of transport, to adapt CC by introducing activities in relevant facilities and in plants under their control.

- Research should be conducted, and services developed concerning CC, particularly in insurance services.
- RAISING AWARENESS OF THE PUBLIC AND KEY DECISION MAKERS: Funding is required to enhance public awareness regarding CC, to involve the private sector, local authorities and community; at the same time, the population needs to be further motivated to reduce GHG emissions through incentives, workshops and the dissemination of material.

Montenegro has received support in a number of different forms of support, including loans and other repayment forms of borrowing . Since financial indicators point to a high level of public debt, at around 66% of GDP in 2016, additional borrowing would clearly have a negative effect on the sustainability of public debt, which would, in time, pose a challenge to fiscal stability.

In this regard, it is necessary to be cautious in the use of borrowing at high interest rates for the implementation of actions. In addition to allocations from the national budget, Montenegro should step up the implementation of EU support programmes in order to fund CC activities. More efforts are also needed to secure donations for projects as this would diminish the need for loans.

The role of local governments in policy making and implementation should be reinforced, and financial liability explicitly defined; this is important due to the long-term effect of eliminating the negative effects of CC.

GENDER EQUALITY IN CLIMATE MITIGATION

Insight into the way the differences in the social roles and economic status of men and women impact CC and the way CC impacts them differently should be taken into account when determining adaptation and mitigation activities. Existing mechanisms for financing climate activities should include gender policies; women should be given equal representation in the decision-making process on CC in order to contribute their professionalism, experience and vision to this process, in particular regarding the management of natural resources. In order to ensure that the measurement, reporting and verification (MRV) activities relating to mitigation are gender-sensitive, the people responsible for MRV should attend training on gender equality and gender issues related to CC mitigation.

Further details on gender equality in CC mitigation can be found in Annex 2.

SUPPORT RECEIVED

The points below summarize the details of Montenegro's support received to date.

- **Financial support** from international organizations and the exchange of expertise with other countries has enabled Montenegro to implement or manage a series of projects concerning CC. Between 2006 and 2014, the state received Official Development Assistance (ODA)[1] of more than €490 million from a number of partners, to respond to CC. The EU, along with a variety of its programmes, has been the principal source of donations; together they have contributed approximately 60% of all project funding. Together, the UN and GEF also contributed approximately 30% of the total funding through programmes and donations.
- **The review of CC projects** and investment to date shows that approximately €119.6 million has been spent on mitigation, adaptation and mixed projects: approximately €114.2 million was in loan funds and €5.4 million in grant funds. The total number of projects relating to CC is probably higher than the number put forward in this report. The majority of grants have been provided by a group of multilateral funds and organizations concerned with climate initiatives; other grants have been provided by bilateral donors and financial support has also been given by international financial institutions.
- Montenegro has been granted significant **capacity-building and technical assistance** for a number of programmes, projects and partnerships by the following donors: the EC, UN and the World Bank, EBRD, GEF, GCF, GiZ, EIB, KfW, LuxDev, ADA, the governments of Italy, Germany, Luxembourg, Austria, Norway, the Netherlands, Greece, etc. The largest share has been provided by the EC and UN, which have supported projects, workshops, studies, initiatives and specific programmes of considerable impact regarding overall capacity-strengthening and technical assistance. This includes technical assistance on the Environment and Climate Regional Accession Network (ECRAN) which between 2013 and 2015 provided support in the form of training, and from the Union for Mediterranean Climate Change Expert Group (UfMCCEG). The ECRAN promoted regional cooperation between EU candidate countries on environment and climate action. Training activities attended by Montenegro under the ECRAN were selected with the aim of facilitating the drafting of reports (NC and BURs), the modelling and defining of NAMA project ideas and the drafting of CC policies. In addition to this, extensive technical assistance was provided by a number of international and regional organizations, such as UNFCCC, UNEP, UNDP, GiZ, USAID and WHO. Montenegro is also currently part of the Regional Implementation of the Paris Agreement Project (RIPAP) which focuses on capacity building and support for participating countries for implementing the 2015 Paris Climate Agreement. Support through RIPAP includes support in preparing technical reports and documents, capacity-building activities, such as workshops and seminars, and ad-hoc assistance. Outcomes include the upgrading of national GHG monitoring and reporting systems and practices, and strengthening of MRV activities.

[1] http://www.oecd.org/dac/stats/officialdevelopmentassistancedefinitionandcoverage.htm.

CHAPTER

The Monitoring, Reporting and Verification (MRV) system in Montenegro

INTRODUCTION

Montenegro is developing its own integrated MRV system to support climate mitigation and adaptation. The full implementation of Montenegro's MRV system will be a crucial tool for engaging stakeholders in action to achieve Montenegro's ambitious national targets outlined in the INDC[1], submitted to the 2015 Paris Agreement. The INDC commits Montenegro to a reduction of GHGs by 30% by 2030 compared to the baseline year of 1990. The INDC of Montenegro is the second most ambitious INDC in the Western Balkan region in terms of emission reductions compared to the 1990 levels.

National MRV system

The key goals of the MRV system are to:

- Gather data on Montenegro's climate challenges (e.g. GHG emissions, vulnerabilities and impacts) and opportunities (GHG removals, low-carbon development, new economic opportunities).
- Inform decision makers and report information on Montenegro's adaptation and mitigation progress, ambition, actions, their support (including climate finance) and their co-benefits.
- Establish and maintain national expertise in CC and climate actions to support Montenegro in developing a low-carbon, well adapted and climate-resilient economy.
- Provide technical advice and guidance to the government, national negotiations, national action implementation, businesses and the public on climate challenges, action and progress.
- Provide transparent, high-quality reports (e.g. NCs, BURs, NDCs).

The MRV system supports reporting on NCs, BUR, on GHG inventories and the provision of other relevant information on climate action a regular basis. Montenegro is working towards a higher level of transparency than is mandatory from non-Annex-I countries and regularly prepares inventories, and has also prepared two NCs and two BURs.

Montenegro is in the process of drafting the Law on Climate Change which will regulate the mitigation of and adaptation to the negative impacts of CC. Through this law, the competent authority for environmental affairs (MSDT) is committed to delivering the National Climate

[1] http://www4.unfccc.int/ndcregistry/PublishedDocuments/Montenegro%20First/INDCSubmission_%20Montenegro.pdf.

Change Adaptation Plan and to the coordination of MRV activities tracking mitigation action. Other relevant ministries will be mandated with the implementation of specific climate actions.

MRV system structure

The structure for the MRV system is presented in Figure 1. Figure 1 highlights the key institutional arrangements being developed by Montenegro including:

1) **A steering committee** contributing to the prioritization of activities within the MRV system and its outputs. The proposed steering committee will be linked with or will form part of the NCSDCCICM (National Council)[2].
2) **The management and coordination of the MRV system** will be led by the Directorate for Climate Change (DCC) within the MSDT.
3) **Defined focal points coordinating data gathering, analysis and reporting** across adaptation, mitigation and climate finance/support including:
   a) **GHG Inventory and projections** – The EPA should act as the inventory agency: this includes the compilation of data provided by the ministries responsible for the implementation of sector-based actions. The EPA should also coordinate the flow of information between experts and the MSDT.
   b) **Mitigation actions** – The DCC should coordinate the flow of information provided to MSDT.
   c) **Vulnerabilities, loss and damage, adaptation actions** – The DCC should coordinate the gathering and flow of information to be provided by experts to the MSDT.
   d) **Climate Observations** – The EPA should coordinate the flow of information to be provided to the MSDT. This should include the delegation of powers to the Institute for Hydrometeorology and Seismology (IHMS) to compile projections using the data provided by the ministries responsible for the implementation of sector-based actions.
   e) **Support and Climate Finance** – The DCC should coordinate the gathering and flow of information to be provided by the experts to the MSDT.
4) **Specific data gathering and compilation expertise** within a range of specialist organizations. Expert organizations and experts are engaged in the relevant sectors according to their areas of existing expertise (e.g. energy systems, buildings and infrastructure, industry and manufacturing, transport, land use and forestry, and agriculture) and cross-cutting activities, such as the GHG inventory and projections, disaster-risk reduction, climate monitoring and the tracking of climate data and support for climate action. These experts will be trained in the gathering, processing and preparation of reports and datasets for the MRV system for the MSDT.

[2] Please see the country profile for Montenegro on the European Sustainable Development Network at https://www.sd-network.eu/?k=country%20profiles&s=single%20country%20profile&country=Montenegro.

a) Climate finance and support

b) Expertise on the GHG inventory is provided by the EPA for the energy, IPPU, AFOLU and waste sectors. Data gathering, compilation and analysis for specific sectors is organized by the relevant ministries – for example, the MARD (LULUCF sector), the Ministry of Transport (air and maritime transport), the Ministry of Internal Affairs (road transportation), the MoE (energy) and also directly by specific industrial and energy installations. The Montenegrin State Statistical Office (MONSTAT) has a special position in terms of providing data as it would also be expected to provide other official statistical data necessary for the GHG inventory.

c) Sector-focused expertise on climate action (mitigation and adaptation) from other ministries or agencies focused on those sectors will be established to gather data on climate actions using the MRV portal and/or the Climate Action Information Request form. Relevant sector experts covering climate actions will also assess the links between Montenegro's climate action and its SDGs.

d) Climate and environmental data, for example on air quality, meteorological data, and data on flooding and sea levels, is provided by Hydro-meteorological Institute.

e) The Directorate of Emergency in the Ministry of Internal Affairs is responsible for compiling a database of emergency events and for coordinating actions under the Sendai Framework for Disaster Risk Reduction.

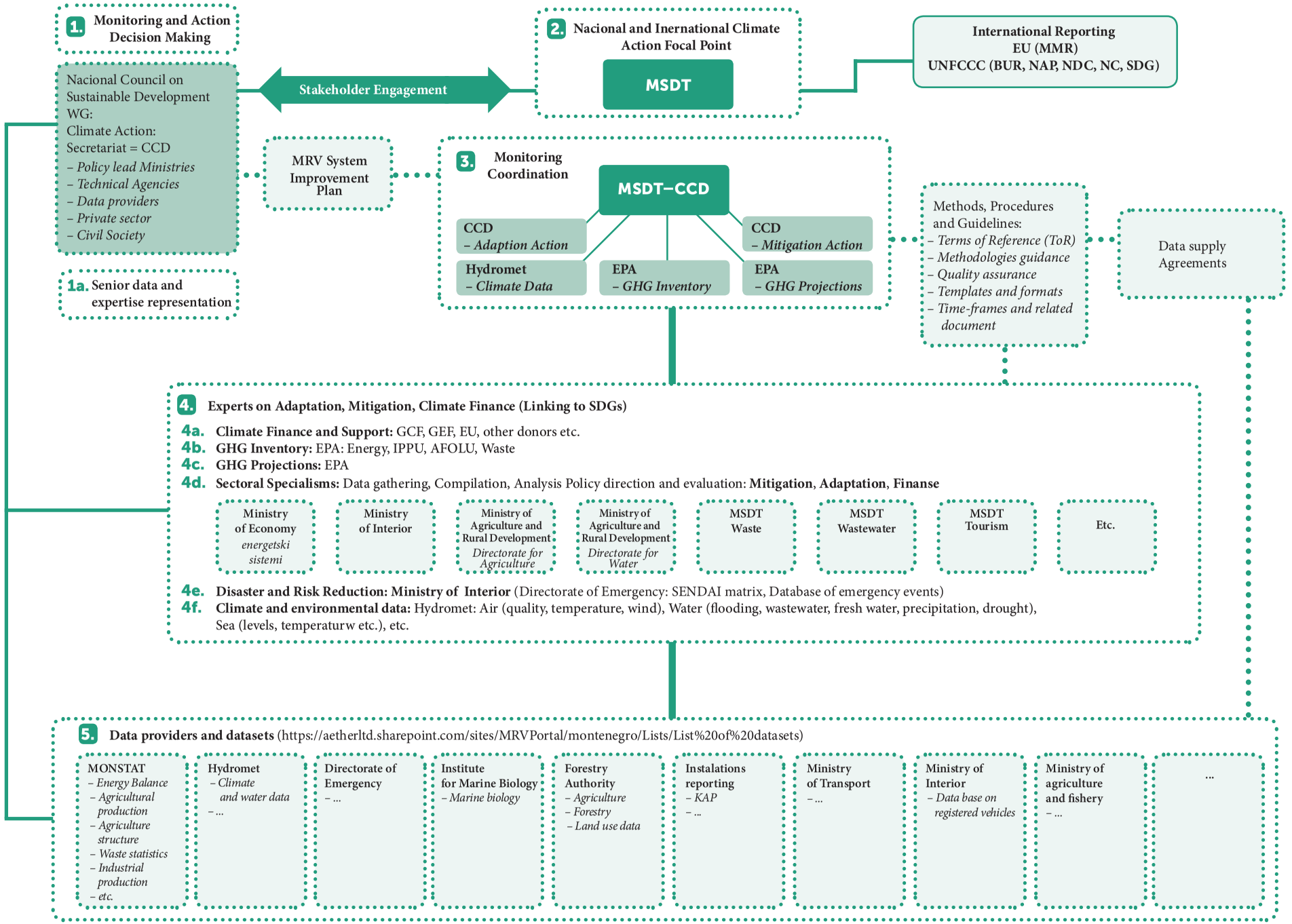


FIGURE 35: Proposed Institutional Arrangements for an MRV System in Montenegro

MRV system management portal

Montenegro has developed an online MRV management portal. This portal provides a management overview for the MRV system and consists of components that structure data, support good-practice activities and reinforce institutional memory. The portal provides a coordination platform for managing information on stakeholders, engagement activities, datasets, QA/QC activities, climate actions and vulnerabilities, impacts, wider benefits, document storage and improvements to the MRV system. The portal develops the communication between stakeholder organisations and allows the MSDT to better link data to policies. Going forward, the portal will be an important aspect of the MRV system and will help to produce transparent outputs such as NDCs, BURs, NCs and NAPs.

The MRV management portal also maintains an improvement plan which documents and prioritizes information requirements in order to fill gaps in understanding.

MRV SYSTEMS FOR ADAPTATION, MITIGATION AND SUPPORT

The following sections outline the current status of the integrated MRV system, including adaptation, mitigation and support.

The status, progress and future actions are categorized into five areas.

1) Institutional arrangements
2) Technical team of experts
3) Data flows
4) Coordination, systems and tools
5) Stakeholder engagement.

MRV SYSTEM FOR ADAPTATION

Montenegro has recognized, through the Law on the Environment (Official Gazette of MNE, 52/16), the need for the implementation of its NAP. This is in association with EU Regulation No. 525/2013 on a mechanism for monitoring and reporting GHG emissions and for reporting other information at the national and EU levels relevant to CC Article 15. Article 15 of the Regulation proscribes that: “By 15 March 2015, and every four years thereafter, aligned with the timings for reporting to the UNFCCC, Member States shall report to the Commission information on their national adaptation planning and strategies, outlining their implemented or planned actions to facilitate adaptation to CC. That information shall include the main objectives and the climate-change impact category addressed, such as flooding, sea level rise, extreme temper-

atures, droughts, and other extreme weather events". This indicates a clear move to ensure that the relevant data is collected from data suppliers and compiled into documents to report and inform policy makers.

Institutional arrangements

Montenegro recently engaged in the preparation of the TNC to the UNFCCC, funded by the GEF and implemented by UNDP. This highlighted the adaptation sectors for which MRV is required. These include climate models, agriculture and forestry, water resources, coastal zones, health and the development of education materials.

The report 'Development of National Climate Change Strategy to 2030', published in 2015 and funded by the EC, suggested recommendations and the need to formulate Montenegro's National Adaptation Plan (NAP).

Following on from these activities, it has been confirmed that the MSDT will act as the focal point for MRV of adaptation action and associated information. The MSDT's activities include the identification of Montenegro's primary challenges and viable adaptation actions for communication to the National Council for follow-up by the implementing stakeholders and in preparing reports. The MSDT will also prepare project proposals for the GCF to raise funds for the development of the National Climate Change Adaptation Plan. Hydromet will be responsible for climate data tracking, including analysis of climate scenarios and support in the assessment of vulnerabilities by sector experts.

The National Council will be further engaged by the MSDT to obtain high-level public and private support for adaptation actions and their MRV. As state policy making in the field of CC is conducted by the MoE, the MARD, the Ministry of Transport and Maritime Affairs (MTMA) and other ministries, engagement of the MSDT (as the MRV coordinator) with the National Council for key adaptation sectors is important. Key stakeholder representatives of the National Council organizations relevant for adaptation are listed and tracked on the MRV management portal.

Technical team of experts

The chapters on Vulnerabilities and Adaptation within the NCs were prepared by experts from the Biotechnical Faculty, Institute for Marine Biology, Institute for Public Health, and the Hydrometeorology and Seismology Institute. However, there is no established mandate for the management of information on climate trends, risks, vulnerabilities and adaptation actions. Several institutions cover different aspects of adaptation through their existing mandated activities, including: the Hydro-meteorological Institute, Water Authority, Coastal Zones Authority, Institute for Public Health, etc. However, it is not clear which laws exist that provide a mandate for organizations and government departments to engage in the analysis and tracking of vulnerabilities, risks and adaptation actions.

An ongoing MRV project commissioned by UNDP Montenegro has highlighted the need to develop engagement and training programmes for experts in certain new aspects of climate action development and tracking, including, where needed, vulnerability, risk, loss and damage assessment and in tracking/making links to and understanding the implications of climate data and climate scenarios. The technical organizations have been identified and are being engaged with through this project.

Data flows

There is no established process to collect regular data related to vulnerabilities, risks and adaptation actions. However, the MRV management portal that has been established provides a convenient focus for the storage of structured, reusable information on action and to track relevant datasets and data suppliers. This will also help to identify new information needs. Data-supply agreements also need to be set up to engage with key data-supplying stakeholders. This will be used by the MSDT and relevant compilation experts.

Coordination, systems and tools

Montenegro is in the process of developing coordination processes, systems and tools for data collection on climate adaptation action. This includes the development of a work plan to gather, check, analyse and report on adaptation, the development of definitions and nomenclature, the consolidation and QA/QC of information on adaptation actions, the development of Modality Procedure Guidelines and the production of training material, method statements and regular outputs on indicators to monitor progress.

Stakeholder engagement

With the establishment of the NCSDCCICM, Montenegro is providing an appropriate channel to highlight adaptation-related trends, challenges and priorities at a high political level. Further stakeholder engagement has been conducted with representatives from a range of ministries as part of a recent process to implement a national MRV system. However, it is noted that further engagement of the public in CC issues is required for awareness raising and behavioural change.

MRV SYSTEM FOR THE GHG INVENTORY

Montenegro's MRV system for the GHG inventory has successfully supported the provision of transparent information for the SNC, NDC and BURs.

Institutional arrangements

Institutional roles have been well defined: the MSDT and DCC act as the national focal point for the GHG inventory. The EPA has the official authorization and resources to manage the GHG inventory and act as the inventory agency. There is also a cooperation agreement between the EPA and Statistical Office (MONSTAT) which supports the inventory compilation process.

In 2017, 'The Rulebook' of the list of gases and method of preparing the GHG inventory and exchange of information was adopted. The Rulebook on the list of gases and the method of preparing the GHG emission inventory and exchange of information prescribes the method of production, the content of the inventory of GHG emissions, the list of gaseous emissions of GHGs, the manner of providing data, the quality control of the data and the deadlines for the preparation of inventories of GHG emissions and the accompanying reports. This is scheduled to be updated with clear tasks outlined for each institution/data supplier.

The National Council will play a key role in the development and use of the GHG inventory. State policy making in the field of CC is carried out by the members of the National Council (i.e. the MoE, the MARD, the MTMA and other ministries). Engagement of the MSDT (as the MRV coordinator) to inform the National Council on progress and trends in GHG emissions and removals for key sectors is important.

The development of the MRV system portal has bolstered the institutional memory of the inventory compilation process since the First BUR was published. This site now tracks the key stakeholder representatives of the National Council organizations.

Technical team of experts

Montenegro currently has two active GHG inventory team members and this number is expected to be increased in the coming years. More staff are required to coordinate and perform quality control of the GHG inventory compilation, as well as to provide expertise on specific sectors (Energy & Large IPPU, Agriculture, LULUCF and Waste and F-Gases). One sector lead expert per group of sectors, sector or group of subcategories is required to support the development of higher-tier methods, which may also require external expert assistance. This process will require continued training and capacity building through courses, exams, as well as engagement with EEA EIONET initiatives and the UNFCCC annual review process. Experts relevant to the GHG inventory will be registered and listed on the MRV management portal.

Data flows

Data for the GHG inventory is collected annually in reporting formats standardized by the Annual Plan for data collection, published by the MSDT as of December 2017. Figure 36 shows the current data flow for GHG inventory information developed through the UNDP project to support Montenegro's MRV system. The data-supply process could be strengthened through the development of legal document and data-supply agreements with key stakeholders. With standardized templates for data providers and a secure data-supply chain, the MRV system portal can be used as a platform to retrieve Excel sheets and templates and to submit data.

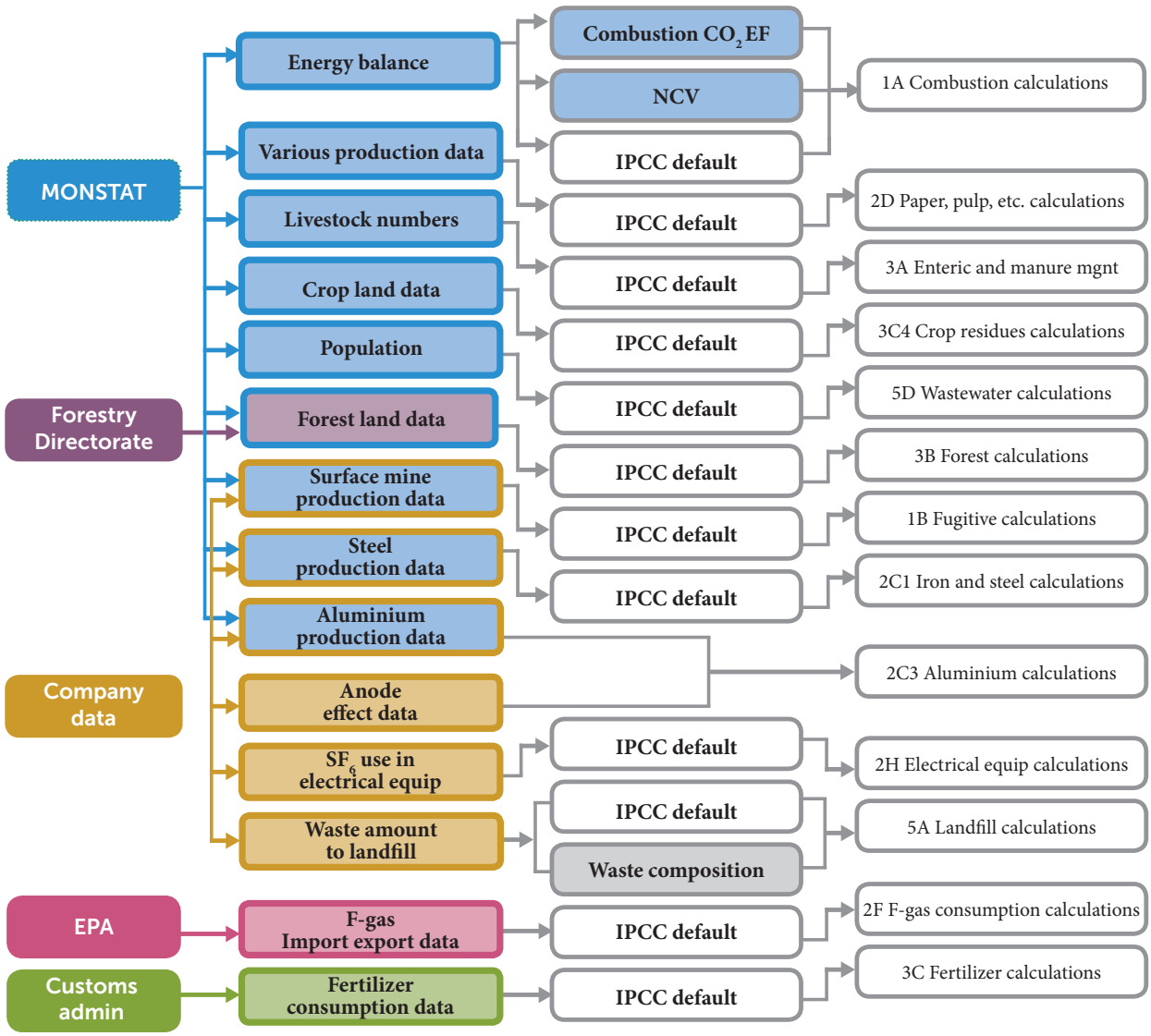


FIGURE 36: Data flow diagram for compilation of the GHG inventory

Coordination, systems and tools

The GHG inventory was updated for the period 1990–2015 as part of the SBUR process. The key improvements to the GHG inventory MRV system that Montenegro is in the process of undertaking, or will undertake in the future, are:

- Detailing the annual data collection plan: this will include the development of a registry of data-supplying stakeholders and datasets in the MRV management system;
- Maintaining a GHG compilation improvement plan: this is stored on the MRV management system;
- Improve data input and move to higher tiers for GHG inventory sectors (particularly AFOLU): this is especially important for sinks data from forestry that are important for the next NDC update (2020). Improve the detail of the GHG inventory for sectors, as necessary, so that it is sufficient for reporting in the CRF format used for the Annex-I annual inventory and MMR reporting.
- Establish formal QA/QC objectives and procedures and integration into working files;
- Integration of Montenegro's GHG inventory into the CRF software for reporting;
- Develop the NIR and NIR-writing processes;
- Establish a regular process for assessing key categories and level-1 and -2 uncertainties with expert training for all sectors.

Stakeholder engagement

Montenegro is improving the visibility of the GHG inventory through the production of interactive data visualizations. These visualizations will display the themes and trends in the inventory in an accessible way to engage public and political attention. Further activities under consideration are:

- Factsheets and indicators highlighting the challenges and tracking progress.
- Stakeholder consultations on estimates and methods, data sources and assumptions.
- Annual publication and use of the Trends chapter of the NIR.

MRV SYSTEM MITIGATION: PROJECTIONS AND CLIMATE ACTION ANALYSIS

Montenegro defined its own INDCs and adopted it at a government session in September 2015 as an annex to the NCCS. Also, Montenegro adopted Doha amendment to Kyoto protocol, as well as Kigali amendment to Montreal protocol. The MRV system should focus on tracking quantifiable, reportable and verifiable, nationally appropriate mitigation actions across a number of key sectors. Montenegro's emission projections were formed based on an earlier analysis for the EDS to 2030, prepared in 2014 for the energy sector, and on the PRIMES reference scenario results for other sectors.

The analysis for the INDC covers all sectors and gases except for the AFOLU sector, where the uncertainty of the data made its inclusion undesirable. However, the quality of the data in other sectors for all gases was deemed appropriate; some potential issues have been highlighted by ECRAN experts (e.g. related to HFC emissions) in the inventory data.

Institutional arrangements

The MSDT, through the DCC, plays an advisory and political role, as well as being responsible for coordination. This ministry has overall responsibility for CC mitigation policy and thus plays a crucial role.

It was also suggested that the MSDT should have overall responsibility in terms of coordinating projections through its advisory bodies and/or technical support. It has been recommended that the EPA manage the GHG projection compilation and the gathering of information on mitigation actions. This will require the appointment of a coordinator to manage the work programme, improvements, QA/QC, data gathering, stakeholder engagement and the compilation of projections and estimates by experts of the impact of mitigation.

As with the MRV system for adaptation, the National Council will play an important role in implementing and tracking mitigation actions. The engagement of the National Council will also promote high-level public and private support for the tracking of progress with the NDC. The key stakeholder representatives of the National Council organizations relevant to information on climate action and projections are listed and tracked on the MRV system portal.

Montenegro will need to further develop the legal framework around climate action MRV. This involves developing the relevant components in the National Strategy for Transposition, Implementation and Enforcement of the EU Acquis that will establish a national MRV system for compiling projections, gathering data on, and estimating the impacts of mitigation action.

Work is under way for full MMR transposition in 2018 and the establishment of the national system for monitoring of policies and measures to reduce GHG emissions and projections. Appropriate laws are required to provide a legal mandate for the gathering, processing and reporting of data related to mitigation actions and to legally form the National System.

Technical team of experts

Through the ECRAN project in 2015–2016, several public servants were trained for Long-Range Energy Alternative Planning (LEAP) software that can be used for GHG projections and mitigation analysis in the energy sector. There have been several modelling exercises and analyses of future energy and emission pathways which have been prepared for Montenegro. These have been used for the development of the EDS, the NCCS, and to establish different projection scenarios for the First BUR. However, to date there has been relatively little consolidation of expertise in any one organization or group of national experts. It has been recommended that the EPA manage the GHG projection compilation activities. With additional resources made available, the EPA will provide additional technical expertise for the development of projection scenarios. The key expert stakeholders and organizations relevant to the compilation of projections and information on climate action are listed on the MRV management portal.

The key improvements to be made for the climate actions and projections MRV system are:

- To establish a sustainable team with members in appropriate organization with the skills and experience of projection modelling (e.g. LEAP and other modelling tools) and mitigation action analysis focusing on renewable and/or low-carbon energy systems, energy efficiency (in manufacturing, buildings and transport), land and forest management, agriculture practices and waste and wastewater management.
- To develop an engagement and training programme for experts through engagement in regional projects, EEA EIONET initiatives and UNFCCC NC and BUR review participation.

Data flows

A framework for a central archive of projections and climate action information has been developed in the MRV portal system. Datasets and sources are linked to data-supplying stakeholders, which strengthens the data flows and encourages regular reporting of data.

The key improvements to the data flows for the climate actions and projections MRV system are:

- To identify and elaborate appropriate laws that provide a legal mandate for the gathering of data.
- To engage with relevant data providers from different ministries via the MSDT.
- To gather data from relevant stakeholders and set up regular data update processes.
- To construct data-supply agreements and templates to ensure consistent reporting.

Coordination, systems and tools

Several modelling exercises and analyses of future energy and emission pathways have been prepared for Montenegro. These have been used for the development of the EDS, the NCCS, and to establish different projection scenarios for the FBUR. However, Montenegro lacks any basic infrastructure for sustained maintenance and reproduction of its outputs on projections and mitigation action analysis. The MRV management portal was designed to address this and will act as a store for datasets, work plans, models, documented methods, processes (e.g. for engaging with stakeholders and updating datasets), systems (e.g. QA/QC, databases, models and tools) and an archive of key information.

Montenegro has benefited from a number of studies that have improved the quality of GHG projections using more sophisticated and advanced tools. Regarding projections, Montenegro was recently involved in a relevant project funded by the Hungarian government. This project will work with Klimapolitika (DPO-Hungary) on the preparation of a framework for the establishment of a national system for policy and projection policies that will apply to the energy and industrial sectors with the application of the TIMES model, including electricity, heating in households, and industry; but it will not cover other sectors, including waste, agriculture, transport, forestry, etc.

Further information currently provided in, or planned additions to, the MRV system include:

- A work plan to gather, check, analyse and regularly report on relevant information on projections and mitigation and for its NDC;
- Definitions and nomenclature that will help stakeholders to identify, classify and prioritize measures across the different mitigation areas and sector strategies;
- A set of quality objectives to underpin data flows;
- An improvement plan to register and prioritize the improvement of the MRV system;
- Templates for documenting key methods, data sources and assumptions used in the production of analysis and outputs.

Regular and transparent reporting of projections will also require the development of key analysis tools (e.g. models for energy and AFOLU), a training programme and country-specific training materials in the activities and analysis needed to produce high-quality outputs and regular outputs and updates on progress (e.g. internal NDC tracking updates for the National Council) with indicators in order to share information on progress with monitoring and implementing stakeholders.

Stakeholder engagement

As part of the ongoing MRV development project, a workshop was held on 18 July 2018 to engage stakeholders in gathering information on mitigation action and indicators. This meeting was attended by representatives of numerous stakeholder organizations involved with projections and mitigation, including the MSDT, EPA and IHMS. The agenda, meeting notes and outputs of this engagement are stored on the MRV management portal.

The engagement of the National Council offers an appropriate channel for the MSDT to highlight mitigation-related trends, challenges and priorities at a high political level. As a climate-change working group secretariat for this Council, the MSDT could take on responsibilities for producing regular updates on indicators and analysis to inform wider stakeholders and decision makers. The MSDT could develop communication and awareness-raising activities on mitigation-related trends, challenges and priorities at a high political level and to the public, as well as to public and private decision makers. Further engagement could focus on using climate data of relevance and of interest from the MRV system and linking climate actions to wider joint benefits (the economy, health, ecosystems, flood protection, water quality, energy security, etc.).

MRV SYSTEM FOR SUPPORT & CLIMATE FINANCE

Institutional arrangements

The Directorate for EU Cooperation and International Development within the MSDT is responsible for environmental finances. The development of formal institutional arrangements for the collection, assessment, management and reporting of information on the support and financing of climate actions is currently under way as part of the MRV management portal. The MSDT acts as a focal point for tracking information on support and climate finance. Through its DCC, it plays an advisory and political role, as well as needing to be responsible for coordination. It should focus on establishing a national support and climate finance tracking team, starting from the relevant government departments and authors for the NC, NDC, BUR and NAP.

The National Council will be further involved with implementing climate action finance and tracking data related to the support and financing of climate actions. The involvement of the National Council should also obtain high-level public and private support for the tracking of progress with the NDC. Additional identification of the departments involved in the support and climate-finance landscape and which can provide expertise for tracking of support and climate finance is required. The areas of engagement include Montenegro's NDC and coverage of the following sectors:

- Agriculture and Forestry – MONSTAT, Ministry for Agriculture and Rural Development.
- Energy – MONSTAT, Ministry of the Economy for Energy Balance, Electricity Transmission System in Montenegro, EPCG.
- Waste – the MSDT (Directorate for Waste Management), MONSTAT.
- Transport – the MTMA.
- Ministry of Internal Affairs.

Technical team of experts

Montenegro currently lacks a coordinated team of support and climate finance experts. Therefore, there is a need to establish a small team of support and climate finance tracking experts from the MSDT or other ministries involved in the support and climate finance landscape. This team will need to be trained in the tracking of support and climate finance and can support/train sector experts in gathering information on support and climate finance at a project level. This could include experts involved with accreditation, as well as multilateral and bilateral donors and international climate funds.

Data flows

Information about the priority investments for Montenegro, in order to meet its INDC targets for mitigation, have been identified and quantified (in terms of Capital Expenditure (CAPEX), Operating expenses (OPEX) and cash flow). Datasets relating to support and climate finance can be stored on the MRV management portal, and this data can be used to inform policy and can be included in national reports and strategies. This list also links datasets to data-supplying stakeholders, which improves the transparency and consistency of the data flow. However, more work can be done to map the investment needs for actions against funding sources. This work should involve maintaining and updating the MRV management portal and developing data-supply agreements designed to set out and engage with key data-supplying stakeholders for data supply.

Coordination, systems and tools

The MRV management portal provides a tool to track support and climate finance. A database of funders and supports is maintained and contains relevant information, such as the type of fund, the fund administrator, the primary contact of the fund and information on how to apply. This database can be linked to specific climate action funding, linking the suppliers and amounts to climate action and impacts.

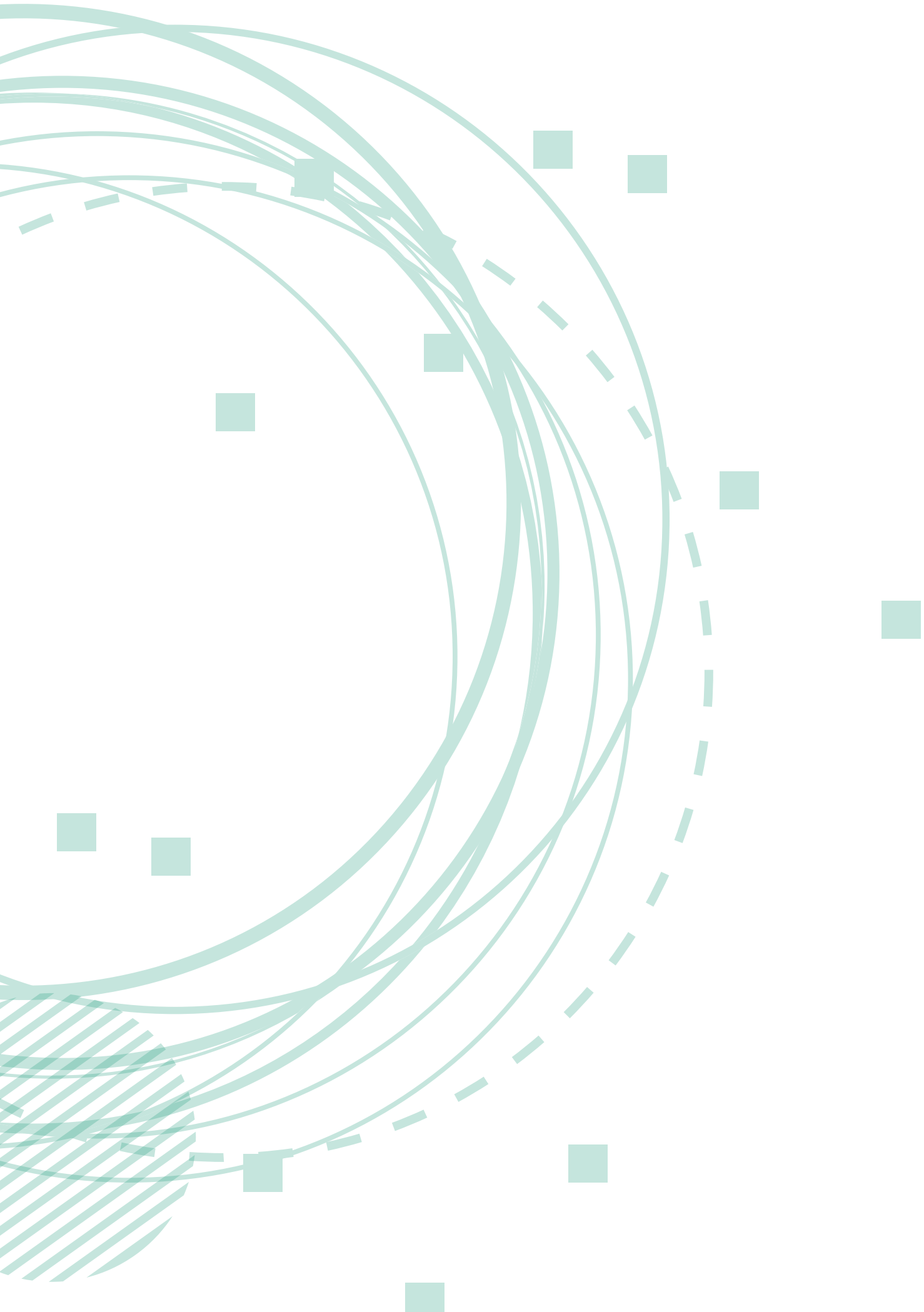
Further information currently provided in, or planned additions to, the MRV system include:

- A work plan to gather, check, analyse and regularly report on relevant information on projections and mitigation and for the NDC;
- Definitions and nomenclature that will help stakeholders identify, classify and prioritize measures across the different mitigation areas and sector strategies;
- A set of quality objectives to underpin data flows;
- An improvement plan to register and prioritize an improvement of the MRV system;
- Templates for documenting key methods, data sources and assumptions used in the production of analysis and outputs.

Stakeholder engagement

As part of the ongoing MRV development project, a workshop was held on 18 July 2018 to engage stakeholders in gathering information. The sessions focused on support and climate finance were attended by the MSDT, the Directorate for EU Integration and International Cooperation, the Division for International Cooperation and the Ministry of Finance. Further engagement of stakeholders and decisions makers should be pursued under the National Council and the MSDT, which should take on responsibilities for producing regular updates on indicators and analysis to inform wider stakeholders and decision makers.

Annexes



Annex 1

DETAILED PRESENTATION OF ACTIONS

No. 1	
Title	Ecological upgrade of TPP Block 1
Type of action	Technical
Scenario	WEM/WAM
Sector	Energy – power and heat energy generation
EU ETS	Yes
Relevant planning and strategic document	EDS 2030, EDS Action Plan 2020, IPPC Law, Decision taken by the EnC Ministerial Council on the implementation of the 2001/80/EC on the limitation of emissions of certain pollutants into the air from large combustion plants
Methodology	Coal-fired TPP, IPCC methodology, modelling by LEAP software tool
Timeframe	2018–2021
Estimated costs	€64.5 m
Gas	CO_2, N_2O
Indicator	Installed capacity in MW, annual output in GWh
GHG reduction potential	n/a (initial stages of conceptual design)
Additional impacts	Reduced power imports and increased exports, lower emissions of dust, sulphur dioxide and nitrogen oxides, recultivation of ash and slag impoundment.
Assumptions	Availability of financing
Risks	Almost none
Steps undertaken	Temporary IPPC permit, designer selected
Expected result	Additional installed capacity of 6.5 MW for power and heat energy generation, greater coal-burning efficiency, reduced air, water and soil pollution, application of BAT, alignment with the Industrial Emissions Law.
Implementing body	EPCG – TPP operator, ME
Description	Ecological upgrade of the TPP Block 1 will increase the TPP's installed capacity from 218.5 MW to 225 MW, and the average annual output from 1 150 GWh to 1 179 GWh. It will include the construction of a desulphurization and denitrification system, upgrade to the electro-filtering plant, construction of a wastewater treatment facility, and reconstruction of the internal system for transporting by-products, as well as building a heating station, as a part of the intended district heating system. Apart from the ecological upgrade to TPP Block 1, a number of other technical interventions are planned to improve the energy efficiency of the plant and reduce the power generation price, and thus reduce GHG emissions from this plant, accounting for 60% of total emissions in the country. In addition, the existing ash and slag impoundment will be recultivated. The plan envisages that the reconstruction works will be completed by 2021. Directive 2001/80 EC (i.e. Directive 2010/75/EU) on the limitation of emissions of pollutants into the air (SO_2, NO_X and dust) started to apply as of 1 January 2018. According to the directive, all existing plants (ones for which the original construction licence or original operating licence was granted before 1 July 1992) may operate for no more than 20 000 hours over the period between 1 January 2018 and 31 December 2023.

No. 2	
Title	Upgrade of existing large HPPs
Type of action	Technical
Scenario	WEM/WAM
Sector	Energy – power and heat energy generation
EU ETS	No
Relevant planning and strategic document	EDS 2030, EDS Action Plan 2020
Methodology	Hydroelectric power plants, IPCC methodology, modelling by LEAP software tool
Timeframe	2018–2020
Estimated costs	€106.7 m
Gas	CO_2
Indicator	Installed capacity in MW, annual output in GWh
GHG reduction potential	23.6 ktCO_2/yr
Additional impacts	Reduced imports and increased exports of power, clean energy, no major interventions, almost no environmental impacts
Assumptions	Availability of financing
Risks	Almost none
Steps undertaken	Bulk of the works already completed
Expected result	Additional installed capacity of 58.5 MW, average annual output increased by 59 GWh, no GHG emissions
Implementing body	EPCG – HPP operator, ME
Description	Upgrade of HPP Piva 342 MW (3×114 MW) increased its installed capacity to 360 MW (3×120 MW) and planned annual power output was increased from 762 GWh to 800 GWh. By upgrading HPP Perućica 307 MW, its installed capacity will increase to 365 MW, and planned annual power output will increase to 900 GWh.

No. 3	
Title	Upgrade of existing small HPPs
Type of action	Technical
Scenario	WEM/WAM
Sector	Energy – power and heat energy generation
EU ETS	No
Relevant planning and strategic document	EDS 2030, EDS Action Plan 2020
Methodology	Small HPPs, IPCC methodology, modelling by LEAP software tool
Timeframe	2018–2020
Estimated costs	€20.25 m
Gas	CO_2
Indicator	Installed capacity in MW, annual output in GWh
GHG reduction potential	6.68 $ktCO_2/yr$
Additional impacts	Reduced power imports and increased exports, clean energy, no major interventions, almost no environmental impacts
Assumptions	Availability of financing
Risks	Almost none
Steps undertaken	Project documentation prepared
Expected result	Additional installed capacity of 2.7 MW, average annual output increased by 16.7 GWh, no GHG emissions
Implementing body	EPCG – HPP operator, Zeta Energy – small hydroelectric operator, ME
Description	By upgrading the small hydroelectric plant Slap Zete 1.2 MW, its installed capacity will increase to 3.2 MW, and planned annual power output will increase from 3.5 GWh to 14.6 GWh. By upgrading the small hydroelectric plant Glava Zete 5 MW, its installed capacity will remain the same, but its planned annual power output will increase from the current 12 GWh to 15 GWh. After upgrading the remaining five small hydroelectric power plants owned by EPCG, their installed capacity will increase from current 2.5 MW to 3.2 MW, and planned annual power output from 5.5 GWh to 7.8 GWh.

No. 4	
Title	Construction of large HPPs
Type of action	Technical
Scenario	WEM/WAM
Sector	Energy – power and heat energy generation
EU ETS	No
Relevant planning and strategic document	EDS 2030, EDS Action Plan 2020
Methodology	Hydroelectric power plants, IPCC methodology, modelling by LEAP software tool
Timeframe	2019–2025
Estimated costs	€671 m
Gas	CO_2
Indicator	Installed capacity in MW, annual output in GWh
GHG reduction potential	337.2 ktCO_2/yr
Additional impacts	Reduced power imports and increased exports, clean energy, major environmental impact during the construction stage
Assumptions	Negotiations with prospective investors
Risks	Major investments
Steps undertaken	Conceptual design for Morača HPPs and preparation of the conceptual design for Komarnica HPP
Expected result	Additional installed capacity of 410 MW, average annual output increased by 843 GWh, no GHG emissions
Implementing body	Private investors, IFIs, ME
Description	Construction of Morača HPP with installed capacity of 238 MW, and planned annual power output of 616 GWh. Construction of Komarnica HPP with installed capacity of 172 MW, and planned annual power output of 227 GWh.

No. 5	
Title	Construction of small HPPs
Type of action	Technical
Scenario	WEM/WAM
Sector	Energy – power and heat energy generation
EU ETS	No
Relevant planning and strategic document	EDS 2030, EDS Action Plan 2020, National Action Plan for Renewable Energy by 2020
Methodology	Hydroelectric power plants, IPCC methodology, modelling by LEAP software tool
Timeframe	2018–2020
Estimated costs	€106.7 m
Gas	CO_2
Indicator	Installed capacity in MW, annual output in GWh
GHG reduction potential	130 ktCO_2/yr
Additional impacts	Reduced power imports and increased exports, clean energy, no major interventions, low environmental impact
Assumptions	Availability of financing, great interest by investors
Risks	Opposition from local community and civil society
Steps undertaken	Concession document signed, applications for energy permits submitted, construction works under way for one small hydroelectric plant
Expected result	Additional installed capacity of 115 MW, average annual output increased by 325 GWh, no GHG emissions
Implementing body	Private investors, IFIs, ME
Description	Construction of a number of small hydroelectric plants with installed capacity of 132 MW, planned annual output of 425 GWh. So far, 11 small hydroelectric plants have been built with an installed capacity of 17 MW and an average annual output of 100 GWh.

No. 6	
Title	Construction of wind power plants
Type of action	Technical
Scenario	WEM/WAM
Sector	Energy – power and heat energy generation
EU ETS	No
Relevant planning and strategic document	EDS 2030, EDS Action Plan 2020, National Action Plan for Renewable Energy by 2020
Methodology	Wind power plants, IPCC methodology, modelling by LEAP software tool
Timeframe	2019–2021
Estimated costs	€165 m
Gas	CO_2
Indicator	Installed capacity in MW, annual output in GWh
GHG reduction potential	Reduction of 50 ktCO_2/yr following the construction of Možura and Gvozd WPPs. Additional 75 MW following the construction of Brajići WPP.
Additional impacts	Reduced power imports and increased exports, clean energy, no major interventions, low environmental impact
Assumptions	Availability of financing
Risks	Almost none
Steps undertaken	WPP Krnovo completed and operational, the works at WPP Možura about to be completed, WPP Gvozd at the preliminary analysis stage, WPP Brajići about to invite tenders
Expected result	Additional installed capacity of 96 (+75) MW, average annual output increased by 256 GWh (+ WPP Brajići), no GHG emissions.
Implementing body	Private investors, IFIs, ME
Description	Construction of WPP Možura, installed capacity of 46 MW, planned average annual output 106 GWh. Construction of WPP Gvozd, installed capacity of 50 MW, planned average annual output 150 GWh. So far, WPP Krnovo has been built, installed capacity 72 MW, planned average annual output 200–230 GWh. The construction of a 75 MW WPP is envisaged within the municipalities of Budva and Bar. Planned annual output is not available yet.

No. 7	
Title	Construction of photovoltaic power plants
Type of action	Technical
Scenario	WEM/WAM
Sector	Energy – power and heat energy generation
EU ETS	No
Relevant planning and strategic document	EDS 2030, EDS Action Plan 2020, National Action Plan for Renewable Energy by 2020
Methodology	Photovoltaic power plants, IPCC methodology, modelling by LEAP software tool
Timeframe	2019–2022
Estimated costs	No
Gas	CO_2
Indicator	Installed capacity in MW, annual output in GWh
GHG reduction potential	8 ktCO_2/yr for two small PVPP. This potential would be greatly increased by constructing a large PVPP of 200 MW installed capacity in the Municipality of Ulcinj and the PVPP Velje Brdo, 50 MW in Podgorica.
Additional impacts	Reduced power imports and increased exports, clean energy, almost no environmental impact
Assumptions	Investor interest
Risks	Almost none
Steps undertaken	Applications for energy permits submitted
Expected result	Additional installed capacity of 13 (+200) MW, average annual output increased by 20 GWh (+ output of new PVPP), no GHG emissions
Implementing body	Private investors, IFIs, ME
Description	Construction of PVPP on rooftops, installed capacity of 5.4 MW, planned average annual output 8.3 GWh. Envisaged construction of a PVPP on land, installed capacity 7.6 MW, planned average annual output 11.7 GWh. A large PVPP planned within the territory of Ulcinj, installed capacity above 200 MW. Planned annual output is not available yet.

No. 8	
Title	Construction of a PP using landfill biogas
Type of action	Technical
Scenario	WEM/WAM
Sector	Energy – power and heat energy generation
EU ETS	No
Relevant planning and strategic document	EDS 2030, EDS Action Plan 2020, National Action Plan for Renewable Energy by 2020
Methodology	Biogas power plants, IPCC methodology, modelling by LEAP software tool
Timeframe	2019
Estimated costs	€1.2 m
Gas	CO_2
Indicator	Installed capacity in MW, annual output in GWh_{el}
GHG reduction potential	0.35 $ktCO_2$/yr
Additional impacts	Reduced power imports and increased exports, clean energy, no major interventions, almost no environmental impact
Assumptions	Availability of financing
Risks	Almost none
Steps undertaken	Technical documentation developed, public call issued for concession
Expected result	Additional installed capacity of 1 MW, average annual output increased by 8.7 GWh, no GHG emissions
Implementing body	Private investors, IFIs, ME
Description	Construction of a power plant using landfill biogas is planned at the Livade landfill, installed capacity of cogeneration modules: 2×500 kWe, Construction of power plants using landfill biogas 8.7 GWh. Repeated tender for concession to landfill biogas for power generation will be advertised shortly.

No. 9	
Title	Construction of biomass-fuelled cogeneration plants
Type of action	Technical
Scenario	WEM/WAM
Sector	Energy – power and heat energy generation
EU ETS	No
Relevant planning and strategic document	EDS 2030, EDS Action Plan 2020, National Action Plan for Renewable Energy by 2020
Methodology	Biomass power plant, IPCC methodology, modelling by LEAP software tool
Timeframe	2021–2030
Estimated costs	€67 m (Kolašin, Bijelo Polje, Rožaje and Nikšić)
Gas	CO_2, CH_4, N_2O
Indicator	Installed capacity in MW, annual output in GWh_{el}, annual heat energy output in GWh_{th}
GHG reduction potential	55.5 $ktCO_2$/yr
Additional impacts	Reduced power imports and increased exports, clean energy, no major interventions, almost no environmental impact, increased indirect GHG emissions (oxides), PM[1] and PAHs[2].
Assumptions	Financial stability of local self-governments
Risks	Almost none
Steps undertaken	Feasibility studies done for four municipalities
Expected result	Additional installed capacity of 33.8 MW_{el} and 7.1 MW_{el}, average annual power output increased by 53.6 GWh_{el} and average annual heat energy output of 85.1 GWh_{th}.
Implementing body	Local self-governments, private investors, IFIs, ME
Description	The project has covered the introduction of a biomass-fuelled (woodchip, pellet and briquette) district heating system in several northern municipalities, in terms with the findings of the study on potentials for using biomass and district heating for 10 municipalities of the northern region. Based on prior feasibility study done during Phase 1 for 10 municipalities, four municipalities were chosen as viable options for biomass-fuelled district heating with targeted feasibility studies done for each. The feasibility study for Kolašin showed the most cost-effective option to be the construction of a cogeneration plant with installed capacity of 2.7 MW_{th} and 0.6 MW_{el}, with planned average annual output of 5.4 GWh_{th} and 4.9 GWh_{el}, investment worth around €5m, effecting an annual emission reduction of approx. 10.8 $ktCO_2$. The feasibility study for Nikšić proposes as optimal the option with a woodchip-fuelled boiler with a capacity of 16 MW_{th} with planned average annual output of 41 GWh_{th}, investment costs of €19.5m, and annual emissions reduction of approx. 2.7 $ktCO_2$. The feasibility study for Bijelo Polje proposed a co-generation woodchip-fuelled plant of 11 MW heat power and 5 MW electric power, with planned average output of 28 GWh_{th} and 37 GWh_{el}, investment worth around €30 m, and an annual emission reduction of approx. 32 $ktCO_2$. The feasibility study for Rožaje proposed a co-generation woodchip-fuelled plant of 4.1 MW_{th} and 1.5 MW_{el}, with planned average output of 10.7 GWh_{th} and 11.7 GWh_{el}, investment worth €12.5m, and an annual emission reduction of approx. 10 $ktCO_2$.

[1] PM = particulate matter (PM10 , PM2.5)
[2] PAH = polycyclical aromatic hydrocarbons

No. 10	
Title	District heating for Pljevlja
Type of action	Technical
Scenario	WEM/WAM
Sector	Energy – power and heat energy generation
EU ETS	No
Relevant planning and strategic document	EDS 2030, EDS Action Plan 2020, National Action Plan for Renewable Energy by 2020, Air Quality Plan for the Municipality of Pljevlja
Methodology	Coal-fired TPP, IPCC methodology, modelling by LEAP software tool
Timeframe	2019–2023
Estimated costs	€23m
Gas	CO_2, CH_4, N_2O
Indicator	Installed capacity in MW_{th}, annual heat energy output in GW_{th}
GHG reduction potential	None
Additional impacts	Addressing the issue of air pollution, reduced environmental impacts, greater environmental impact during construction
Assumptions	Availability of financing
Risks	Almost none
Steps undertaken	Ecological upgrade of TPP Block 1 started
Expected result	Less coal burnt in individual furnaces
Implementing body	EPCG – TPP operator, end users of heat energy, local district heating operator, ME
Description	District heating system for Pljevlja will be carried out in parallel with the upgrade of TPP Pljevlja. It will address the long-standing issue of air pollution and other environmental issues in Pljevlja. The air in Pljevlja is loaded with pollutants from the burning of lignite in individual furnaces in approx. 5 000 households. The project aims to make use of a central heat energy source (TPP Block 1 following the ecological upgrade) to provide teleheating for Pljevlja, and to do away with individual furnaces.

No. 11	
Title	Improved energy efficiency in public, residential and commercial buildings
Type of action	Technical and regulatory
Scenario	WEM/WAM
Sector	Energy – residential, commercial and public sector
EU ETS	No
Relevant planning and strategic document	EDS 2030, EDS Action Plan 2020, 3rd EE Action Plan 2016–2018, Operational Plan for Improving Energy Efficiency
Methodology	Building retrofit, IPCC methodology, modelling by LEAP software tool
Timeframe	2018–2030
Estimated costs	€20m (public buildings)
Gas	CO_2, CH_4, N_2O
Indicator	Energy savings expressed in MW_{el}, savings in heat energy in MW_{th}
GHG reduction potential	7.5 $ktCO_2$/yr in public buildings. No data for residential and commercial buildings since there is no national building inventory.
Additional impacts	Optimal energy use with improved living standards, together with nature conservation and economic development.
Assumptions	Availability of financing
Risks	Almost none
Steps undertaken	Loan agreements signed
Expected result	Social monitoring findings show that better living and working conditions in retrofitted buildings provide better comfort.
Implementing body	MoE, Ministry of Health, Ministry of Education, Ministry of Labour and Social Welfare, Real Estate Administration, local self-governments, investors (private and households) and owners (private and households), financial institutions
Description	Improving energy performance of buildings is an ongoing activity being implemented since 2008. Improvement of energy performance of buildings occupied by central and local-level authorities is being done in accordance with the energy-efficiency operational plans. The existing plans cover more than 30 buildings (mostly in the health and education sectors) until 2021 and a number of buildings occupied by local administration authorities. Given that improved energy performance of buildings is now a statutory requirement, the action will continue throughout the relevant period, i.e. until 2030. Improving the energy performance of residential and commercial buildings is quite a popular action that has been done already for several years. This is particularly true of the capital city, where the local authorities are subsidizing 50% of the costs for building retrofitting. Given that the requirements of the EU directive on energy performance of buildings have been in force since 2013, this action includes all the measures, such as minimum energy performance requirements, building certification, energy audit methodology, and regular energy audits of HVAC systems. So far approx. €34.5 million has been invested in retrofitting public buildings.

No. 12	
Title	Construction of new buildings
Type of action	Technical and regulatory
Scenario	WEM/WAM
Sector	Energy – residential, commercial and public sectors
EU ETS	No
Relevant planning and strategic document	EDS 2030, EDS Action Plan 2020, 3rd EE Action Plan 2016–2018, Operational Plan for Improving Energy Efficiency
Methodology	New buildings, IPCC methodology, modelling by LEAP software tool
Timeframe	2018–2030
Estimated costs	n/a since there is no national building inventory
Gas	CO_2, CH_4, N_2O
Indicator	Energy savings expressed in MW_{el}, savings in heat energy in MW_{th}
GHG reduction potential	150 $ktCO_2$ by 2020. No data on new buildings for the period 2021–2030.
Additional impacts	Improved living and working conditions along with reduced environmental impacts
Assumptions	On average, annually some 321 800 m^2 of dwellings will be built (248 000 m^2 in family homes and 73 800 m^2 in residential buildings). Data on new non-residential buildings is not available, so assessments are based on new residential buildings only.
Risks	Almost none
Steps undertaken	New regulation adopted
Expected result	Financial benefits from energy savings
Implementing body	Private investors, households, financial institutions, ME
Description	New buildings are constructed under the terms of the Rulebook on Minimum Energy Performance Requirements in effect as of 2015, stipulating maximum allowable annual specific energy consumption for heating of 66–76 kWh/m^2 for residential, and 72 kWh/m^2 for non-residential buildings. The energy savings thus achieved will amount to 296.84 GWh (25.5 ktoe) by the end of 2020.

No. 13	
Title	Energy labelling and eco-design requirements for energy-related products
Type of action	Technical and regulatory
Scenario	WEM/WAM
Sector	Energy – residential, commercial and public sectors
EU ETS	No
Relevant planning and strategic document	EDS 2030, EDS Action Plan 2020, 3rd EE Action Plan 2016–2018
Methodology	Energy labelling and eco-design requirements, IPCC methodology, modelling by LEAP software tool
Timeframe	2018–2033
Estimated costs	€14m
Gas	CO_2, CH_4, N_2O
Indicator	Electrical energy savings in MW_{el}, annual heat energy savings in MW_{th}
GHG reduction potential	500 $ktCO_2$
Additional impacts	Phase-out of inefficient home appliances
Assumptions	Availability of financing
Risks	Almost none
Steps undertaken	New regulation adopted
Expected result	Financial benefits from energy savings
Implementing body	Home appliance suppliers, end users, MoE
Description	The Energy Labelling Regulation started to be applied as of 2017, while the Ecodesign Directive will be applied as of the second half of 2018. Rulebooks for energy labelling have been adopted and cover the following energy-related products: washing machines, air-conditioning, refrigerators, TV sets, dishwashers, electric light bulbs and lamps and car tyres, while the eco-design rulebooks cover the following energy-related products: non-directional light bulbs for households, fluorescent lamps without integrated dimmer switches, high intensity discharge lamps and accompanying dimmers switches and luminaires, electric motors, receivers converting digital to analogue signals, water pumps, non-seal circulation pumps, domestic washing machines, domestic clothes dryers, domestic dishwashers, external power supply devices, fans, domestic refrigerators, room air-conditioning and fans, TV sets, standby and off-mode electric power consumption for electric and electronic office equipment and domestic appliances, directional light bulbs, LED lights and the associated equipment.

No. 14	
Title	Improved public lighting
Type of action	Technical and regulatory
Scenario	WEM/WAM
Sector	Energy – residential, commercial and public sectors
EU ETS	No
Relevant planning and strategic document	EDS 2030, EDS Action Plan 2020, 3rd EE Action Plan 2016–2018, Operational Plan for Improving Energy Efficiency, local energy-efficiency plans
Methodology	Switching from mercury to LED bulbs, IPCC methodology, modelling by LEAP software tool
Timeframe	2018–2020
Estimated costs	The data on investments already done or the ones still needed is not available nor on the total number of lights already replaced.
Gas	CO_2
Indicator	Power savings in MW
GHG reduction potential	12 $ktCO_2$
Additional impacts	Financial savings for local self-governments
Assumptions	It is presumed that by 2020 all municipalities will have installed energy-efficient lighting, thus effecting savings in the range of 30 GWh.
Risks	Almost none
Steps undertaken	Some local self-governments have already upgraded their public lighting or are about to
Expected result	Improved street lighting
Implementing body	Local self-governments, MoE
Description	Public lighting has already been replaced in some municipalities. All local energy-efficiency plans envisage this action, since it is easy to implement, cost-effective and gives good results.

No. 15	
Title	Use of renewable energy in transport (biodiesel and alternative fuels)
Type of action	Technical and regulatory
Scenario	WEM/WAM
Sector	Energy – transport
EU ETS	No
Relevant planning and strategic document	EDS 2030, EDS Action Plan 2020, National Action Plan for Renewable Energy to 2020, Study on Prospects for Using Alternative Fuels in Transport, Study on Energy Efficiency Prospects in Transport, Action Plan for Sustainable Use of Energy in Transport in Montenegro
Methodology	Use of biodiesel in transport, IPCC methodology, modelling by LEAP software tool
Timeframe	2018–2030
Estimated costs	n/a
Gas	CO_2
Indicator	Reduced use of fuel oils
GHG reduction potential	10 ktCO_2 by 2020
Additional impacts	The target for renewables in transport met (by 2020)
Assumptions	Target: 10% renewables (9% biodiesel and 1% electric energy) in transport
Risks	Almost none
Steps undertaken	Action plan developed
Expected result	Reduced environmental impacts due to lower emissions of CO_2, indirect GHG, dust, VOC and PAH
Implementing body	Distributors of oil derivatives, MoE
Description	By 2020 at least 10% of total energy consumed in all modes of transport should come from renewable sources, while 90% should be accounted for by the use of biodiesel and the rest for electric cars and electric traction.

No. 16	
Title	Introduction of low-emission vehicles
Type of action	Technical and regulatory
Scenario	WAM
Sector	Energy – transport
EU ETS	No
Relevant planning and strategic document	EDS 2030, EDS Action Plan 2020, National Action Plan for Renewable Energy by 2020, Study on Prospects for Using Alternative Fuels in Transport, Study on Energy Efficiency Prospects in Transport, Action Plan for Sustainable Use of Energy in Transport in Montenegro
Methodology	Introduction of electric, LPG, hybrid and hydrogen vehicles, IPCC methodology, modelling by LEAP software tool
Timeframe	2018–2030
Estimated costs	None
Gas	CO_2
Indicator	Reduced use of fuel oils, no. of low-emission vehicles
GHG reduction potential	9 ktCO_2 for electric and LPG vehicles. No data regarding the number of hybrid vehicles
Additional impacts	Reduced number of vehicles using fossil fuel oils together with the increased use of cars using alternative fuels and more energy-efficient cars will lead to reduced air pollution, particularly in urban areas. Financial savings for local self-governments.
Assumptions	EDS 2030 envisages the procurement of some 2 750 electric vehicles by 2020 and 15 550 by 2030
Risks	Costly infrastructure
Steps undertaken	Action plan developed
Expected result	Reduced environmental impacts due to lower emissions of CO_2, indirect GHG, dust, VOC and PAH
Implementing body	Public transport operators, state administration, private car owners, MoE
Description	Low carbon (green) vehicles or low consumption vehicles include hybrid vehicles, LPG-fuelled vehicles, electric vehicles and hydrogen vehicles. In the country there are already a number of hybrid and LPG vehicles (8 100 in 2017), while electric vehicles are scarce, and there are no hydrogen vehicles. EDS 2030 envisages increasing the share of LPG-fuelled private cars, and switching from fuel oil to CNG in buses. One of the linchpins of the energy policy is the promotion of energy-efficient and low-carbon cars. This requires a solid regulatory framework and subsidy schemes to provide financial, fiscal or operational incentives for entities opting for energy-efficient vehicles, primarily public transport operators. Electric vehicles require certain infrastructure, charging stations, while no infrastructure is envisaged for hydrogen vehicles in the foreseeable future.

No. 17	
Title	Sustainable downtown urban mobility
Type of action	Technical and regulatory
Scenario	WAM
Sector	Energy – transport
EU ETS	No
Relevant planning and strategic document	TCNT, Action Plan for Sustainable Use of Energy in Transport in Montenegro, local Strategic Development Plans, local Air Quality Plans, local Sustainable Energy Plans, local Energy Plans
Methodology	Introduction of electric, LPG, hybrid and hydrogen vehicles, IPCC methodology, modelling by LEAP software tool
Timeframe	2021–2030
Estimated costs	None
Gas	CO_2
Indicator	Reduced use of fuel oils, no. of low-emission vehicles, alternative modes of transport
GHG reduction potential	None – data not available for other municipalities
Additional impacts	Less traffic congestion
Assumptions	Availability of financing
Risks	Requires costly infrastructure
Steps undertaken	Sustainable mobility plans developed for three coastal municipalities and Cetinje
Expected result	Reduced environmental impacts due to lower emissions of CO_2, indirect GHG, dust, VOC and PAH
Implementing body	Public transport operators, state administration, local self-governments, MoE
Description	Sustainable urban mobility implies the upgrading of intermodal transport; increased use of public transportation; promotion of cycling by constructing cycling lanes; improved road safety; promotion of eco-friendly transport solutions in municipal and regional transport systems; better air quality and promotion of further development of low-carbon transport solutions. This concept should be based on polycentric sustainable urban mobility plans to be developed and adopted by the end of 2020. Such plans are to focus on land and sea transportation and offer solutions for non-motorized and motorized transport modes with the ultimate goal of increasing accessibility and connectivity in the given area. The Capital City Podgorica envisages modernization of local public transportation, reduction in downtown traffic, including the construction of a mini bypass to avoid the downtown area, a ban on freight transport in congested downtown areas, introduction of a "car share" system for the city administration and public companies, an increase in pedestrian paths, introduction of a "bike share" system, and ongoing extension of the cycle path network. In addition, one of the focuses of the energy policy is on mainstreaming EE into transport infrastructure initiatives.

No. 18	
Title	Increased use of railway passenger and freight transport
Type of action	Technical and regulatory
Scenario	WAM
Sector	Energy – transport
EU ETS	No
Relevant planning and strategic document	EDS 2030
Methodology	Railway transport, IPCC methodology, modelling by LEAP software tool
Timeframe	2018–2030
Estimated costs	None
Gas	CO_2
Indicator	Reduced use of fuel oils, no. of low-emission vehicles
GHG reduction potential	Data not available
Additional impacts	Switch to mass-mobility modes, less road traffic congestion
Assumptions	Rehabilitation and modernization of railway infrastructure completed
Risks	Almost none
Steps undertaken	Rehabilitation and modernization of railway infrastructure commenced
Expected result	Reduced environmental impacts due to lower emissions of CO_2, indirect GHG, dust, VOC and PAH
Implementing body	Railway operators, MoE
Description	Over the last 10 years the total of €123.1m has been invested in railway rehabilitation and modernization. The EDS 2030 envisages 50% of cargo transport being switched to electrically powered railway transport. One of the energy policy pillars is to foster public transportation development, including railways, as an action towards rational energy use and promotion of EE.

No. 19	
Title	Establishing energy management in the industrial sector
Type of action	Regulatory
Scenario	WAM
Sector	Energy – industry and construction
EU ETS	No
Relevant planning and strategic document	3rd EE Action Plan 2016–2018
Methodology	ISO 50001 standards, IPCC methodology
Timeframe	2018–2030
Estimated costs	None
Gas	CO_2
Indicator	Reduced energy consumption
GHG reduction potential	None
Additional impacts	Lower energy costs
Assumptions	Conducting mandatory energy audits for production industries and ISO 50001 standard
Risks	Almost none
Steps undertaken	None
Expected result	Reduced environmental pollution
Implementing body	Operators of industrial facilities, MoE
Description	Given many years of financial difficulties for KAP and Steel Company Nikšić, no major EE actions have been undertaken in these facilities so far. Considering the relatively low share of other industrial consumers in overall consumption, the establishment and introduction of an energy management system would be the first step towards a well-designed, systematic and gradual move towards greater energy efficiency in industrial facilities. The energy management system enables efficient management of production processes for greater output with equal energy consumption, including mandatory energy audits for manufacturing industries and the application of ISO 50001.

No. 20	
Title	Subsidies for reducing energy consumption
Type of action	Technical and regulatory
Scenario	WAM
Sector	Energy – all energy consumption subsectors
EU ETS	No
Relevant planning and strategic document	EDS 2030, EDS Action Plan 2020, 3rd EE Action Plan EE 2016–2018
Methodology	Installing solar water heating systems, furnaces fired by modern forms of biomass, IPCC methodology, modelling by LEAP software tool
Timeframe	2018–2030
Estimated costs	None
Gas	CO_2
Indicator	Reduced energy consumption, no. of low-emission vehicles
GHG reduction potential	1.39 ktCO_2/yr.
Additional impacts	Increased awareness of reducing energy consumption
Assumptions	Availability of funding
Risks	Almost none
Steps undertaken	Several programmes already implements, the legal framework for the ESCO concept developed
Expected result	Reduced environmental impacts due to lower emissions of CO_2, indirect GHG, dust, VOC and PAH
Implementing body	Public sector, households, private sector, commercial banks, MoE
Description	The ongoing support programme for introducing biomass-fuelled heating for households ENERGY WOOD is based on a funding scheme previously developed for the solar water heating programme, MONTESOL. Regretfully, MONTESOL did not achieve any significant results. In addition to these, other financial, fiscal and operational incentives are needed, e.g. for the purchase of green vehicles, such as tax reliefs for cars using alternative fuels or low-consumption cars for entities that opt to purchase energy-efficient/ecological cars. The ESCO financing model is not in place yet, but certainly remains one of the options for investments in EE projects in public street lighting, water supply and waste water systems and other utilities.

No. 21	
Title	Introducing BAT in technological processes in KAP
Type of action	Technical and regulatory
Scenario	WEM/WAM
Sector	Industrial processes and product use – aluminium production
EU ETS	Yes
Relevant planning and strategic document	Strategy for the Development of Processing Industry (2014–2018)
Methodology	Introduction of BAT in the aluminium industry, IPCC methodology, IPCC software
Timeframe	2018–2025
Estimated costs	€300m
Gas	CF_4, C_2F_6, CO_2
Indicator	Less energy consumption, reduced emissions of CO_2 and synthetic gases
GHG reduction potential	Reduction of annual CO_2eq emissions by 2020 by at least 500 ktCO_2eq in comparison to 2007 levels
Additional impacts	More competitive production due to lower energy consumption and a higher level of metal processing
Assumptions	Availability of financing
Risks	Almost none
Steps undertaken	The Industrial Emissions Law is being drafted
Expected result	Reduced environmental impacts due to lower emissions of CO_2, indirect GHG, dust, VOC and PAH
Implementing body	KAP operator, MSDT, MoE
Description	Modernization of production and the introduction of BAT at KAP in terms of energy efficiency and reduced emissions. Total investment for introducing BAT, excluding the Electrolysis Plant, amounts to approx. €50m, while the investment in BAT in the existing facilities and building the new Electrolysis Plant would require some €300m. The BAT requirements are to be applied both for the existing and new facilities, under Directive 2010/75/EU on industrial emissions.

No. 22	
Title	Introducing BAT in other facilities
Type of action	Technical and regulatory
Scenario	WEM/WAM
Sector	Industrial processes and product use – production of iron and other products
EU ETS	Yes (No)
Relevant planning and strategic document	Strategy for the Development of Processing Industry (2014–2018)
Methodology	Introduction of BAT in industry, IPCC methodology, IPCC software
Timeframe	2018–2030
Estimated costs	None
Gas	All GHGs
Indicator	Number of integrated permits, less energy consumption, reduced GHG emissions and less pollution
GHG reduction potential	No
Additional impacts	More competitive production due to lower energy consumption and a higher level of metal processing
Assumptions	Availability of financing
Risks	Almost none
Steps undertaken	The Industrial Emissions Law is being drafted
Expected result	Reduced environmental impacts due to lower emissions of CO_2, indirect GHG, dust, VOC and PAH, and less waste generated
Implementing body	Operators of industrial facilities, MSDT, MoE
Description	The BAT requirements are to be applied both to the existing (steel plant) and new facilities, under Directive 2010/75/EU on industrial emissions.

No. 23	
Title	Support for organic agricultural production
Type of action	Technical
Scenario	WAM
Sector	Agriculture, forestry and land use – agriculture
EU ETS	No
Relevant planning and strategic document	Strategy for the Development of Agriculture and Rural Areas (2014–2020), 2018 Agro Budget
Methodology	
Timeframe	2018–2030
Estimated costs	€7.6m
Gas	N_2O, CH_4
Indicator	Increased number of organic agricultural producers
GHG reduction potential	n/a due to a lack of data
Additional impacts	Competitive production and marketing of products
Assumptions	Availability of financing
Risks	Almost none
Steps undertaken	Appropriation within the action for sustainable management of agro resources
Expected result	Reduced environmental impacts, less energy consumed, less fertilizers used
Implementing body	Agricultural producers, MARD
Description	Despite the limited farming land available – 518 000 ha – Montenegrin agriculture is very diverse. The fact that it has not been overused and that only a low share of fertilizers (over 10 times lower than the EU average) and pesticides are still used are its distinct advantages. The low use of fertilizers and pesticides is an excellent basis for developing organic agriculture. Apart from non-polluted areas, there is huge room for organic production with a short transition period. Monteorganica, the authorized entity for organic agriculture controls and certification (certification body) has issued so far 314 certificates to organic producers, listed in the Register and eligible for state funding for the support to organic agriculture.

No. 24	
Title	Support to manure management
Type of action	Technical
Scenario	WAM
Sector	Agriculture, forestry and land use – livestock breeding
EU ETS	No
Relevant planning and strategic document	Strategy for the Development of Agriculture and Rural Areas (2014–2020), 2018 Agro budget
Methodology	Manure management, IPCC methodology, IPCC software
Timeframe	2018–2030
Estimated costs	€1.2m
Gas	N_2O
Indicator	Increased number of agricultural producers managing manure
GHG reduction potential	n/a, due to a lack of data
Additional impacts	Meeting the Code of Good Agricultural Practice standards
Assumptions	Availability of financing
Risks	Almost none
Steps undertaken	Appropriation within the action for sustainable management of agro resources
Expected result	Reduced environmental impact, reduced emissions
Implementing body	Agricultural producers, MARD
Description	Examining the situation in the field, a number of areas have been identified where farmers would have to invest additionally to comply with the standards set by the Code of Good Agricultural Practice. The most common environmental risk stemming from agriculture is the risk of localized pollution to surface and ground waters with manure, liquid manure, polluted water and to a somewhat lesser degree, silage effluent. All registered holdings entered which at the time of application have at least five conditional head of livestock (50 sheep, 50 goats, 5 cows/bulls, 10 heifers) registered in the Animal Identification and Marking Register are eligible for support.

No. 25	
Title	Improve the state of forests and additional afforestation
Type of action	Technical and regulatory
Scenario	WEM/WAM
Sector	Agriculture, forestry and land use – forestry
EU ETS	No
Relevant planning and strategic document	National Strategy with Forest and Forestry Development Plan (2014–2023). 2018 Forest Stewardship Plan
Methodology	Afforestation, IPCC methodology, IPCC software
Timeframe	2018–2023
Estimated costs	€0.2m (2018)
Gas	CO_2
Indicator	Increase in CO_2 sinks
GHG reduction potential	Increase CO_2 sinks by more than 10% (200 $ktCO_2/yr$) by the end of the period covered
Additional impacts	Increased biodiversity, economic gains
Assumptions	Availability of financing
Risks	Almost none
Steps undertaken	Change in the concept of forest utilization
Expected result	Increase CO_2 sinks, greater biodiversity, economic gains
Implementing body	Forest Administration, wood processing industry, private investors, concessionaires, MARD
Description	Increase sustainability of forest management by increasing growing stock in commercial forests from 104 to 115 million m^3 gross wood mass through planned stewardship, care and silviculture increase quality, stability, resilience and productivity of forests, thus laying the foundations for long-term sustainable use of all forest functions.

No. 26	
Title	Reduce the share of bio-waste in municipal waste
Type of action	Technical and regulatory
Scenario	WEM/WAM
Sector	Waste – removal of solid municipal waste
EU ETS	No
Relevant planning and strategic document	State Waste Management Plan 2015–2020
Methodology	Landfill waste, IPCC methodology, IPCC software
Timeframe	2018–2030
Estimated costs	None
Gas	CH_4
Indicator	Reduce the share of biodegradable waste in landfills, increase recycling
GHG reduction potential	None
Additional impacts	Better use of raw materials, resource efficiency
Assumptions	Availability of financing
Risks	Almost none
Steps undertaken	Revise State Waste Management Plan 2015–2020
Expected result	Reduced environmental impact
Implementing body	Landfill operators, local utilities, MSDT
Description	The government has not yet fully defined the guidelines for durable solutions for waste management. The State Waste Management Plan 2015–2020 mentioned thermal processing of municipal waste as one of the viable options, but this option is not being considered any more, rather focusing on building 3–5 regional recycling centres. To meet the targets for the share of biodegradable municipal waste being disposed at landfills, the figure of 35% of the total mass of biodegradable waste that was generated in 2010 must be reached by no later than 2027. In order to divert biodegradable municipal waste, its share must be at least 75% of the total biodegradable waste from 2010 and must be reached by no later than 2020.

No. 27	
Title	Apply sustainable production and consumption patterns
Type of action	Technical and regulatory
Scenario	WAM
Sector	All sectors
EU ETS	No
Relevant planning and strategic document	Sustainable Development Strategy to 2030
Methodology	
Timeframe	2018–2030
Estimated costs	No
Gas	All GHGs
Indicator	Less energy consumed, reduced CO_2 emissions, reduced pollution, changed patterns of behaviour
GHG reduction potential	No
Additional impacts	More competitive production due to lower energy consumption and resource use
Assumptions	Availability of financing
Risks	Almost none
Steps undertaken	Guidelines for corporate social responsibility
Expected result	Reduced environmental impact
Implementing body	Companies, individuals, MSDT
Description	Sustainable production and consumption patterns foster sustainability in all sectors of the economy, introducing the concept of "product and service life cycle" accompanied by the environmental footprint of products and services, aiming to reduce use of natural resources, generation of harmful and toxic matters, emissions and discharges into water or soil, and waste generation, supporting sustainable and inclusive development, poverty alleviation and better quality of living. Practical and voluntary mechanisms and tools for sustainable production and consumption patterns include: ecological labelling, ecological management, introduction of ecological management into the commercial and public sectors, green procurement, introduction and verification of clean technologies, consumer education, calculation of environmental footprints for products and companies, social responsibility, and tools to foster integrated product management and recycling.

Annex 2

GENDER EQUALITY IN CLIMATE MITIGATION

In order to provide a better overview of mitigation measures, it is necessary to collect gender-disaggregated data and thus to take into account gender differences; this is a modern approach to this issue. The different needs, attitudes and priorities of men and women need to be considered when designing gender-specific policies and measures. As a consequence, mitigation strategies cannot rely exclusively on technology and on markets, but should include a broad spectrum of structural and lifestyle changes. However, Montenegro's national statistics currently do not include gender-disaggregated data on climate change. There are plans to improve statistics about gender as part of the several forthcoming projects.

Women tend to be more concerned with climate change and are more likely to accept ambitious efforts to cut GHG emissions; they have different needs than men concerning energy consumption and mobility. However, women contribute more to mitigation within their role of household management. Women are more prepared to change their habits in order to reduce energy consumption and to buy low-emission products. However, they are often less aware of their own energy consumption and resist measures that require additional work. Men and women have different preferences concerning technology associated with the reduction of GHG – most women reject risky methods, such as nuclear energy, carbon capture and storage technologies.

In order to improve women's participation, this aspect should be more thoroughly considered and included both in existing and future national policies and in action plans under measures concerning sustainable development and climate change; such an improvement could be achieved through systematic gender analysis, the collection and use of gender-disaggregated data, by setting gender indicators and by developing practices that support a greater focus on and commitment to gender equality. The gender-disaggregated data that should be collected for inclusion in the national statistics should, at least, include the following:

- The share (number) of women in administrative positions in charge of climate-change decisions;
- The percentage shares of men and women in sectors concerned with climate change;
- The number of women working as farmers;
- The beneficiaries of fuel subsidies (disaggregated for men and women);
- The level of education (disaggregated for women and men);
- The number of women who own cars, who are drivers and users of public transport, disaggregated by age and gender, and by geographical location.

The use of such indicators and data monitoring would highlight any shortcomings and gaps, and could thus help to improve the level of expertise regarding mainstreaming gender equality when dealing with climate issues.

Annex 3

IMPROVEMENT PLAN

PRIORITY	IMPROVEMENT TITLE	ASSUMPTIONS/RISKS	BENEFITS	CATEGORIES	LEAD STAKEHOLDER	PROGRESS ASSESSMENT
High	Update of the existing rulebook		Supporting improvement of GHG legislation	Mitigation; Adaptation		
High	Detailed analysis of commitments of MMR		Basis for establishment of National GHG System and EU MMR reporting compliance.	Mitigation		
High	Drafting legislation based on MMR analysis		EU MMR reporting compliance.	Mitigation		
High	Continuous team building/ training		Efficient and compliant functional national system	Mitigation		
High	MRV team expansion		Fully functional national system	Mitigation		
High	Data-supply security		Continuous improvement of GHG estimates. No loss of important datasets.	Mitigation		
High	GHG Inventory quality systems		Quality assurance for stakeholders	Mitigation		
High	Training and mentoring for MRV coordinator for Adaptation	Trained representatives will be able to stay in post for at least 2 years to realize benefits of training.	Enhanced participation in adaptation negotiations. Improved advice to national strategies and decision makers on adaptation actions and their impacts on national strategies and SDGs. Better/ quicker engagement of stakeholders and implementation of actions.	Adaptation		Needs identified.

PRIORITY	IMPROVEMENT TITLE	ASSUMPTIONS/RISKS	BENEFITS	CATEGORIES	LEAD STAKEHOLDER	PROGRESS ASSESSMENT
Low	GHG Inventory, Projections and Mitigation action infographics		Institutional awareness	Mitigation		
Medium	Increased awareness of advantages and opportunities for the country of a strong inventory framework		Increased public awareness			Marketing of the inventory has not started yet.
Medium	GHG inventory calculation systems			Mitigation		
Medium	GHG Inventory reporting tools (CRF)		Easier reporting/ MMR obligation	Mitigation		
Medium	GHG Inventory NIR improvement		Easier reporting/ MMR obligation	Mitigation		
Medium	GHG Inventory uncertainties		Functional GHG	Mitigation		
Medium	Public engagement with GHG inventory data		Public awareness	Mitigation		
Medium	Updates to National Council and WG on CC		Public awareness	Mitigation; Adaptation		
Not determined	To ensure compliance with the MMR established through a fully functioning national GHG system (5–10 years)	No requirement or urgency for MMR reporting. Lack of priority for climate MRV at high levels.				See results below
Not determined	A permanent national system for (1) the estimation of anthropogenic emissions of greenhouse gases by sources and sinks and the reporting of inventories and national inventory reports	No requirement or urgency for climate policy analysis or UNFCCC National Communication BUR reporting. Lack of priority for climate MRV at high levels.				See results below

PRIORITY	IMPROVEMENT TITLE	ASSUMPTIONS/RISKS	BENEFITS	CATEGORIES	LEAD STAKEHOLDER	PROGRESS ASSESSMENT
Not determined	Functioning institutional arrangements: A set of short-term institutional building blocks in place to allow future recurring reporting and continuous improvement on GHGs mitigation inventories, projections and PAMs.	Human and financial resources				The Montenegrin Environmental Protection Agency (EPA) is responsible for the preparation, updating and reporting of the comprehensive GHG Inventory, as prescribed by national legislation and ratified international treaties. Montenegro has de-facto institutional arrangements that have allowed the elaboration of the GHG Inventory. In 2014, the Rulebook of gases list and method of preparing the GHG Inventory and exchange of information was adopted. There is an appointed national GHG inventory team (data collection, inventory calculation, reporting) within the EPA (three experts: one for energy and industrial processes, one for agriculture and forestry and one for waste), dealing with these issues. They are collecting data based on the annual data collection plan, which is currently under development. So far, they do not have QA/QC procedures.
Not determined	A sustainable team has been built and trained to fill the identified institutional arrangements	Human and financial resources				The GHG team is established within the EPA. Currently three employees were trained, mostly through GEF (INC SNC, FBUR) projects.
Not determined	GHG Inventory sustainable data supply system developed. Improve inventory annual data collection plan.	Human and financial resources				Montenegro's Agency has good cooperation with all data suppliers, but this is so far on a voluntary basis, i.e. there is no legal framework for information collection. The EPA has established a cooperation agreement with the Statistical Office (MONSTAT). In work done on previous GHG inventories, the information was provided in non-standardized reporting formats and on a voluntary basis.

PRIORITY	IMPROVEMENT TITLE	ASSUMPTIONS/RISKS	BENEFITS	CATEGORIES	LEAD STAKEHOLDER	PROGRESS ASSESSMENT
Not determined	A quality and effective GHG Inventory time series for year X to X–2	Human and financial resources				Through work on FBUR process, an advanced MRV system was drafted and the complete GHG Inventory for the time series 1990–2013 was estimated, in accordance with the 2006 IPCC Guidelines methodology.
Not determined	Establish national system for mitigation (policies and measures to reduce emissions and projections).			Mitigation		There is no national system for mitigation (policies and measures to reduce emissions and projections). The mitigation chapters within NCs and BUR were prepared by a team of independent experts (mostly national) including some international ones (Czech experts for FBUR).
Not determined	To ensure compliance with the MMR (Articles 12 & 14), established through a fully functioning national MRV system (5–10 years)					Establish functional MRV system
Not determined	A permanent national system for (1) the estimation of projections of anthropogenic emissions of greenhouse gases by sources and sinks; and (2) the assessment of the impacts of policies and measures for GHG emissions and removals.					

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