# DRAFT OF THE NATIONAL ENERGY AND CLIMATE PLAN OF MONTENEGRO

**05 December 2024**

**Work in progress**

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# Table of Content

# LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| BaU | Business as Usual |
| cap | Vapita |
| CAPEX | Capital expenses |
| CBAM | Carbon Border Adjustment Mechanism |
| CDD | Cooling degree days |
| CE | Circular Economy |
| $CH_4$ | Methane |
| CO2 | Carbon dioxide |
| $CO_2eq$ | $CO_2$ equivalent |
| EBRD | European Bank for Reconstruction and Development |
| ECMs | Energy Conservation Measures |
| ECRB | Energy Community Regulatory Board |
| EE | Energy Efficiency |
| EED | Energy Efficiency Directive |
| EIA | Environmental Impact Assessment |
| EnC | Energy Community |
| EnCS | Energy Community Secretariat |
| ENTSO-E | European Network of Transmission System Operators |
| EPBD | Energy Performance of Buildings Directive |
| ESCO | Energy Service Company |
| ESIA | Environmental and Social Impact Assessment |
| ETS | Emission trading system |
| EU | European Union |
| EV | Electric Vehicle |
| FEC | Final Energy Consumption |
| FiT | Feed in Tariff |
| GACMO | Greenhouse Gas Abatement Cost Model |
| GCF | Green Climate Fund |
| GDP | Gross Domestic Product |
| GEF | Global Environment Facility |
| GHG | Green House Gas |
| ha | Hectare |
| HDD | Heating degree days |
| HFC | Hydrofluorocarbons (HFCs) |
| HPP | Hydro Power Plant |
| IAP | Ionian Adriatic Pipeline |
| IEE | Industrial Energy Efficiency |
| INDC | Intended Nationally Determined Contributions |
| IPA | Instrument for pre-accession assistance |
| IPPU | Industrial processes and product use |
| ITS | Intelligent Transport Systems |
| LCDS | Low Carbon Development Strategy |
| LNG | Liquified Natural Gas |
| LPG | Liquified Petroleum Gas |
| LULUCF | Land Use, Land-Use Change and Forestry (LULUCF) |
| MMR | Monitoring Mechanism Regulation |
| MRVA | Monitoring, Reporting, Verification and Accreditation |
| MVP | Monitoring and Verification Program |

| | |
|---|---|
| MW | Megawatt |
| N2O | nitrous oxide |
| NAP | National Adaptation Plan |
| NDC | Nationally Determined Contributions |
| NECP | National Energy and Climate Plan |
| NEEAP | National Energy Efficiency Action Plan |
| $NO_X$ | Nitrogen Oxides |
| nZEB | Near Zero Energy Building |
| PaM | Policy and Measure |
| PHEV | Plug-in Hybrid Electric Vehicle |
| $PM_{2.5}$ | Particulate Matter |
| PV | Photovoltaic |
| QA/QC | Quality Assurance / Quality Control |
| RES | Renewable Energy Source |
| SDG | Sustainable Development Goals |
| SEA | Strategic Environmental Assessment |
| SEAP | Sustainable Energy Action Plan |
| SEE CAO | South-East Europe Coordinated Auction Office in Montenegro |
| SET-Plan | Strategic Energy Technology Plan |
| sHPP | small Hydro Power Plant |
| $SO_2$ | Sulfur dioxide |
| TAP | Trans Adriatic Pipeline |
| TASR | Technical Analysis Summary Report |
| TEFC | Total Energy Final Consumption |
| TEN-E | Trans-European Energy Networks |
| TEN-T | Trans European Transport Networks |
| toe | ton(s) of oil equivalent |
| TPES | Total primary energy supply |
| TPP | Thermal Power Plant |
| TSO | Transmission System Operator |
| tWG | technical Working Group |
| UN | United Nations |
| UNDP | United Nations Development Programme |
| UNFCCC | United Nations Framework Convention on Climate Change |
| VAT | Value added tax |
| WAM | With Additional Measures |
| WB | Western Balkans |
| WB* | World Bank |
| WB6 | Albania, Bosnia and Herzegovina, Kosovo, North Macedonia, Montenegro, Serbia |
| WBIF | Western Balkans Investment Framework |
| WEM | With Existing Measure |

## LIST OF FIGURES

## LIST OF TABLES

# INTRODUCTION

In the Strategy for the European Energy Union published by the European Commission in February 2015, it has been emphasized that integrated management is needed to ensure that all energy-related activities at EU level and at national, regional and local level contribute to the objectives of the Energy Union. Thereby the scope will be broadened beyond the Climate and Energy Policy Framework by 2030 and will incorporate all five key dimensions of the Energy Union: 1. Energy security, 2. Internal energy market, 3. Energy efficiency, 4. Decarbonisation and 5. Research, innovation and competitiveness. The NECPs should cover the period from 2021 to 2030, laying down the pathway to achieve the agreed 2030 targets, build upon what each Contracting Party should deliver in relation to their policies for 2020 (as a baseline), and include a perspective until 2050 in order to ensure consistency with long-term relevant policy objectives at EU, UNFCCC and Energy Community level.

Montenegro, as a member of the UN, by ratifying the Paris Agreement, pledged to join the international community with the objective to reduce greenhouse gas emissions. In addition, as a member of the Energy Community and a candidate for EU membership, Montenegro pledged to meet the goals of the Energy Community and the European Union in the fields of renewable energy, energy efficiency and greenhouse gas emission reduction. In order to fulfill these obligations and to achieve set goals, Montenegro must harmonize and coordinate its energy and climate policies. Integrating environmental and climate change issues into ambitious development and energy policies and strategies is one of country's greatest challenges in joining the European Union.

The development of this plan follows Recommendation 2018/01/MC- EnC [1] requesting Contracting Parties to produce their NECPs in accordance with Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action[2] (hereafter referred to as Governance Regulation). The Policy Guidelines PG 03/2018 of June 2018 on the development of National Energy and Climate Plans under Recommendation 2018/01/MC-EnC[3] provides a good overview of the scope, required content and the timeline of the NECP process for the Contracting Parties of the Energy Community. The objective is to align the Montenegrin NECP with the new goals of 2030 set by the Energy Community Ministerial Council based on the Decision of the Ministerial Council of the Energy Community No 2022/02/MC-EnC[4], of 15 December 2022, regarding the reduction of greenhouse gases (GHG), the share of renewable energies and energy efficiency, respectively for final energy consumption and primary energy consumption.

This document has been developed from the NECP draft template based on the requirement of the Governance Regulation, which was made available to the Energy Community Contracting Parties to support the national NECP development processes. It is noted that the NECP is an endeavour of continuous improvement and that the current version has been produced as good as possible and with great effort.

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[1] https://www.energy-community.org/dam/jcr:de3adce9-e047-4fb3-a632-f63c64a5c9c6/REC_2018_01_MC_CLI.pdf (last access 25.11.2024)

[2] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R1999&from=EN (last access 25.11.2024)

[3] https://www.energy-community.org/dam/jcr:c9886332-a1f5-43ee-b46c-31c637aedfa6/PC_03_2018_ECS_NECP.pdf (last access 25.11.2024)

[4] https://www.energy-community.org/dam/jcr:421f0dca-1b16-4bb5-af86-067bc35fe073/Decision_02-2022-MC_CEP_2030targets_15122022.pdf (last access 25.11.2024)

# SECTION A: NATIONAL PLAN

# 1 OVERVIEW AND PROCESS FOR ESTABLISHING THE PLAN

## *1.1* Executive Summary

*i. Political, economic, environmental, and social context of the plan*

Montenegro became a party to the UN Framework Convention on Climate Change by succession, after becoming independent in 2006, being a non-Annex I Party to the UNFCCC. The Ministry of Ecology, Sustainable Development and Development of the North is the main national entity responsible for the national environmental and climate change policy and the National Focal Point to the UNFCCC, GCF and GEF. Montenegro regularly submits greenhouse gas inventory reports as well as national reports to the Secretariat of the Convention.
The Second Biennial Update Report was submitted to the UNFCCC Secretariat in December 2019, while the Third National Report under the United Nations Framework Convention on Climate Change was submitted to the UNFCCC in early October 2020. The Technical analysis of the third biennial update report of Montenegro was submitted on 7 February 2022 (TASR).
The European integration has been at the top of Government's agenda ever since the country independence, and the membership of the European Union remains a strategic goal of the country. In the context of the EU accession process, the country also initiated harmonization of its EU and UNFCCC commitments. The EU integration agenda has generated momentum for political, economic and social reforms and contributed to consensus building on cross-sectoral policy. While EU accession poses great challenges in terms of human and financial capacity at the national and local levels, it also provides opportunities for the creation of more integrated, crosscutting policies and better utilization of available resources.
Montenegro is implementing several international obligations to move towards a low-carbon economy, including the establishment of goals for increasing the share of renewable energy by gross final energy demand, improving energy efficiency, and reducing greenhouse gases (GHG) emissions in electricity generation by setting the limit of 20,000 operational hours until 2023 of the only lignite-fired power plant, as well as eco-upgrade of this power plant including the construction of the desulphurization and denitrification system, upgrade to the electro-filtering plant, construction of wastewater treatment facility, and reconstruction of the internal system for transporting ash and slag that will significantly reduce all the air pollutants ($SO_2$, $NO_X$, $PM_{2.5}$). The lignite-fired Thermal Power Plant (TPP) Pljevlja itself is envisaged as a heat source for the town of Pljevlja (envisaged heat removal from the turbine, heat exchangers, pumping station, and the auxiliary boiler room as the backup source).
On its path towards accession to EU, Montenegro has opened Negotiation Chapter 27 covering Environment and Climate Change. It will have to integrate into domestic legal framework numerous requirements of the EU climate policy and to align with climate acquis. The EU Report on Montenegro's progress from May 2019 in the accession process states that: "Limited progress has been made in further aligning legislation with the EU acquis. Montenegro should focus in particular on environment and climate change. Montenegro's level of alignment on climate change remains limited. On horizontal legislation, in June 2018, Montenegro adopted

the 2018-2020 action plan for its national strategy to align with and implement the EU acquis on environmental protection and climate change. However, the lack of administrative capacity and financial resources at national and local level are delaying the strategy's implementation. Genuine dialogue between civil society and the government is required to achieve effective public participation and consultation in decision-making. The Fund for Environmental Protection was formally established in November 2018 and is now becoming operational. Montenegro has a Climate Change Strategy up to 2030 in place but has to intensify its work to ensure consistency with the EU 2030 climate and energy policy framework and to ensure that its strategy is integrated into all relevant sectoral policies and strategies. Considerable efforts are still needed to align with the EU climate acquis". The EU Report on Montenegro's progress from November 2023 states in Chapter 15 on Energy: "Montenegro has reached a good level of preparation in the area of energy. Some progress was made, mainly by creating a day-ahead energy market and in moving to market-based schemes for renewable energy production. Last year's recommendations were thus partially addressed. In the coming year, Montenegro should, in particular: finalise and adopt the national energy and climate plan (NECP); transpose and implement the Electricity Integration Package and accelerate the move to market-based support schemes for renewable energy production based on streamlined permitting and connection procedures; adopt the Law on security of supply of oil products and appoint the stockholding body for the mandatory oil reserves."
It is also stated that "The NECP will become the new strategic plan for the development of the energy sector until 2030, include policy and measures in the field of renewable energy and energy efficiency and align Montenegro's energy policy with 2030 Energy Community targets."

According to the 2023 census, the population of Montenegro was 623,633 and thus slightly higher than the population according to census 2011 (620,029 inhabitants). The population density is approximately 50 inhabitants per square km. Between 2003 and 2011, the annual population growth was slightly negative; statistics show a negative growth rate of about 0.02%. Of the total population, 306,807are male and 316,826 are female in 2023. The most recent statistics show the composition of Montenegro's population:

- 18 % Children 0–14 years
- 65 % People aged 15–64 years
- 17 % People aged 65 or over

Life expectancy at birth in 2018 was 77 years.

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 females, 65.5% live in urban areas, while for males this percentage is 63.2%. In 2017, the migration rate was 8.4%, continuing the upward trend in population movements. Migration is mainly related to the movement of population from rural to urban settlements, and the negative consequences are twofold. On one hand, there is increasing pressure on resources in urban regions, and on the other hand, rural areas are being left without a population, especially in the mountainous parts – pastures are overgrown, land is left uncultivated, and is overgrown with weeds and forest vegetation. This further leads to a decrease in investment in uninhabited areas and less development of these parts of Montenegro.

The Montenegrin gross domestic product (GDP) in 2018 was EUR 4,663 million, while for 2017 it was EUR 4,299 million, and in 2021 it was EUR 4,731 . GDP per capita in 2018 was EUR 7,495 while in 2017 it was EUR 6,908. Table 1 shows an overview of the important economic and social indicators in Montenegro for several years. Figure 1 shows a disaggregation of Montenegro's GDP for 2018. (MONSTAT, 2018; MONSTAT 2022[5]).

| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Gross domestic product at current prices, EUR million | 4,299 | 4,663 | 4,951 | 4,186 | 4,955 |
| Population (in thousands) | 622.4 | 622.2 | | | |
| Gross domestic product per capita in EUR (3 = (1/2)) | 6,908 | 7,495 | | | |
| Gross domestic product at constant prices (prices of previous year), EUR million | 4,141 | 4,517 | 4,853 | 4,193 | 4,731 |
| Real growth rate of GDP (%) ((GDP at constant prices in current year/GDP at current prices in previous year) × 100) – 100 | 4.7 | 5.1 | | | |

Table 1.1: Overview of economic and social indicators

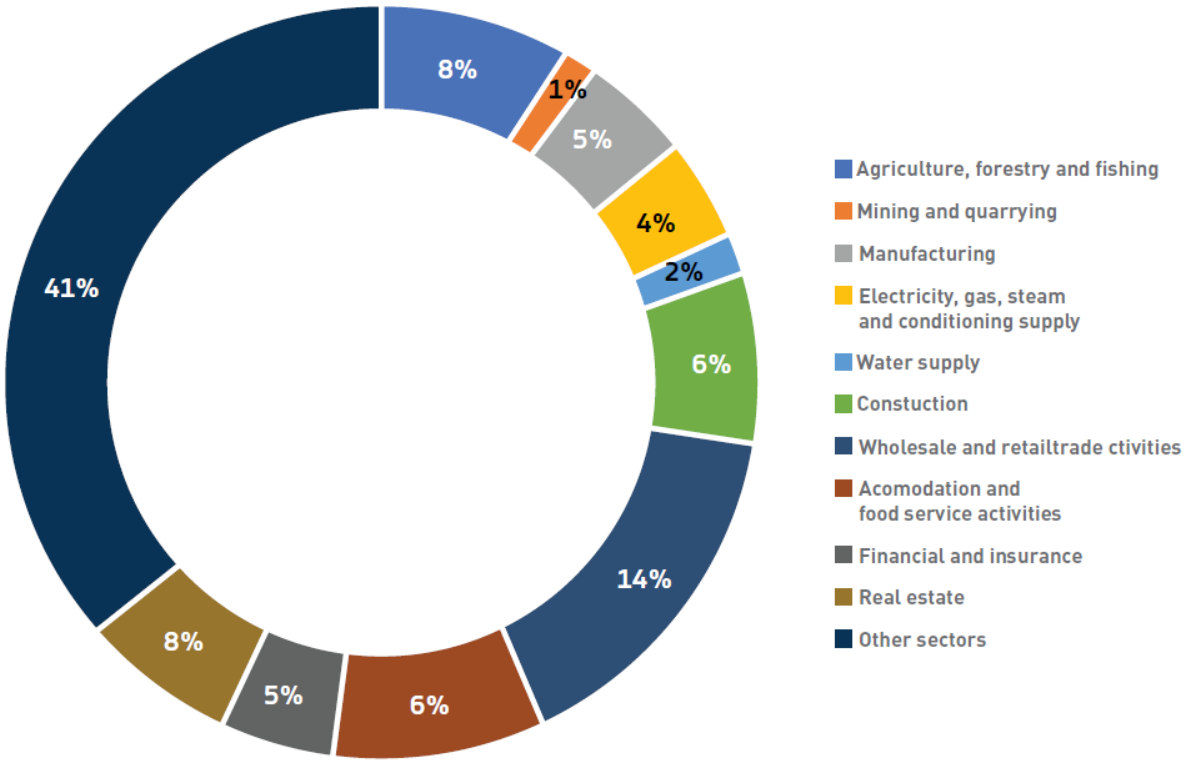



*Figure 1: Montenegro's GDP structure – 2018 (Other sectors includes: public administration; professional, scientific, and technical activities; education; human health; and transportation)*

[5] https://monstat.org/eng/publikacije_page.php?id=1814

Montenegro's population is experiencing poverty and income inequality. However, in the last few years the conditions have improved. The at-risk-of-poverty rate in Montenegro in 2017 was 23.6%, which was 1.6% lower compared to 2013. A decreasing trend is also recorded in the relative at-risk-of-poverty gap, since the value of this indicator in 2013 was 39.7%, and in 2017 it was 34.0%, which is a decrease of 5.7%. The permanent at-risk-of-poverty rate for the period 2013–2016 was 15.6%. Income distribution inequality reduced from the value of 8.5 recorded in 2013 to 7.6 recorded in 2017 (MONSTAT, 2018).

### *ii. Strategy relating to the five dimensions of the Energy Union*

There are three key legal and strategic acts that address the dimension of decarbonisation.
**Energy Policy of Montenegro by 2030** (hereinafter the Energy Policy), which takes into account three main priorities (security of energy supply, the development of a competitive energy market and sustainable energy development in the country). The Policy will be updated soon, in line with the Energy Law.
**Energy Development Strategy (EDS) until 2030 with Action Plan 2016-2020** and **The National Climate Change Strategy (NCCS)** until 2030 and appropriate Strategic Environmental Impact Assessments (SEIA) were adopted in 2012 and 2015 respectively. The NECP will replace both Strategies for the post-2020 period. This also applies with the **National Renewable Energy Action Plan of Montenegro.**
**National Strategy for Sustainable Development (NSSD) until 2030** together with a corresponding Action Plan was adopted in 2016, integrating the UN Agenda for sustainable development until 2030. The document represents a strategic framework for the transposition of the UN sustainable development goals and defines a set of indicators to track national progress on the implementation of the sustainable development policy, which also involves the establishment of an indicator-based reporting information system.

The Law on Protection against Negative Impacts of Climate Change introduces the obligation to develop a Low-Carbon Development Strategy with an Action Plan.
The **Low Carbon Development Strategy** is now delegated through the preparation of IPA III, IPA 2021 Action Document. It should be noted that the **Low-Carbon Development Strategy (LCDS)** until 2050 as well as **National Adaptation Plan (NAP)** have not been prepared but envisaged by the recent Law on the Protection against adverse impacts of Climate Change. These acts will be in line in line with the NECP requirements.
The development of LCDS has been delegated as one of the priority activities within the project "Technical support for monitoring and implementation of environmental protection and climate action policies", funded by the IPA 2016 programme. Due to the newly created situation in relation to COVID 19, the European Union has supported Montenegro in the fight against the spread of the virus and the recovery of the economic consequences of the epidemic by reallocating the funds from the approved IPA programme. A certain amount of funds has been directed from the Environment and Climate Action sector and allocated to the Competitiveness and Innovation sector, in order to support small and medium-sized enterprises on a larger scale. In this context, the tender procedure for the service contract Technical Support for Monitoring and Implementation of Environmental and Climate Action Policies has been cancelled.

The Ministry of Ecology, Sustainable Development and Development of the North, in cooperation with the UN Development Programme, has prepared a project proposal for the development of the National Plan for Adaptation to Climate Change, which was finalized in the first half of 2020 in accordance with comments received from the Green Climate Fund (GCF). The project proposal for the development of the NAP has been approved by the GCF and implementation has started. Besides, the Ministry is participating in the project TRATOLOW, that follows and builds on previous initiatives such as the Environment and Climate Regional Accession Network (ECRAN, 2013-2016) and the Regional Implementation of Paris Agreement Project (RIPAP, 2017-2018), that have successfully fostered regional cooperation and cooperation with EU Member States and have contributed to the strengthening of capacities in beneficiary administrations. The overall objective of the project is to contribute to climate change mitigation and adaptation and the development towards a resource efficient, low emissions and climate resilient economy. The purpose of the project is:

- to support the Beneficiaries to build their capacity for the implementation of the 2015 Paris Agreement and for the development of low emissions and climate resilient economies;
- to enhance the regional exchange of information, best practices, peer to peer reviews, experience and awareness raising between the IPA II beneficiaries and the Member States towards the implementation of Beneficiaries' commitments under the Paris Agreement.

The dimensions of energy efficiency, energy security and the internal energy market have been elaborated within the framework of the Energy Development Strategy.

The national strategy relevant to the dimension of research, innovation and competitiveness is the **Smart Specialisation Strategy (S3) 2019–2024.**
With regard to these strategies, this document also outlines systematized measures expected to contribute to research, innovation and competitiveness of the national economy in sectors relevant to the energy transition.

Other strategies with cross-dimensional relevance are described below:

**Industrial policy of Montenegro 2024-2028** respects the principles based on the development of the green economy, resource efficiency and sustainable production and consumption, industrial waste management, introducing environmental standards and defining measures and activities for their implementation. The industrial policy is aimed at digital transformation and improvement of the innovative performance of companies, as well as their transformation towards green and sustainable business, which will enable an increase in the competitiveness of Montenegrin industry for faster integration with the EU single market. The strategic goals are:

- Improving the environment for the digital and green transition of the industry;
- Growth of investments and financing models for long-term competitiveness of the industry;
- Encouraging innovation based on the principles of smart and sustainable industry development;

- Improving access to the EU single market and strengthening regional economic cooperation.

**Transport development strategy of Montenegro for the period 2019-2035** determines the situation in the areas of transport, defines the infrastructural, organizational and operational goals of the development of the transport system, which are realized through short-term and long-term implementation plans. The Strategy sets out plans for improving the economic development, efficiency, safety, connectivity and ecological sustainability of the country's transport system, ensuring at the same time the integration of the transport sector and the completion of the process of harmonizing the regulatory framework of the transport sector with the acquis of the EU, environmental and safety standards and obligations. The most important strategic goal is Environmental sustainability which includes:

- Reduction of carbon dioxide emissions, noise levels and the impact on the natural, historical and socio-economic environment.

Also, three priority areas are in direct correlation with 5 dimensions:

- Management of railway and port services
- Introduction of Intelligent Transport Systems (ITS)
- Intermodality and freight transport in road traffic.

**Tourism development strategy of Montenegro for the period 2022-2025** is developed in order to ensure the further development of tourism, an increase in employment, raising the standard of living population standards, more balanced regional development, but also the improvement of global recognition of the country. Also, the Government of Montenegro is committed to the continuous sustainable development of tourism, with a focus on efficient use of resources, with the promotion of Montenegro as a sustainable, inclusive, green and smart tourist destination. Green and responsible tourism is one of the strategic goals. Some of the measures are:

- Environmental certification - a voluntary mechanism confirmation of the quality of sustainable business. The certification process involves an expert assessment business compliance with certain sustainability criteria.
- E-mobility
- Increasing the energy efficiency of tourist facilities with electricity saving measures
- Energy transition towards renewable energy sources - use of solar energy in tourist facilities.

**The strategy for the development of agriculture and rural areas in period 2023-2028** represents the development strategy of Montenegro, where directions for the management of agricultural resources are determined in a long-term sustainable way. This strategy provides a vision and a plan for implementing the strategic transformation of agriculture and rural areas in Montenegro until 2028, which will ensure the implementation of a different series of activities and measures. It is important to emphasize Strategic goal 2: Ensure efficient management of natural resources of Montenegro and achieve the goals of the Green Agenda which includes:

- Contribute to mitigating climate impacts, including reducing greenhouse gas emissions and improving carbon sequestration, as well as promoting sustainable energy

- Support sustainable development and effective management of natural resources such as water, land and air, including reducing dependence on chemicals
- Contribute to stopping the process of biodiversity loss

**Forest and forestry development strategy of Montenegro for the period 2023-2028** establishes goals and guidelines for the development of forests and forestry, in accordance with national forestry policy, measures for the improvement of forests, as well as indicative financial means for implementing the strategy and the way to provide them. National forest inventory is carried out for the purpose of drafting strategic planning documents in forestry and exchange information in accordance with the law (at national and global level). Important strategic goals are:

- Preserving and strengthening the capacity of forests for resilience and adaptation and climate change resilience, including fire prevention and other solutions
- Encouraging the sustainability and competitiveness of industries based on forests, bioenergy and beyond green industry and circular economy.

**Waste management strategy until 2030** is under preparation (draft phase). The strategy has the task of defining the aspirations of the state with regard to the organization of the functioning system, to define priorities and direct the development and organization of the waste management system in accordance with the requirements of the legislation and assumed obligations, as well as the current real possibilities of Montenegro as a country, to define clear directions movements and specific tasks in terms of achieving the desired goals in all sub-areas that make the waste management system complete, to, if possible, define the deadlines for achieving the stated goals, as well as to establish the way of monitoring the achievement of the set goals. Some of the specific goals of the Strategy are:

- accelerated and intensive development of public awareness about the necessity of solving the situation in the country with regard to waste management, as well as about the equally important and binding participation of the population, economy and state institutions in the functioning and respect of the established waste management system;
- introducing the principles of circular economy into the production and trade system in Montenegro with the clear goal of improving the reuse of materials and products;
- achieving a satisfactory level of development and intensive application in practice of the system of primary and secondary waste selection, all with the aim of collecting recyclable, primarily packaging, materials for reuse and/or recycling, i.e. their economic valorization, i.e. processing into other products of similar or lower quality, which certainly have a place on the market;
- increasing the degree of separation and utilization of biodegradable waste;
- increasing the degree of separation and adequate recycling and disposal of construction waste and demolition waste;
- provision of sewage sludge treatment;
- reducing the amount of waste that must be permanently disposed of at one of the landfills;
- preparation of the waste management system for the future use of energy from waste and/or thermal treatment of waste.

### *iii. Overview table with key objectives, policies and measures of the plan*

The key objectives outlined in the Integrated Energy and Climate Plan are the reduction in greenhouse gas emissions for 2030, the share of RES in the gross final energy consumption and energy efficiency, expressed as consumption of primary energy and direct consumption of energy.
Table 1.2 presents national targets with respect to primary energy consumption, final energy consumption, share of renewable energy in the gross final energy consumption and reduction of GHG emissions in target year (2030), as well as the estimation of the level of reaching of the goals for WEM (business as usual scenario with existing measures) and WAM scenarios (WEM scenario strengthened by adding new measures in order to reach the national goals).
The EnC targets for Montenegro are also presented to demonstrate compliance with the EnC provisions respectively to show that the targets are in the same order of magnitude as the results of the WAM scenario.

| Key Objectives | EnC Targets for Montenegro [6] | National targets | WEM scenario in 2030 | WAM scenario in 2030 |
|---|---|---|---|---|
| Primary energy consumption | 0,92 Mtoe | 0.92 Mtoe | 1.04 Mtoe | 0.97 Mtoe |
| Final energy consumption | 0,73 Mtoe | 0.73 Mtoe | 0.82 Mtoe | 0.77 Mtoe |
| Share of renewables in the gross final energy consumption | 50 % | 50 % | 43 % | 53 % |
| GHG emission decrease[7] | 55 % (total 2.42 $MtCO_{2eq}$) | 55 % (total 2.42 $MtCO_{2eq}$) | total 3.06 $MtCO_{2eq}$ | total 2.40 $MtCO_{2eq}$ |

*Table 1.2: Overview of the key objectives with projections*

As it can be seen from the following table, the major difference between WEM and WAM scenario is in the usage of renewable energy for electricity production and consumption of renewable energy (biofuels and electricity) in the transport sector. This led to significant increase of RES share in the transport an as a consequence also to decrease of GHG emissions from transport sector (which is recognized as the second most intensive sector with respect to GHG emissions).

| RES share per sector | WEM scenario in 2030 [%] | WAM scenario in 2030 [%] |
|---|---|---|
| RES T | 7 | 24 |
| RES E | 66 | 79 |
| RES HC | 49 | 49 |

*Table 1.3: Overview of RES share per sector (transport, electricity production and heating and cooling)*

Table 1.4 presents an overview of all existing policies and measures (WEM scenario) and additional policies and measures designed in order to reach the national goals in target year (WAM scenario) with pointing out targeted EU dimensions and sectors.

[6] https://www.energy-community.org/implementation/package/CEP.html
[7] This target excludes LULUCF emissions and removals.

There are 45 PaMs in total. More than half of them target Decarbonisation dimension (23 PaMs) since reaching of the GHG target is by far the most challenging task. Also, there are more PaMs defined for WEM scenario than for WAM scenario, but in terms of reaching of the key objectives, PaMs defined for WAM scenario are significantly more effective.

| Policies and measures | Dimensions | Target sector | WEM | WAM |
|---|---|---|---|---|
| Environmental refurbishment of Thermal Power Plant (TPP) Pljevlja | Decarbonisation | Energy industries / electricity generation | × | |
| New renewable power plants | Decarbonisation | Energy industries / electricity generation | × | |
| Additional renewable power plants | Decarbonisation | Energy industries / electricity generation | | × |
| Refurbishment of small hydro power plants (increased EE) | Decarbonisation | Energy industries / electricity generation | × | |
| Development of decentralized energy generation (distribution medium voltage connection) | Decarbonisation | Energy industries / electricity generation | × | |
| Additional development of decentralized energy generation (distribution medium voltage connection) | Decarbonisation | Energy industries / electricity generation | | × |
| Promotion of e-mobility | Decarbonisation | Transport | | × |
| Introduction of mandatory share of biofuels in fuel supply | Decarbonisation | Transport | | × |
| Uniprom KAP: electrolysis cells replacement and overhauling | Decarbonisation | Industry | × | |
| Uniprom KAP: Cell hibernation | Decarbonisation | Industry | | × |
| Reduction of HFCs in line with the Law Acknowledging Amendments to the Montreal Protocol on Substances that Deplete the Ozone Layer | Decarbonisation | Industry | × | |
| Prosumers in industry | Decarbonisation | Industry | | × |
| Biofuels in industry | Decarbonisation | Industry | | × |
| Financial incentives for introduction of hybrid special working machines in industry sector | Decarbonisation | Industry | | × |
| Development of decentralized energy generation by producer - customers (prosumer) | Decarbonisation | Residential / commercial sector | × | |
| Additional development of decentralized energy generation by producer - customers (prosumer) | Decarbonisation | Residential / commercial sector | | × |
| Support for organic agricultural production | Decarbonisation | Agriculture | | × |
| Support to Manure Management | Decarbonisation | Agriculture | | × |
| Reduction of bio-waste in municipal waste | Decarbonisation | Waste | × | |
| Increase of connection rate to sewage system (target 93% by 2035) | Decarbonisation | Waste | × | |
| Increase of CH4 recovery in landfills | Decarbonisation | Waste | | × |
| Reduction in the area annually affected by wildfires | Decarbonisation | LULUCF | | × |
| Further increases in the share of industrial round wood used for long-term products | Decarbonisation | LULUCF | | × |
| District Heating in Pljevlja | Energy efficiency | Energy industries / heat generation | | × |
| Reduction of losses in the electricity transmission power network | Energy efficiency | Energy industries / electricity transformation | × | |
| Reduction of losses in the electricity transmission power network | Energy efficiency | Energy industries / electricity transformation | × | |
| Ban on import of old vehicles (Euro 4 or lower standard) | Energy efficiency | Transport | | × |
| Passenger transport modal shift to public bus transport | Energy efficiency | Transport | | × |
| Passenger and freight transport modal shift to rail | Energy efficiency | Transport | | × |
| Development and implementation of energy efficiency regulatory framework in buildings | Energy efficiency | Residential / public / commercial | × | |
| Increased energy efficiency in public buildings | Energy efficiency | Public | × | |

| Policies and measures | Dimensions | Target sector | WEM | WAM |
|---|---|---|---|---|
| Energy labeling and ecodesign requirements for energy related products | Energy efficiency | Residential / public / commercial | × | |
| Establishment and implementation of EE criteria in public tendering | Energy efficiency | Residential / public | × | |
| Implementation of energy efficiency measures in public municipal companies | Energy efficiency | Public | × | |
| Establishment and development of energy management in public sector | Energy efficiency | Public | × | |
| Financial incentives for citizens/private households (for energy efficiency investments) | Energy efficiency | Residential | × | |
| Market coupling | Internal Energy Market | Energy industries / electricity transformation | × | |
| Imbalance netting | Internal Energy Market | Energy industries / electricity transformation | × | |
| Development of electricity transmission power network | Security | Energy industries / electricity transformation | × | |
| Development of electricity distribution power network | Security | Energy industries / electricity transformation | × | |
| Developing battery electric storage systems (BESS) | Security | Energy industries / electricity transformation | | × |
| Smart Specialisation Strategy of Montenegro 2019-2024 | Research, Innovation & Competitiveness | All sectors | × | |
| Law on incentives for research and innovation development | Research, Innovation & Competitiveness | All sectors | × | |
| Programme for improvement of competitiveness of Montenegrin economy and Industrial Policy of Montenegro – Programme line for incentivising circular economy (link to PaM Transition to circular economy) | Research, Innovation & Competitiveness | All sectors | × | |
| Continuation of Programme for improvement of competitiveness of Montenegrin economy and Industrial Policy of Montenegro – Programme line for energy efficiency in industry | Research, Innovation & Competitiveness | All sectors | × | |

*Table 1.4: Overview of policies and measures*

## 1.2 Overview of current policy situation

*i. National energy system and policy context of the national plan*

National energy system

All figures in this chapter are based on the data form energy balance (Source: National Statistical Office). Significant import dependence and low fuel diversification are the main characteristics of Montenegrin energy supply. There are four types of fuel in final energy use in Montenegro: coal (mostly lignite), mineral oil products, wood fuels and electricity (see Figure 2). Coal is mainly (99 % share) used for electricity production (it is responsible for 40-60% of annual electricity supply). Mineral oil products are mainly used in the transport sector (over 70 % share). Wood fuels are mainly used in residential and service sectors (86% and 9 %, respectively).

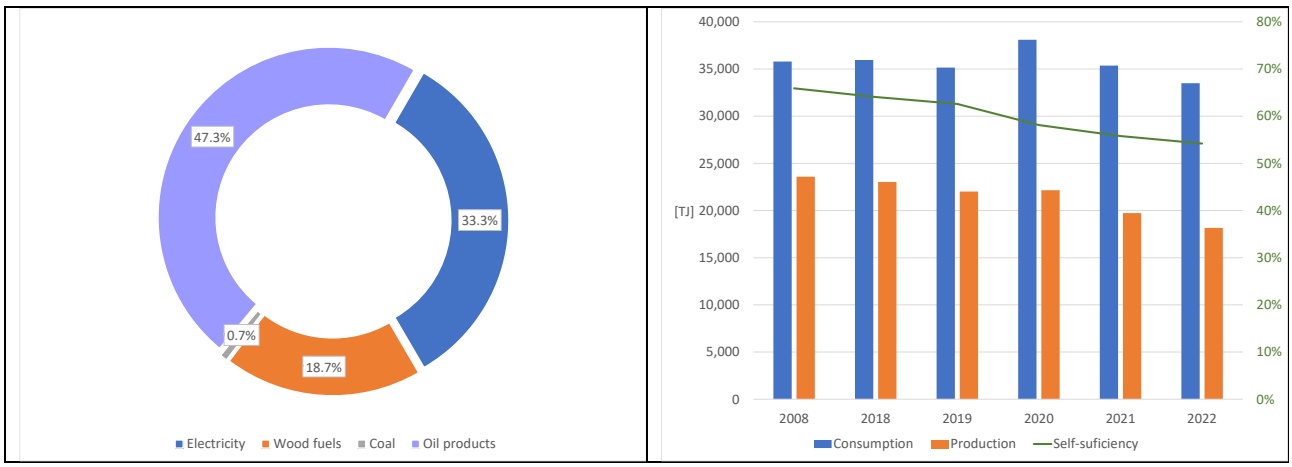



*Figure 2: Final energy use per type of fuel in 2022 and historical trend of consumption*

All needs for fuels are supplied from national sources except the need for mineral oil products which is supplied from imports (100 % of consumption). Oil products are the most dominant fuel in the final energy balance (47%) and this fuel determines the self-sufficiency level of national energy balance (54%-66%). Electricity is also an important component of the final energy balance (with increasing importance in the future) but almost all the needs for it are supplied from domestic production. However, it is important to emphasize that although there is enough electricity production for domestic needs at the annual level, there is a need for significant import during the second and third quarter of the year because the main electricity production corresponds to hydro power plants which are characterized by lower production during dry part of the year (period of the year with high demand because of touristic season). A great share of hydro power plants production is also the main reason why there is a significant change in self-sufficiency level of national energy balance over years (strong dependence on hydrology i.e. weather conditions throughout a year).

Total **final energy consumption** in recent years varies between 33 PJ and 38 PJ (see Figure 2) and it is expected to slightly increase in the next five-year period. Main driver of the demand increase in future is industry development (currently heavy industry is at its lowest production level in history). The most energy intensive sectors are the transport and the residential sector which consume more than two thirds of the total final energy (see Figure 3). However, their

fuel mix significantly differs. The most dominant fuel in the transport sector is diesel (80 % share) and the share of gasoline is 15 %. The remainder are LPG (3,5 %) and electricity (1,5 %). On the other hand, the fuel mix of the residential sector includes only electricity and fuel wood which together make a 99 % share. Taking into account that the electricity is mainly produced by hydro power plants and wind power plants (typically 60 % share) it is clear that carbon footprint of the residential sector is significantly lower than it is for the transport sector. This difference will be even more expressed in the following years due to expansion of prosumer concept in the residential sector. Therefore, only policies and measures targeting the transport sector are effective in terms of achieving the GHG target on the country level. With the expansion of prosumer concept and development of new renewable power plants the residential sector will become close to totally decarbonized by 2030.

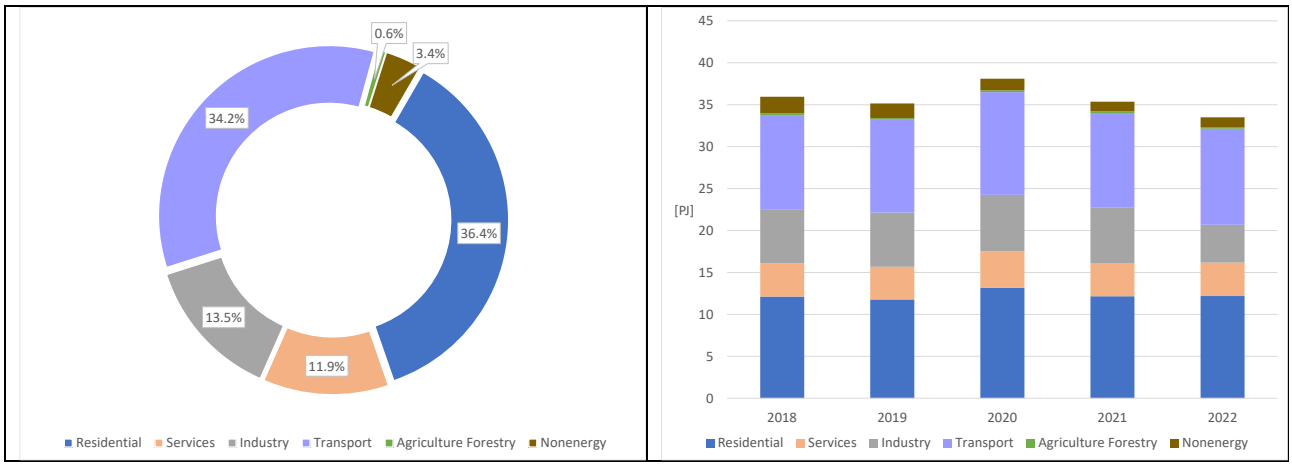



*Figure 3: Final energy use per sector in 2022 and historical trend of sectorial consumption*

As for **primary energy production** (see Figure 4), there are several sources: coal, wood fuels and renewables (hydro, wind and solar). Almost all the coal production (more than 99 % share) is used in thermal power plant for electricity production, as well as all renewables (2 large hydro power plants and currently 38 small hydro power plants, 2 wind power plants and 5 small solar power plants). During the last 3 years there is an ongoing expansion of prosumers (mostly PV plants at residential consumers sites) which has more and more impact on electricity mix of the country (currently ca 70 GWh per year which is 5 % of the total electricity consumption of the residential sector). Total primary energy production is around 30 PJ. Although coal has the most dominant place in the structure of the electricity production, renewable energy will play the most important role in the further development of the energy mix in Montenegro since there are plans for expansion of wind and solar energy use.

**Thermal Power Plant Pljevlja** has been the most stable source of electricity for the past 40 years. TPP Pljevlja with HPP Perucica and HPP Piva cover more than 85 % share of domestic electricity production. All of these plants are operated by state owned company (EPCG). This company is the only public supplier of electricity. As it was mentioned earlier, annual electricity production from hydro power plants is volatile on an annual and monthly basis so the significance of stable electricity production from TPP Pljevlja is great. Although the cost of TPP Pljevlja electricity production is significantly higher than the cost of electricity production of mentioned HPPs, the combined effect of their operation throughout a year enables a very competitive electricity price for the company that operates with these plants. Additionally, it is important to emphasize that the electricity price for consumers in Montenegro is significantly

subsidized due to the social standard level of citizens. That is made possible by the mentioned company which is state owned, and it is responsible for public electricity supply.

This company will continue to rely on TPP Pljevlja in the future until secure operation of the system with a sufficient number of new renewable energy sources is ensured.

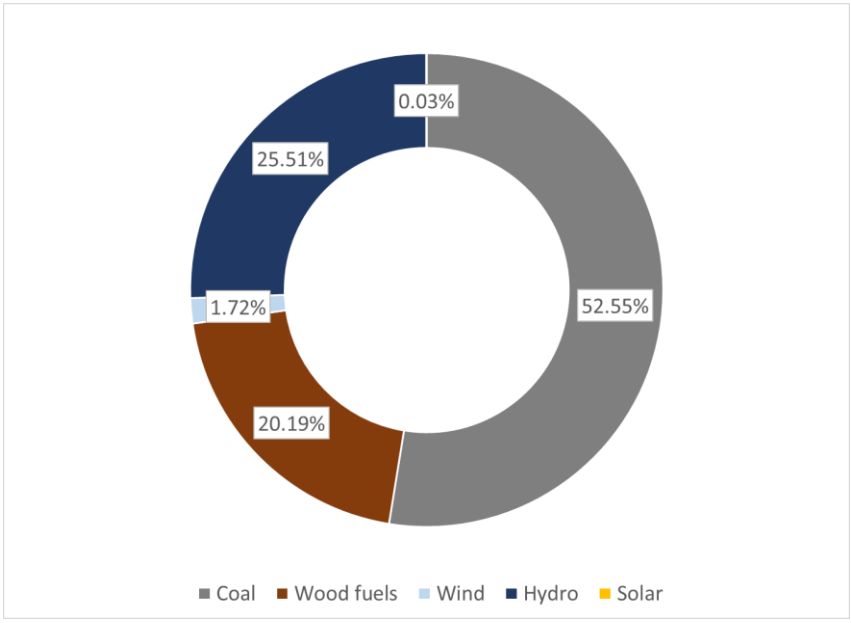



*Figure 4: Primary energy production*

If the electricity produced by the TPP Pljevlja were to be replaced with imported electricity, the price of electricity for consumers would significantly increase. The revised project documentation and accompanying guarantees indicate that the ecological reconstruction of the TPP Pljevlja will result in the fulfillment of all criteria for obtaining the environmental work permits. This reconstruction does not aim to reduce greenhouse gas emissions, but due to the nature of the project, there will be a certain increase in energy efficiency. The main goal of the ecological reconstruction of the TPP Pljevlja is to meet the prescribed standards for emissions for plants of that type, all in order to obtain the so-called environmental work permits. It is clear that the cost of electricity produced in TPP Pljevlja will increase in the near future due to carbon related additional costs but due to its great social and economic impact, especially with regard to the Dimension Energy Security, it will remain in operation. It is expected that this plant is operational up to 2035-2037 but with a certain lowering of operating hours over the years necessary to help meet the national goals.

The **total installed capacity of all power plants** in Montenegro at the end of 2023 was 1,067.238 MW. An overview of installed power by energy entities and power plants is shown in Table 1.5.

| Operator | Power Plant | Installed power [MW] |
|---|---|---|
| EPCG AD Nikšić | TPP Pljevlja | 225.000 |
| | HPP Piva | 342.000 |
| | HPP Perućica | 307.000 |
| | sHPP Rijeka Crnojevića | 0.650 |
| | sHPP Lijeva Rijeka | 0.110 |
| | sHPP Rijeka Mušovića | 1.950 |
| | sHPP Podgor | 0.465 |
| | sHPP Šavnik | 0.200 |
| DOO Zeta Energy Danilovgrad | sHPP Glava Zete | 4.480 |
| | sHPP Slap Zete | 1.672 |
| DOO Hidroenergija Montenegro Podgorica | sHPP Jezerštica | 0.844 |
| | sHPP Bistrica | 5.600 |
| | sHPP Rmuš | 0.474 |
| | sHPP Spaljevići 1 | 0.650 |
| | sHPP Orah | 0.954 |
| | sHPP Šekular | 1.665 |
| | sHPP Jelovica 1 | 3.285 |
| | sHPP Jelovica 2 | 0.619 |
| DOO Synergy Podgorica | sHPP Vrelo | 0.615 |
| DOO Igma Energy Andrijevica | sHPP Bradavec | 0.954 |
| | sHPP Piševska Rijeka | 1.080 |
| DOO Kronor Podgorica | sHPP Jara | 4.568 |
| | sHPP Babino polje | 2.214 |
| DOO Hydro Bistrica Podgorica | sHPP Bistrica Majstorovina | 3.600 |
| DOO Nord Energy Andrijevica | sHPP Šeremet Potok | 0.792 |
| DOO Simes Inžinjering Podgorica | sHPP Ljevak | 0.551 |
| DOO Small Hydro Power Plant Kutska Andrijevica | sHPP Kutska 1 | 1.800 |
| DOO Small Hydro Power Plant Mojanska Andrijevica | sHPP Kutska 2 | 0.810 |
| DOO Small Hydro Power Plant Mojanska Andrijevica | sHPP Mojanska 1 | 1.600 |
| DOO Small Hydro Power Plant Mojanska Andrijevica | sHPP Mojanska 2 | 1.050 |
| DOO Small Hydro Power Plant Mojanska Andrijevica | sHPP Mojanska 3 | 0.720 |
| DOO BB Hidro Podgorica | sHPP Lipovska Bistrica | 0.993 |
| DOO Power AB Group Kolašin | sHPP Bukovica | 0.282 |
| DOO Viridi Progressum Kolašin | sHPP Paljevinska | 0.553 |
| DOO Đekić Podgorica | sHPP Pecka | 0.821 |
| DOO Manira Hydro Mojkovac | sHPP Elektrana Mišnića | 0.222 |
| DOO „Hidroenergija" Andrijevica | sHPP Štitska | 0.893 |
| DOO „Hidroenergija" Andrijevica | sHPP Umska | 0.442 |

| | | |
|---|---|---|
| DOO Vodovod i kanalizacija Andrijevica | sHPP Krkori | 0.374 |
| DOO SHPP Vrbnica Podgorica | sHPP Vrbnica | 6.750 |
| DOO Benergo Berane | sHPP Miolje polje | 0.288 |
| DOO Krnovo Green Energy Podgorica | WPP Krnovo | 72.000 |
| DOO Možura Wind Park Podgorica | WPP Možura | 46.000 |
| DOO Eco Solar System Danilovgrad | PV DG | 0.997 |
| DOO Bar-Kod Podgorica | PV Bar-Kod | 0.585 |
| DOO Invicta Podgorica | PV Invicta | 0.416 |
| „Fudbalski savez Crne Gore" Podgorica | PV FSCG | 0.032 |
| SE „Milenijum" | PV Milenijum | 0.086 |
| DOO „Čevo Solar" Podgorica | PV Čevo | 3.250 |
| Prosumers | PV | 13.766 |
| Prosumers | sHPP | 0.012 |
| | **TOTAL** | **1,067.238** |

*Table 1.5: Generation capacities in Montenegro*

**Depending on the energy source used for electricity generation**, the capacities are divided into hydropower plants, thermal power plants, wind power plants and solar power plants. In the energy mix (installed power), hydropower plants are represented with 66.05 % (704,904 MW), thermal power plants with 21.08 % (225 MW), wind power plants with 11.06 % (118 MW), and solar power plants with 1.81 % (19.334 MW) in relation to the total installed production capacity.

In 2022, 3,235.09 GWh of electricity was generated. The share of electricity produced in renewable power plants was 55,05 % (45,08 % + 9,97 % from HPPs and WPPs respectively). The remainder of electricity production came from TPP Pljevlja. Only year after the situation was significantly different. Total amount of electricity generated was 4,046.71 GWh (2023) where the share of renewable energy was 62,36 % (54,29 % corresponds to HPPs). This shows how hydrological circumstances affect the electricity mix of Montenegro.

Already in 2016, 41.60% of the gross final electricity consumption came from renewable energy sources, thus exceeding the 2020 target of 33%, mostly due to the revision of statistical data on biomass.

In 2018, Montenegro exported 976 GWh of electricity, which is 25.12% more than imports, which amounted to 780 GWh.

During the period 24th May to 2nd June 2019, for the first time Montenegro produced enough electricity from renewable energy sources to meet all needs. Wind power plants Krnovo and Možura produced 12% of the electricity consumed.

Significant activities related to the diversification of electricity sources are underway, such as: construction of a solar power plant at the location Briska Gora (50+200 MW), preparation of tender documentation for the solar power plant in Velje Brdo (50 MW), creating conditions for the implementation of the Gvozd (54.6 MW) and Brajići (100.8 MW) wind farm projects.

So far, the construction of 32 sHPPs was completed, which perform concession activities. Only in 2020, 13 small hydropower plants were put into operation. Before 2020, 15 sHPPs were completed, additional 11 in 2020 and 6 in 2021, all of which operate as privileged producers in line with its concession agreements.

New projects planned to be implemented by EPCG (status December 2021):

WF Gvozd – 54.6MW, 150GWh
SPP Briska Gora – 50+200 MW, 90+360 GWh
HPP Komarnica – 171.9MW, 213GWh
HPP Perućica – Agregat A8 – 58.5 MW, -50 GWh
SHHP Otilovići – 3.3 MW, 11.4 GWh
HPP Kruševo – 90MW, 235 GWh
SPP Velje Brdo – 50 + 100 MW, 80 + 160 GWh
SPP Vilusi I - 30 MW, 45 GWh
SPP Dragalj/Vilusi II - 80 MW, 140 GWh
SPP Čevo - 100 MW, TBD
SPP Slano - 33,6 MW + 5-7 MW

**Road transport is the main mode for passengers**, while **rail is used for freight transport** (see Figure 5). The economic situation is such that the main users of freight transport by rail have found an alternative or reduced their business volume.

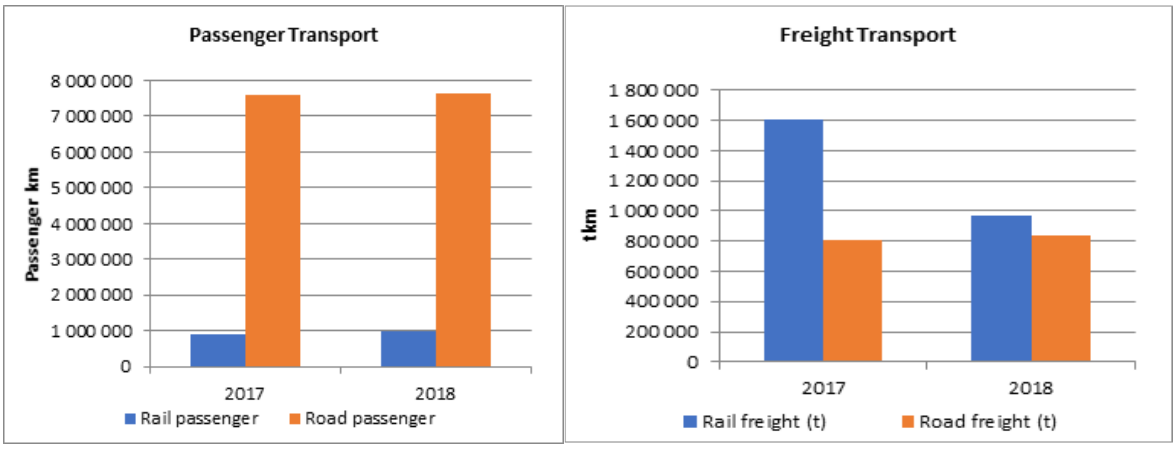



*Figure 5: Passenger and Freight Transport per mode*

There is a **high dependence on private vehicles**. There are no $CO_2$ emissions standards for passenger vehicles in force, but the regulation on the content of labels, guides, posters, displays and other promotional literature and materials on fuel consumption and carbon dioxide emissions from new passenger cars for such standards is currently under preparation. This Rulebook will additionally transpose Directive 1999/94/EC.

The total final consumption of petroleum products in 2020 amounted to 320 thousand tons, of which 268.2 thousand tons were spent in the transport sector, 59.0 thousand tons in the industry. In the total final consumption of petroleum products in 2018, traffic participated 68.9%, while industry had a share of 15.2%, the rest 15.9%. Import of petroleum products in 2018 amounted to 418.3 thousand tons.

Montenegro has so far concluded two Concession Contracts for the **Production of Hydrocarbons** Offshore of Montenegro, in accordance with the Law on Exploration and Production of Hydrocarbons:

1) Concession Contract for Production of Hydrocarbon for Blocks 4118-4; 4118-5; 4118-9; 4118-10, with a total area of 1,228 km2, which was concluded on 14 September 2016 with the companies Eni Montenegro BV, the Netherlands and Novatek Montenegro, BV the Netherlands.

Duration of the Exploration Phase is seven (7) years, with two Exploration Periods (sub - phases) of four (4) and three (3) years.

The Government of Montenegro, on its sessions from 12 March and 29 December 2020, approved the requests of the concessionaire for the extension of the first Exploration Period, i.e. the Exploration Phase, for total of 18 months. The first Exploration Period will last until 14 March 2022, while Exploration Phase will last until 14 March 2025.

On 3rd April 2021, concessionaires have started drilling of the first exploration well offshore of Montenegro. Well depth is 6.5 km and it is situated 27 km of the port of Bar, where see depth is 99 meters. Main target of the concessionaires is commercial discovery of oil.

In accordance with the contract, within the first Exploration Period concessionaires are obliged to drill another well, which estimated depth is 1,045 m, on 14 km distance from port of Bar, where see depth is 72 m. Main target of the Concessionaires is discovery of gas, where further G&G analysis and market analysis will provide an answer if commercial exploitation is possible, having in mind low demand for gas in Montenegro and lack of gas infrastructure.

By mid-2022, the Concessioners were supposed to make decisions on further investments in the project, depending on the results of the current drilling campaign. However, in February 2022 it was clear that the drillings were not successful.[8]

2) Concession Contract for Production of Hydrocarbon for Blocks 4219-26 and 4218-30, with a total area of 338 km2, which was concluded on March 15, 2017, with the company Energean Montenegro Limited, Cyprus.

Duration of the Exploration Phase is seven (7) years, with two Exploration Periods (sub - phases) of three (3) and four (4) years.

The Government of Montenegro, on its sessions from 19 December 2019 and 31 July 2020, approved the requests of the concessionaire for the extension of the first Exploration Period, i.e. the Exploration Phase, for total period of two (2) years. The first Exploration Period will last until 15 March 2022, while Exploration Phase will last until 15 March of 2026.

Within the first Exploration Period Concessionaire is obliged to conduct 3D geophysical survey, which is already executed, and to developed set of G&G studies. Within the first Exploration Period Concessionaire is obliged to farm out 41% of Participating Interest to a new partner.

By mid-2022, Concessioners should have made decisions on further investments in the project including finding a new partner. However, Concessionaires did not meet the requirements to enter the second Exploration Period, and the contract was terminated.[9]

[8] https://balkangreenenergynews.com/no-oil-gas-in-first-offshore-test-hole-in-montenegro-but-more-drilling-ahead/

[9] https://montenegrobusiness.eu/montenegro-business-recent-energy-offshore-hydrocarbon-exploration/

It is planned to continue the exploration of hydrocarbons, and further plans for exploration of oil and gas in Montenegro, including possible new licensing rounds, will be aligned with new Government and EU policies in the energy and climate sector.

Montenegro currently does not have access to natural gas sources, nor infrastructure to support its use. The Energy Development Strategy until 2030 clearly recognizes natural gas as an important energy source, which would contribute to the diversification of the Montenegrin energy mix and thus to increasing energy security. It is planned to use natural gas as a substitute for other more carbon-intensive forms of energy, and in particular for the use of electricity and coal for heating and cooling.

Natural gas is considered the most environmentally friendly among fossil fuels because it has the lowest carbon dioxide emission factor per unit of energy released compared to other fossil fuels. As such, compared to other fossil fuels, it pollutes the environment less and will therefore become increasingly important as the stocks of existing fossil fuels decrease.

In 2017, the Government of Montenegro adopted the Master Plan for Gasification of Montenegro, which together with the Report on Strategic Environmental Assessment and Guidelines for Planning Priority Investments in Gas Pipeline Projects forms the umbrella document for the natural gas sector in Montenegro.

The master plan considers possible supply scenarios for Montenegro and concludes that it is most realistic for Montenegro to be supplied with natural gas by building the Ionian-Adriatic Gas Pipeline (IAP) and to valorize its gas reserves from the Adriatic submarine, as the hydrocarbon exploration efforts described in the sections above show.

The Government of Montenegro is primarily focused on the implementation of policy measures targeting the households and service end-use sectors.

Policy Context of the Plan

Through technical support provided by the regional project CDCP III financed by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Montenegro started with preparation of NECP elaboration.

With regard to energy data for planning and progress monitoring, the Ministry of Energy and MONSTAT should harmonize methodology of data collection and processing for preparation of the final energy balances and monitoring for implementation.
The Ministerial Council of the EnC in November 2021 adopted Decision No 2020/12//MC-EnC on the implementation of the Commission Regulation (EU) 2019/2146 of 26 November 2019 amending Regulation (EC) No 1099/2008 of the European Parliament and of the Council on energy statistics, as regards the implementation of updates for the annual, monthly and short-term monthly energy statistics (EC).

**Decarbonisation (GHG emissions and removals; renewable energy)**

Climate change issues have been regulated by the recent Law on Protection against Adverse Impacts of Climate Change.
With the Third National Communication (TNC), Montenegro is once again fulfilling its international obligations under the UNFCCC. This report includes the results of new GHG

inventories for 2016 and 2017, recalculation of previous time series from 1990 onwards, as well as general description of measures formulated, adopted, and implemented for the management and planning of GHG emission reductions. It also presents the climate profile of the country, highlighting the sectors and regions most vulnerable to climate change impacts, while providing an analysis of potential adaptation measures.
The report summarizes information on the processes related to capacity building at the national level and the promotion of investments and financing mechanisms in the country, among other relevant issues. The information described in this TNC summarizes the efforts made in the country related to climate change management, with an emphasis on the period following the presentation of the Second National Communication (SNC) in 2015.

**Energy Efficiency**

In order to further develop the basic legal framework in the energy efficiency on the final consumption side, as well as to harmonize national legislation with EU directives, the Ministry of Energy has developed regulatory framework for energy efficiency in buildings, bylaws on labelling/eco-design of energy related products and Plan for reconstruction of central government buildings 2024-2026 in order to implement the Law on Efficient Use of Energy.

*Transport*
Montenegro has not yet aligned its legislation with the Trans-European transport networks acquis, but has reached a satisfactory level of preparedness regarding strategic development of the transport networks in accordance with TEN-T design and objectives. The Ministerial Council in November 2021 adopted the Decision on amending the Treaty establishing the Energy Community and incorporating Directives (EU) 2018/2001 on the promotion of the use of energy from renewable sources.

*Buildings*

The Government of Montenegro received a loan from the International Bank for Reconstruction and Development (IBRD) for continuing the implementation of the project Energy Efficiency in Montenegro, through the phase two. Implementation of the second phase of the project The *Montenegrin Energy Efficiency Project (MEEP 2)* started on September 1, 2018, and it is planned to last until end 2023. The value of the project budget is EUR 6 million. The *Energy Efficiency Program in Public Buildings (EEPPB)* has been implemented in two phases in period 2012-2020, based on a loan and financial contribution agreement signed with KfW Bank, in the amount of EUR 13.44 million (1st phase) + EUR 22.743 million (2nd phase) with the aim to provide technical support for establishment of the inventory on buildings and development of the national building certification software. The new project phase *Promotion of Energy Efficiency in Public Buildings - Greening Public Infrastructure in Montenegro* will last 2021-2025. The Project will be financed by KfW with a loan in the amount of up to EUR 45 million and EUR 5 million the EU grant. It is worth mentioning that under this project last result was reconstruction of Governmental Building (Rimski Trg).

The Ministry of Energy is implementing the program Energy Efficient Home (overall coordination and by providing subsidies for the interest-free loans) aimed at reducing heating costs and increasing comfort in households, achieving a significant reduction in $CO_2$ emissions in residential sector and developing a market for biomass heating systems.

**Energy Security**

Energy security targets are being expected to be set up by the Government through general guidelines of the energy policy.

The most significant investment venture in the region was the commissioning of a submarine high voltage direct current (HVDC) cable between Italy and Montenegro on 15th November 2019. The submarine cable connects the Italian and Montenegrin transmission systems, from the province of Pescara to Lastva in Kotor. With the realization of this project, Montenegro is becoming a regional energy hub. This interconnection is of strategic importance for the security of electricity systems and the connection of the national electricity markets of the two countries. The realization of this investment can have a positive impact on attracting other investments, especially those in renewable energy sources, given the development of energy policies in the European Union and countries in the region. The HVDC cable called MONITA is on the list of projects of common interest of the European Union (Projects of Common Interest - PCI).

It also contributes to improving network stability.

The interconnection capacity is 600 MW, but it is also planned to lay the other half of the cable in the coming years. 423 km of cable was laid under the Adriatic Sea, at a maximum depth of 1,215 meters. Parts of this interconnection are 22 km long underground cables, out of that 16 km in Italy and 6 km in Montenegro.

Security analysis of the electricity sector and the role of the HVDC interconnection, quantitative assessment or forecast, security-specific measures (linked to policy and legal/regulatory matter) has still not developed, but activities on establishing the regional mechanism meant for coordinated security analyses are underway (methodology is in preparation).

The connected infrastructure, which has the status of a project of interest to the Energy Community (PECI), includes the construction of TS 400/110/35 kV Lastva, 400 kV OHL Lastva - Čevo and 400 kV OHL Čevo - Pljevlja, while additional infrastructure includes the construction of double 400 kV OHL Pljevlja 2 – Bajina Bašta – Višegrad.

**Internal Energy Market**

Electricity trade in Montenegro is so far dominated by bilateral agreements, and the establishment of an organized market began in 2017, when the Power Exchange LLC Podgorica (BELEN) was established by EPCG, CGES and COTEE. The potential for the development of small electricity markets, such as the Montenegrin one, can be realized through connecting with regional, and then the future single European electricity market. The creation of a liquid wholesale market is a precondition for the development of a competitive retail electricity market.

The electricity market consists of a wholesale and a retail market.

The wholesale market refers to the trade of electricity between companies for generation, supply and trade of electricity, while the retail market refers to the supply of end customers by licensed companies for electricity supply.

Participants in the wholesale electricity market are generators, traders, suppliers, self-supply

customers and suppliers' vulnerable customers.

In addition to the above, market participants are also considered:

- transmission system operator, as an entity that buys and / or sells electricity to cover losses in the transmission system, for ancillary services and balancing of the system,
- the distribution system operator, as an entity that purchases electricity to cover losses in the distribution system, and
- market operator, as an entity that buys electricity produced from eligible producers and sells it to suppliers and self-supply customers.

In September 2021, there were 53 traders operating on the Montenegrin wholesale market.

Participants in the retail electricity market are:

- the buyer, as a legal or natural person who buys electricity for his own consumption,
- supplier, as an entity that buys, sells and resells electricity in its own name and for its own account and has a license to sell electricity to end customers,
- closed distribution systems because they have a dual role, both as a distributor and as a supplier.

On-going activities on the drafting legislation transposing Regulation (EU) No. 2015/1222 establishing guidelines for Capacity Allocation and Congestion Management (CACM) is important for providing a secure legal framework for connecting the electricity market of Montenegro with regional and European markets (market coupling).
Electricity systems in the region were part of a single electricity system and as such they are interconnected in technical terms and allow energy exchange between countries.
The existence of interconnection between the transmission systems of Italy and Montenegro is a prerequisite for connecting the electricity markets of these two countries. The creation of connected regional markets and their integration into the single European electricity market is the basic goal of European energy policy, and thus the path of those countries that strive EU accession.
The Energy Regulatory Agency REGAGEN, The Power Exchange BELEN and the TSO CGES participate in the implementation of the project of Albania, Montenegro, Italy and Serbia (AIMS), which is aimed at connecting the electricity markets of these countries. The realization of the project implies the active participation of transmission system operators and power exchanges in creating the preconditions for connecting the market,
The realization of the project CEI Central European Initiative - Strengthening Energy Regulators in the Western Balkans aims to strengthen the human resources capacity of energy regulators, TSOs and PXs and their readiness for the new obligations of the market integration process.
By connecting the market, a more reliable electricity supply and greater competition in performing market energy activities will be achieved. It enables overcoming the problem of unattractiveness of small markets, which due to their size do not attract a sufficient number of traders and suppliers, which gives special importance for connecting the Montenegrin electricity market with a stable and liquid Italian market. With the commissioning of the submarine cable, which connects the markets of these two countries, the necessary condition for connecting the markets has been fulfilled. The realization of such a significant transmission infrastructure gives a positive impetus to investors who want to invest in generation capacity. This will be further encouraged by the establishment of a functional exchange on which

electricity will be traded, which is another necessary condition for the process of connecting the electricity market.
The energy market in Montenegro is harmonized and developing in line with the EU Third Energy Package and the Clean Energy Package transposed by the Energy Law and the Law on Cross-border Exchange of Electricity and Natural Gas. According to current plan, Montenegrin Power Exchange (MEPX) will begin trading in Q3/2022 and currently is looking for service provider. The Energy and Water Regulatory Agency of Montenegro (REGAGEN) is the only Western Balkan 6 country regulator holding an observer status in ACER Working Groups. This status was achieved in 2018.

Drafting, adoption and enforcement of by-laws in the competence of REGAGEN, as defined in the Law in the forthcoming period up to 2030.

Below is a list of bylaws that the Agency is obliged to adopt or approve based on the Energy Law. Although the most of them have already exists, we assume that there is a certainty that all will be the object of Agencies activities till 2030.

By-laws, which are in the competence of the Agency, are defined in the Energy Law (articles 43, 44, 95, 114a and 132g).

*Article 43 Methodologies and rules*

The Agency shall set the methodologies:
1) determining regulatory allowed revenue of system operator and prices, terms and conditions for:
-use of transmission and distribution systems for electricity and gas;
- use of gas storage systems, and LNG facilities which are connected to the transmission or distribution system;
2) determining prices, deadlines and conditions for provision of ancillary services and balancing services for transmission systems for electricity and gas;
3) setting prices for use of transmission or distribution system which shall be paid by users of a direct line when the direct line is connected to the transmission or distribution system;
4) setting prices which the supplier of the last resort and vulnerable customers shall apply;
5) setting regulatory allowed revenue and charge for operation of electricity and gas market operator.
6) determining method on providing of funds for Agency's operation.

(4) The Agency shall set the following rules:
1) for resolution of disputes by applying rules of arbitrage;
2) for change of prices initiated by an energy undertaking or initiated by the Agency itself;
3) on licenses for performance of energy activities;
4) on certificates for the system operator;
5) for functioning of supplier which performs the activities of supplier of the last resort and vulnerable customers;

6) about requirements for award of permits on the basis of which producers and suppliers of electricity and gas undertakings may supply final customers through a direct line;
7) about conditions and procedure in which final customers for electricity and gas may switch to another supplier;
8) for settling of difference between justified and actual revenues and determined costs between licensed distribution system operators;
9) for unbundling of accounts, management and information, in order to avoid cross-subsidies between activities in the gas sector; and
10) maintain confidentiality of commercially sensitive information used by system operators.
11) for determining of the status of a closed electricity distribution system;
12) on minimum quality of delivery and supply of electricity and gas;
13) for drafting and monitoring of implementation of the ten year development plans on transmission i.e. distribution electricity systems;
The Agency shall set general conditions for electricity and gas supply;

*Article 44 Approving of methodologies and rules*

The Agency shall approve methodologies for:
1) determining of charges for connection to transmission and distribution systems for electricity and gas;
2) determining of charges for connection of gas storage system and LNG facilities which are connected to transmission and distribution system;
3) calculation and charging of unauthorized use of electricity;

(2) The Agency shall approve market rules for electricity market, respectively gas market as well as rules on:
1) functioning of transmission system for electricity and gas;
2) functioning of distribution system for electricity and gas;
3) metering in distribution systems for electricity and gas;
4) balancing in gas transmission system;
5) operation and functioning of gas storage system;
6) operation and functioning of LNG facility;
7) application of transparent mechanisms for operation and allocation of capacities for electricity transmission based on market principles;
8) application of transparent mechanisms for operation and allocation of capacities for gas transmission based on market principles;
9) allocation of cross-border capacities for electricity transmission in conformity with agreed rules in the region.
10) determining and prevention of unauthorized use of electricity by distribution system operator (DSO);
11) operation of electricity balancing market;
12) rules and conditions for functioning and operation of system in interconnection which are adopted in accordance with the law governing the cross-border exchange of electricity and gas.

(3) The Agency approves the methodologies and acts referred to in Art. 114a and 132g of the Energy Law.

*Article 95 RES share*

The manner of calculating, displaying and publishing the share of all types of energy sources in the produced or delivered electricity, as well as the manner of calculation control shall be prescribed by the Agency.

The Agency approves the methodologies and acts referred to in Art. 114a of the Energy Law:

The electricity transmission system operator is obliged to, in cooperation with the transmission system operators of other countries, and in order to connect the day-ahead and intraday electricity market, adopt methodologies and acts regulating:
1) submission of information on production and load that producers and customers submit to the electricity transmission system operator, and which especially refer to their technical characteristics, availability of production units and loads, timetables of production units as well as the order of engagement of production units;
2) a proposal for a common network model, containing scenarios for each period of capacity calculation of individual network models for its control area including interconnections as well as a description of the procedures for merging individual network models into a common network model;
3) proposal of capacity calculation methodology;
4) time of opening and time of closing of intraday connection between trading zones;
5) deadline for guaranteeing the validity of the day-ahead market capacity;
6) calculation of planned exchanges that are the result of the day-ahead market coupling;
7) alternative procedures to ensure efficient, transparent and non-discriminatory capacity allocation in the event that results cannot be obtained on a connected day-ahead basis;
8) additional regional auctions in addition to intraday connectivity;
9) conditions for explicit allocations that market participants must meet in order to participate in an explicit allocation;
10) determination of capacity prices on the intraday market;
11) as well as other acts and methodologies necessary for connecting the day-ahead and intra-day electricity market.

The Agency approves the methodologies and acts referred to in Art. 132g of the Energy Law:

NEMO is obliged, in cooperation with the nominated operators of the electricity market of other countries, to adopt methodologies and acts regulating:
1) plan for joint performance of market connection operator functions;
2) algorithm used in single day-to-day interconnection and intraday interconnection of the electricity market, developed taking into account the requirements of electricity transmission system operators and nominated electricity market operators for its development in accordance with paragraph 1 of this Article;
3) products that nominated electricity market operators may take into account in the procedure of single day-ahead connection and intraday connection;

4) maximum and minimum prices in the procedure of single day-ahead connection and intraday connection.

Ministry of Energy is working on finalization of 2 laws: new Law on Energy and Law on Cross-Border Exchange of Electricity and Natural Gas with aim of harmonization with the so-called Electricity Integration Package. The adoption of those laws is key to the process of coupling with the single European market which should result in an exemption from the application of CBAM by 2030.

**Auctions as a model to support the development of renewable energy sources**

In August 2024, Montenegro has adopted its first Law on the Use of Energy from Renewable sources. By adopting this law, Montenegro made a big step forward in harmonizing national legislation in the field of energy with EU regulations and set a framework for achieving national goals in this area. The new law on the use of energy from renewable sources will enable the transition to a modern system of incentives based on market premiums, while the concept of current feed-in tariffs will be abandoned and will be possible only for small plants and demonstration projects.

**Research, innovation and competitiveness**

The most recent Smart Specialisation Strategy (2019-2024) is a national (in case of Montenegro, being a single NUTS10 region) innovation strategy setting development priorities in order to build competitive advantage by developing and connecting own capacities in research and innovation with the needs of the economy, while responding coherently to growing opportunities and market development, which helps to avoid duplication and fragmentation of policies. As a key element of economic development policy, smart specialization increases the competitiveness of the economy by concentrating and linking research and innovation resources to a limited number of determined priority economic areas. Energy production - being one of the key economic sectors in Montenegro, coupled by recent important infrastructural investments, energy transmission underwater cable (recognized as a project of interest to the Energy Community, which makes Montenegro a regional energy transmission node from Western Europe to Western Balkans), has been determined as one of the priorities of the Smart Specialisation Strategy. The priority is framed as "Energy and sustainable environment", placing green and circular economy together with energy sector development, where rational use of resources, decarbonisation and climate neutrality are common denominators. ICT is a horizontal priority within the strategy, seen as a set of enabling technologies for digital transformation of the vertical, traditionally strong economic sectors in Montenegro. Through an Entrepreneurial Discovery Process, the strategy has recognized focal areas and technologies in the field of energy. Further improvement and technology transfer can be implemented in hydro, wind and wood waste energy production as well as energy efficiency. Untapped potential lies in solar energy, development of smart networks and cities, energy storage systems, integration of prosumers and transport electrification. Research, innovation and intelligent technology transfer in these areas have been recognized as potential drivers of competitiveness in the energy sector.

10 NUTS - Nomenclature of Territorial Units for Statistics

While the European Commission has accepted the Montenegrin Smart Specialisation Strategy, it gave instructions for its further improvement, in particular through the development of an Operational Programme with definition of more refined focus areas and technologies and integration of the emerging new concept of "sustainable smart specialisation", in line with the European Green Deal and policy documents being developed by the EC within the EU strategy for the Western Balkans.
Montenegro continues to successfully implement the smart specialisation strategy. In June 2022, the government established a new composition of the Council for Innovation and Smart Specialisation, presided by the Minister of Science and Technological Development. In December 2022, the Council adopted the Information on the innovation programmes of the Innovation Fund of Montenegro for 2023, based on which the Innovation Fund prepared the 2023 work plan, adopted by the government in April 2023. Several calls for proposals have been launched.

### *ii. Current energy and climate policies and measures relating to the five dimensions of the Energy Union*

**Cross-sectoral**

**The Sustainable Development Strategy of Montenegro by 2030 -** approved by the Government 7th July 2016
This is a comprehensive strategic document which covers an array of different topics, but one of the main objectives is transition to green economy through mitigation of climate change, efficient use of resources, circular economy, sustainable consumption and production, competitive growth of economy, etc. This strategy is an umbrella and long-term development Strategy of Montenegro, which fully integrates the UN Agenda 2030 and represents the national response to those requirements and identified national needs, including reporting on the national implementation of the Agenda. This is important because of the SDG 14 and other related goals.

**Special Purpose Spatial Plan for Coastal Zone of Montenegro until 2030** approved by the Parliament in July 2018
The Spatial plan for Coastal zone ensures a formal and planned basis for the sustainable development of the area. The document provides organizing and arranging issues of the Coastal zone valuable space until 2030. The plan proposes measures for improvement of energy efficiency: Improving energy efficiency is particularly related to the installation or application of low-energy buildings, the improvement of air-conditioning and hot water systems, the promotion of lighting, the concept of intelligent buildings (energy management of main consumers from a central location). All of these options can be used to some extent in the construction of facilities in the Coastal Region.

**Spatial Plan of Montenegro until 2020** approved by the Parliament in March 2008
The Spatial Plan of Montenegro is the main document implementing cross-sectoral harmonization, in which the spatial development of Montenegro is defined on an integrative and balanced plan in accordance with sustainable development. The Spatial Plan had provided a strategic framework for the general spatial development of Montenegro until 2020. The Government of Montenegro has initiated the new Spatial Plan by 2040 drafting process, and the new **Spatial Plan of Montenegro until 2040** was officially adopted in October 2023.

**Industrial policy of Montenegro 2024-2028.** respects the principles based on the development of the green economy, resource efficiency and sustainable production and consumption, industrial waste management, introducing environmental standards and defining measures and activities for their implementation. The industrial policy is aimed at digital transformation and improvement of the innovative performance of companies, as well as their transformation towards green and sustainable business, which will enable an increase in the competitiveness of Montenegrin industry for faster integration with the EU single market. The strategic goals are:

- Improving the environment for the digital and green transition of the industry;
- Growth of investments and financing models for long-term competitiveness of the industry;
- Encouraging innovation based on the principles of smart and sustainable industry development;
- Improving access to the EU single market and strengthening regional economic cooperation.

**Tourism development strategy of Montenegro for the period 2022-2025. (2022)** is developed in order to ensure the further development of tourism, an increase in employment, raising the standard of living population standards, more balanced regional development, but also the improvement of global recognition of the country. Also, the Government of Montenegro is committed to the continuous sustainable development of tourism, with a focus on efficient use of resources, with the promotion of Montenegro as a sustainable, inclusive, green and smart tourist destination. Green and responsible tourism is one of the strategic goals. Some of the measures are:

- Environmental certification - a voluntary mechanism confirmation of the quality of sustainable business. The certification process involves an expert assessment business compliance with certain sustainability criteria.
- E-mobility
- Increasing the energy efficiency of tourist facilities with electricity saving measures
- Energy transition towards renewable energy sources - use of solar energy in tourist facilities.

The Government has adopted **the Action Plan for Meeting the Final Benchmark in Chapter 27 - Environment and Climate Change** in February 2021
Montenegro adopted the Final Report on the implementation of the National Strategy for the Transposition, Implementation and Enforcement of the EU Acquis for Environment and Climate Change (only opening benchmark in this chapter) on 19 November 2020.

According to the Final Report the total percentage of the implementation of obligations for the period 2016-2020 is 80.35%.
Having in mind that the National Strategy for the Transposition, Implementation and Enforcement of the EU Acquis for Environment and Climate Change was related to the period until July 2020, the Government of Montenegro adopted the Action plan for the fulfillment of the closing benchmarks in the Chapter 27 on 18 February 2021 (after EC has submitted the positive opinion on the Action plan on 23 December 2020).
The report on the implementation of the Action Plan will be prepared on a semi-annual basis and submitted to the Government for information and adoption. The same report will be translated into English in order to provide timely information to the EC and to keep the competent authorities of the EC constantly informed, in particular regarding to the regular annual meetings of the Subcommittee on Transport, Environment, Energy and Regional Policy and of the Stabilization and Association Committee.

**Decarbonisation (GHG emissions and removals; renewable energy)**

The decarbonisation dimension has two key elements

- GHG emissions and GHG emissions sinks;
- renewable energy sources (RES).

The issue of climate change on a global scale is addressed by the United Nations Framework Convention on Climate Change (UNFCCC). Montenegro became a party to the UNFCCC by succession, after becoming independent in 2006, being a non-Annex I Party to the UNFCCC.
During 2019, at the legislative level, **the Law on Protection against Adverse Impacts of Climate Change (Official Gazette of Montenegro, No 73/19)** was enacted, covering all the climate issues relevant for Montenegro. The law incorporates elements of the new EU policy set Clean Energy Transition for establishment of National Systems for GHG inventories and National Systems for PaMs and projections, carbon storage and ozone layer protection, obligations of the stationary plant and the aircraft operator as well as envisages Low Carbon Development Strategy (LCDS) and National Adaptation Plan (NAP) preparation. The Law provides the basis for the establishment of the National System for Monitoring, Reporting and Verification of Greenhouse Gases, the operation of the Emissions Trading System, as well as a sectoral distribution of efforts to reduce emissions outside the Emissions Trading System. Moreover, the Law represents the basis for enhancement of issues of the use of ozone-depleting substances and fluorinated gases. The Government adopted Regulation on Activities and Gases for Issuance of the Emission Allocation Allowances to the Stationary Plants Carrying out Activities Resulting in GHGs and has prepared set of other bylaws (regulations and rulebooks) in accordance with abovementioned Law. A number of new EU regulations have been in transposing preparation during 2020, which regulate this field.
Montenegro plans to adopt a majority, if not all laws and bylaws, to speed up its EU integration process. The Ministry of Ecology, Sustainable Development and Development of the North has been working on amendments to the Law on Protection from the Negative Impacts of Climate Change, in accordance with the Decarbonisation roadmap, EU Climate Law.
Montenegro has implemented concrete activities in order to achieve full compliance with the EU acquis in the field of climate change by adopting the Law on Protection Against Negative Impacts of Climate Change (OG of MNE, No 73/19).
This Law represents the basis for the establishment of the National System for Monitoring, Reporting and Verification of Greenhouse Gases, the operation of the Emissions Trading

System, which will ensure a sectoral distribution of efforts to reduce emissions outside the Emissions Trading System. Moreover, the Law represents the basis for enhancement of issues of the use of ozone-depleting substances and fluorinated gases.
In accordance with the Law, 14 bylaws have been adopted to achieve compliance with the EU regulations in this field.
In order to achieve a higher degree of harmonization in the field of climate change and harmonization with the new EU legislation it is necessary to further harmonize the Law on Protection Against the Negative Impacts of Climate Change with the new EU legislation, the implementation of which will be in the period 2022-2025 and to ensure that the objectives of the EU Green Agreement are achieved, including the CBAM mechanism, the Green Agenda for the Western Balkans, taking into account Montenegro's obligations under the Paris Agreement.
It is planned to determine all parts and provisions of the laws and bylaws adopted so far within the EU package 55 and the Roadmap for decarbonisation, which need to be transposed into the Law on Protection from the Negative Impacts of Climate Change and accompanying bylaws and recommendations for transposition into other national laws and bylaws to be amended) including:

- Regulation (EU) 2018/1999 as adapted and adopted by the Energy Community Ministerial Council,
- Implementing Regulation (EU) 2020/1208 (on the on structure, format, submission processes and review of information reported by Member States pursuant to Regulation (EU) 2018/1999),
- Delegated Regulation (EU) 2020/1044 (with regard to values for global warming potentials and the inventory guidelines and with regard to the Union inventory system),
- Revision of the EU Emissions Trading System (ETS), including maritime, aviation and CORSIA as well as a proposal for ETS as own resource.

Including the new EU acquis within the EU Package Fit for 55:

- Carbon Border Adjustment Mechanism (CBAM) and a proposal for CBAM as own resource,
- Effort Sharing Regulation (ESR),
- Revision of the Regulation on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry (LULUCF),
- Revision of the Directive on deployment of alternative fuels infrastructure,
- Revision of the Regulation setting $CO_2$ emission performance standards for new passenger cars and for new light commercial vehicles.

Montenegro as a Party to the UNFCCC prepares and submits every four years a national report on climate change reporting on the implementation of the Convention's obligations.

In addition to above mentioned, the key strategies and laws relevant to the dimension of Decarbonisation are as follows:

**Intended nationally defined contribution (INDC) and updated nationally defined contribution (NDC II)**

Montenegro submitted its Intended nationally defined contribution to the 2015 Paris Climate Agreement, committing itself to reducing greenhouse gases emissions by 30% by 2030 against the baseline year of 1990. INDC of Montenegro did not consider adaptation measures. By ratification of the Paris Agreement in September 2017, INDC has become legally binding and transformed into NDC. With the revision of the NDC, Montenegro excludes the measure related

to the construction of small hydropower plants and sets a new target value of a GHG reduction of 35% by 2030, compared to 1990 (not including the LULUCF and agriculture sector due to lack of data), or a reduction of greenhouse gas emissions by 2117 kilotons by 2030.

**National Air Quality Management Strategy by 2020** - approved by the Government in November 2012
This strategy was adopted with the Action Plan for the period 2013-2016, subsequently; the Government adopted the Action Plan for the period 2017-2020 with the 4th annual Report on implementation of the strategy, in April 2017. The main objective of the Strategy is to maintain and improve air quality, inter alia through reduction of emissions of air pollutants from stationary sources. The new Air Quality Management Strategy 2021-2029 is currently under preparation.

**Energy Law (published in OG MNE No. 5/2016, 51/2017, 82/2020)**
The Energy Law defines energy activities and regulates the conditions and manner of their performance, in order to ensure quality and safe supply of end-users with energy; public services in the field of energy of interest to Montenegro; encouraging the production of energy from renewable sources and high-efficiency cogeneration, manner of organization and management of the electricity and gas market; the manner and conditions of using renewable energy sources and cogeneration; energy efficiency in the energy production, transmission and distribution sector, as well as other issues of importance to the energy sector.

**Law on Air Protection (OG MNE 043/15)** regulates the manner of air quality monitoring, protection measures, assessment and improvement of air quality, as well as air quality planning and management.

**Law on Environment (OG MNE 080/16)** regulates the principles of environmental protection and sustainable development, instruments and measures for environmental protection and other issues of importance for the environment.

**Law on Industrial Emissions (OG MNE 017/19)** regulates measures for the prevention and control of emissions from industrial plants, which may have negative impacts on human health, the environment or material goods and other issues of importance for integrated prevention and control of environmental pollution.

**Law on Spatial Planning and Construction of Facilities** (OG MNE 064/17, 044/18, 063/18)
This Law stipulates the system of space planning, the manner and conditions for the construction of facilities, legalization of illegal buildings and other issues of importance for space planning and construction objects.

**The National Forests Strategy 2014-2023 (revised in 2018) with Action Plan 2019-2020** defines and establishes an efficient system for sustainable forest management, preconditions will be created to improve the condition of forests, which would be a recognizable symbol of the ecological state with their quality, functions and products. The strategy also recognizes the importance of valorization of ecosystem services and promotes actions on the development of the wood industry concerning the achievement of a high degree of finalization of wood products through the development and connection of enterprises in the value chain.

**Forest and forestry development strategy of Montenegro for the period 2023-2028 (2023)** establishes goals and guidelines for the development of forests and forestry, in accordance with national forestry policy, measures for the improvement of forests, as well as indicative financial means for implementing the strategy and the way to provide them. National forest inventory is carried out for the purpose of drafting strategic planning documents in forestry and exchange information in accordance with the law (at national and global level). Important strategic goals are:

- Preserving and strengthening the capacity of forests for resilience and adaptation and climate change resilience, including fire prevention and other solutions
- Encouraging the sustainability and competitiveness of industries based on forests, bioenergy and beyond green industry and circular economy.

**Law of Forests (OG MNE 047/15)**
This law regulates the cultivation, protection, preservation and improvement of forests, planning, method and conditions of use forests, construction and maintenance of forest roads, forest monitoring, as well as other issues of importance for forests, forests land and forestry. This law applies to the protection, conservation and use of forest trees located outside the forest and forest land.

The **Agriculture and Rural Development Strategy (2014-2020)** starts from the basic characteristics of the country, such as preserved environment, rich biodiversity, available natural resources and the current level of agricultural development, as well as the European commitment of Montenegro. The starting point of the Strategy is the multi-functionality of agriculture, which puts agriculture in a much broader context, and not only in terms of GDP share.

**The strategy for the development of agriculture and rural areas in period 2023-2028 (2023)** represents the development strategy of Montenegro, where directions for the management of agricultural resources are determined in a long-term sustainable way. This strategy provides a vision and a plan for implementing the strategic transformation of agriculture and rural areas in Montenegro until 2028, which will ensure the implementation of a different series of activities and measures. It is important to emphasize Strategic goal 2: Ensure efficient management of natural resources of Montenegro and achieve the goals of the Green Agenda which includes:

- Contribute to mitigating climate impacts, including reducing greenhouse gas emissions and improving carbon sequestration, as well as promoting sustainable energy
- Support sustainable development and effective management of natural resources such as water, land and air, including reducing dependence on chemicals
- Contribute to stopping the process of biodiversity loss

**Law on Agriculture and Rural Development** (OG MNE 56/2009, 34/2014, 1/2015, 30/2017 i 51/2017)
This law regulates the following: the development of agriculture and rural areas, support measures in agriculture and eligibility criteria for measures, usage, the organization of producers, the quality and labelling of agricultural products and food, for agricultural products and food, complementary agricultural activities, the organization of agriculture, for public services in agriculture, the establishment of a Paying Agency, for registration and record

keeping, as well as many other issues in the field of Agriculture and Rural Development.

**National Action Plan for Combating Land Degradation and Mitigation until 2023** approved by the Government in November 2015
The National Action Plan is document which foreseen positive effects of improvement of the situation in the area of soil degradation prevention in Montenegro are achieved. This document provide systematization and a comprehensive approach to land treatment as a single resource is of great importance for future planning and management activities by all institutions under the jurisdiction of the land issue.

**Law on National Parks (OG MNE 28/14)**
The Law on National parks stipulate that the resources national parks: land, forests, water, plant and animal world and other natural resources, as well as the work of created values in national parks, can be used in accordance with the law, the spatial plan of special purpose and the management plan, taking into account the preservation of biological and peripheral diversity.

**The Waste Management Plan 2015 – 2020 of Montenegro -** approved by the Government in July 2015
Current Waste Management Plan proposes three options for regional waste management:

- Establishment of 5 regional centres
- Establishment of 3 regional centres
- Centralising waste management in a single waste management center

None of these options were realised since 2015, therefore expecting that the revised plan for the period beyond 2020 will bring another solution.

**The Waste Management Strategy of Montenegro by 2030 –** approved by the Government in July 2015
This Strategy contains an Action Plan aimed at implementation of targets set in the legal framework regarding reuse and recycling of waste and introduction of circular economy.

**Law on Waste Management -** published in OG MNE No. 064/11, with amendments published in OG MNE No. 039/16
The Law regulates overall principles of waste management including separate waste streams and sets target for recycling of waste:

- at least 50% of total collected qty of recyclables to be prepared for re-use by 2020;
- at least 70% of inert construction waste to be prepared for re-use by 2020.

**The Transport Development Strategy 2019-2035** approved by the Government in July 2019
The Transport Development Strategy of Montenegro is targeting to support the improvement of the economic efficiency, safety, accessibility and environmental sustainability of the country's transport system whilst ensuring a seamless integration of the transport sector, as well as national and EU policies.

**The Railway Development Strategy for the period 2017-2027** approved by the Government in May 2018
The railway Development Strategy stimulate financial sustainability and self-sustainability of

railway infrastructure, provide qualitative and accountable maintenance of railway infrastructure and accuracy of transport, maximize development potentials of the region of Montenegro, be competitive and with an improved service in transportation of cargo and passengers, support efficient and effective system of state institutions taking care of the railway sector, minimize negative environmental impacts of transport.

**The Maritime Development Strategy 2020-2030** summarizes the potential that the Blue Economy contributes to the Montenegrin public and private sectors. The strategic document consists of four main parts, which include all aspects that are correlated with the economic, social, infrastructural and regulatory framework in Montenegro.
The Strategy seeks to strengthen the role of the maritime economy sector in the development and competitiveness of Montenegro through a clearly defined maritime policy and sustainable development initiatives. More precisely, the strategic document sets out strategic goals and operational goals with accompanying indicators of success, and an action plan that clearly defines activities whose implementation contributes to the realization of strategic and operational goals, reporting and evaluation and other issues of importance for further development of the maritime sector and valorization potential in this area for period 2020-2030.

**Law on Road transport** (OG MNE 21/2009, and 40/2011 i 92/2017)
It regulates the conditions and the manner of performing activities of public transportation of passengers and freight, provision of bus and freight stations services, as well as transportation for own needs in road transport.

**Law on Security, Organization and Efficiency of Rail Transport** (OG MNE 1/14)
The Law regulates secure and uninterrupted railway traffic, interoperability and functioning of the railway system. It deals with efficiency but not of energy consumption, rather the efficiency of railway systems and operation of the rail. An important part of this law covers functioning of city rail (metro, etc.) cable-cars, funiculars and ski-lifts which are recognized as railways with special transportation-technical features (Article 134) which are used for public transport of passengers and/or goods.

**Law on Rail** (OG MNE 27/13 i 43/13)
Article 29 stipulates that during the performance of the activity, the infrastructure manager shall be obliged to take care of environmental protection in accordance with the law regulating environmental protection. This Law is divided into three main chapters regulating three areas:
1) Planning of the rail development;
2) Management of the rail infrastructure;
3) Rail transport.

**Law on Air Transport** ("Official Gazette of Montenegro" No 30/2012, 30/2017)
Airborne noise and exhaust gases produced by the aircraft during take-off and landing must be below the prescribed maximum levels of noise and exhaust emissions in accordance with the regulations issued by the Ministry, with the consent of the state administration body competent for environmental protection and with the concluded international agreements.

The **Second Biennial Update Report on climate change (SBUR) -** adopted by the Government on 04th April 2019
Revised and updated report provides latest information on national circumstances and institutional arrangements relevant to the preparation of the national communications and the biennial update reports. The SBUR updated the national GHG inventory for the whole series 1990-2015, using IPPC 2006 Guidelines. The SBUR also covers Climate Change Mitigation and Action Plan as well as Development of Conceptual Framework for Monitoring, Reporting and Verification (MRV).

The **Third National Communication on Climate Change** under the UN Framework Convention on Climate Change (TNC) has been recently submitted to the UNFCCC Secretariat. By submitting the Third National Communication (TNC), Montenegro is fulfilling its international obligations under the United Nations Framework Convention on Climate Change (UNFCCC). The TNC has updated the list of greenhouse gas emissions for the period 2016-2017, in line with the new IPCC 2006 methodology of the Intergovernmental Panel, with significantly improved data in waste and forestry sectors. Also it contains a recalculation of previous time series from 1990, as well as a general description of the measures that Montenegro has formulated, determined and implemented in order to manage and plan for the reduction of greenhouse gas emissions.

**Energy efficiency**

**The Fourth Energy Efficiency Action Plan (EEAP) for the period 2019-2021** - approved by the Government on 27th June 2019
NEEAP is fully in line with the key strategic documents in the field of energy and sustainable development defining the national target for energy efficiency and it defines national target for energy efficiency. Fourth EEAP, through the planned measures, elaborates the strategic commitments established by the Energy Development Strategy of Montenegro until 2030. Also, the measures from the 4th EEAP correspond to the measures from the National Strategy for Sustainable Development until 2030, which recognize energy efficiency as a key priority for achieving the goals of sustainable development and transforming the economy towards efficient use of resources. Future EEAPs will be part of the NECP.

**The National Housing Strategy for the period 2011-2020** approved by the Government on 29th September 2011
The main goal of the Strategy was to define the direction of further development of the housing sector by analyzing the existing situation, establishing a vision within the housing sector, defining the mission and formulating housing policy.

**Law on Efficient Use of Energy** (published in OG MNE No. 57/14, 3/15, 25/19, 140/22)
The Law regulates the responsibilities for the introduction and the implementation of energy efficiency policy and measures in order to enable efficient energy consumption by end-users. The text of the Law is compliant with the main EU directives in the field of energy efficiency whereas the implementation of the Law is ensured through the adoption of bylaws. The Law on Efficient Use of Energy focuses mainly on establishment of framework conditions for energy efficiency (targets, EEAP and local plans), exemplary role of the public sector, energy

performance of buildings, energy related products and energy services, while energy efficiency in transport sector did not get particular attention.

**Regulatory framework in force regulating the field of energy efficiency of buildings**, adopted on the basis of the Law on Efficient Use of Energy, has been updated in 2024. New building codes have introduced:

- Stricter minimum energy efficiency requirements for construction of new and renovation of existing buildings;
- Procedure for energy performance certification of building based on the national methodology and by using a national software for energy performance calculation.

**Rulebooks for energy labeling** have been adopted and cover the following energy-related products: washing machines, TV sets, dishwashers, air-conditioning, refrigerators, electric light bulbs and lamps and car tires, 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.

## Energy Security

The energy security dimension is regulated mostly by **Electricity Transmission System Operation Rules,** which preparation is obligation under the **Energy Law.**

**Energy Policy by 2030 -** approved by the Government in March 2011.
The Energy Policy of Montenegro by 2030 is the main strategic document which establishes three main priorities for the development of energy sector of Montenegro: security of energy supply, development of a competitive energy market and sustainable energy development. It is envisaged to prepare new Energy Policy for 2040.

## Internal Energy Market

**Energy Law** regulates organized purchase and sale of electricity, balance responsibility, balancing and payment data, balance group, rights, obligations and responsibilities of market operators, exclusion of participants from the electricity market, stock market electricity, rules for the functioning of the market, legal entity for coordinated auctions, ancillary and balancing services in the field of electricity, nominated electricity market operator (NEMO), as well as rights, obligations and responsibilities of NEMO.
In line with the 19th Ministerial Council conclusions, all Parties confirmed the need for Treaty amendments and expressed their commitment to further work on compromise solutions in a constructive manner. The Commission proposed to focus in the meanwhile on alternative solutions within the framework of the current Energy Community Treaty in order to achieve progress on the integration of electricity markets, including through measures in the electricity field under relevant Title of the Treaty for discussion in 2022.

**Market rules published in the Official Gazette of Montenegro, No. 44/2017**
These Rules determine:
1) procedures, principles and standards for the organization and functioning of the electricity market in accordance with the applied market model,
2) the principle of economic priority, with the exception of privileged producers, in accordance with the Energy Law,
3) the manner of identification and registration of participants in the electricity market (hereinafter: market participant) and operators, the manner of exercising the rights of market participants, principles and procedures for determining and implementation of balance responsibility,
4) obligations of market participants, including obligations based on balance responsibility,
5) types of contracts concluded on the market and contracts related to the functioning of the market and formal contracts determined by the Law,
6) standards and procedures for performing and recording transactions on the electricity market,
7) standards and procedures for creating, maintaining and updating the database for the needs of the electricity market,
8) standards and procedures for registration, development, verification and change of daily timetables,
9) the manner of publishing data related to the functioning of the market, except for commercially sensitive information,

10) the manner and procedure of calculating quantitative deviations for the final settlement of the holders of balance responsibility of balance groups, i.e. balance responsible entities and their financial settlement on the electricity market,
11) the form and content of the bank guarantee or other means of securing payment,
12) procedures and principles for the purchase of electricity produced in the facilities of eligible producers and
13) procedures and principles for the purchase and sale of electricity produced in the facilities of eligible producers between the Electricity Market Operator and the supplier and the self-supplier buyer.

**Research, innovation and competitiveness**

Up to 2021, Montenegro had not introduced specific R&I policies and measures for the energy sector. Funding and support instruments for R&I are allocated on a competitive basis, in line with the broad priorities indicated in the Strategy of Scientific-Research Activity or Smart Specialisation Strategy, but without specific sector approach (bottom-up calls).

In that way, in the period 2018-2020 13 projects from research and innovation in the energy field were supported through several funding schemes, in total value of 1.4 million EUR. Out of around 16 M EUR funding from the public sector (EU and state budget) in the same period, energy made 8.7%. Out of the amount earmarked for energy R&I, 1 million EUR was supported from EU-H2020 funds, mainly in the energy business sector, 300,000 EUR was supported from the state budget while 100,000 EUR was own matching funding of the project participants from the business sector. The EU funded projects deal with management of cross-border transmission of renewable energy and storage facilities and intelligent energy market technologies. The statistical figures on expenditure on R&D in the Sector D (NACE classification of economic activities) shows total spending of 1.9 million EUR in 2018, which makes around 8% of total R&D spending in Montenegro in the same year. However, we note oscillations from one year to another (2017: 1.82% of total was spent in Sector D).[11]
These figures show very limited investment made in energy R&I in Montenegro – a situation that needs to be significantly improved in the next period, by more and better coordinated and directed funding from several ministries, public agencies but also business sector. The mentioned improvement of the Smart Specialisation Strategy and creation of its Operational Programme should define new policy instruments related more specifically to priority domains, while the Innovation Fund of Montenegro should efficiently implement these instruments. This Plan will contribute to strengthening of energy R&I in Montenegro, as well.
In 2023, the Innovation Fund has launched several programme lines in the period May-June (value EUR 1.65 million), and the Call for co-financing national scientific research projects with total funds amounting to EUR 2.3 million was published in May.

**Law on Innovation Activity (Official Gazette of Montenegro 82/20)**
The law foresees definition of the National Innovation System, with introduction of its new elements, including the central innovation programmes (S3 comprised) implementing body – The Innovation Fund of Montenegro and the Innovation and Smart Specialisation Council as the main governance body.

[11] Source: Ministry of Education, Science and Inovation (official statistical producer for R&D)

**Law on Incentives for Research and Innovation Development (Official Gazette of Montenegro 82/20)**
The law foresees a set of fiscal incentives for 3 types of subjects within the innovation system: subjects performing innovation activity, including startups and freelancers; subjects ensuring innovation infrastructure; and subjects investing in innovation activity. The implementation is expected to start from mid-2021.

**Industry Policy 2019-2023** - approved by the Government in July 2019
Industrial policy of Montenegro 2019-2023 (IP 2023) is a strategic document for the development of competitiveness of the Montenegrin economy with a focus on the industrial sector. IP 2023 recognizes that the real bearers of change and development are companies that, with adequate support, should maximize their potential for growth, development and competitiveness.

**Strategy for development of small and medium sized enterprises (2018-2022)** - approved by the Government in July 2018
The strategy has five objectives related to: (i) improving the business climate; (ii) access to sources of finance; (iii) entrepreneurship skills and competences; (iv) strengthening competitiveness of SMEs; and (v) promotion of entrepreneurship among women and young people.

State support within the previous two policies is dominantly realized through the **Programme for the improvement of competitiveness of Montenegrin economy**, which integrates initial measures for energy efficiency and circular economy.

*iii. Key issues of cross-border relevance*

International cooperation with bodies in the **European Union and the Energy Community** is an extremely important segment in the work of all the energy entities in Montenegro.
Montenegro as Energy Community Contracting Party and EU candidate country is willing to follow the European energy policy and is obliged to transpose and implement the EU energy directives and regulations.
Key issues of cross-border significance are the integration of energy markets, major infrastructure projects near the national border and cross-border infrastructure projects, international scientific and research cooperation related to the dimensions of the Energy Union, and other activities that may affect non-EU and EU Member States.

The 19th Ministerial Council held in November 2021, adopted the General Policy Guidelines on the adoption of a Decarbonisation Roadmap for the Contracting Parties of the Energy Community proposed by the European Union. Adopting the Decarbonization Roadmap by the Ministerial Council sends an important signal as to the readiness of the Energy Community to join the European Union and other international partners in achieving net zero greenhouse gas emissions by 2050.
Montenegro is a member of the **CESEC (Central and South-Eastern Europe Connectivity)** regional initiative, which aims to speed up the integration of gas and electricity markets in central and south-eastern Europe. The initiative was set up in February 2015 by Austria,

Bulgaria, Croatia, Greece, Hungary, Italy, Romania, Slovakia and Slovenia. These countries were later joined by eight Contracting Parties to the Energy Community: Ukraine, Moldova, Serbia, North Macedonia, Albania, Bosnia and Herzegovina, Kosovo and Montenegro.

**The Transmission Grid Development Plan** is a legal obligation for the national transmission system operator (CGES). CGES has drawn up its own Transmission Grid Development Plan 2020-2029, which is approved by the regulator RAE. The Plan contains a list of investments that have already been agreed and projects to be implemented within the next three years. The Plan also sets out network planning for the next ten years.
The current Plan is based on ENTSO-E's Ten Year Network Development Plan (TYNDP) 2018, and provides information on the key transmission infrastructure to be developed in the CGES network. According to the Transmission Grid Development Plan, two interconnectors with other countries (Albania and Serbia) are envisaged in the following period:

- Construction of 110 kV OHL Briska Gora – Albania in 2020-2024
- Construction of 400 kV OHL Pljevlja 2 – Bajina Bašta in 2025-2029.

CGES is one of the full members of the European Network of Transmission System Operators for Electricity (ENTSO-E). ENTSO-E's activities are aimed at achieving energy and climate goals through the establishment of a single electricity market, ensuring its optimal functioning, harmonization of member transmission systems, reliability and flexibility of the system, which enables the integration of renewable energy sources into the European energy system. ENTSO-E has an important role to coordinate the planning, development and management of individual transmission systems at the pan-European level, while taking into account not to violate the security of electricity supply to customers connected to systems.
CGES is a member with observer status in the IGCC (European Imbalance Netting cooperation) and has applied for membership in MARI (European Tertiary balancing energy cooperation - European cooperation for the exchange of tertiary balancing energy). Within the bloc of Montenegro, Serbia and Northern Macedonia (SMM bloc), regional Imbalance Netting cooperation establishment is underway. Regional imbalance netting (RIN) will have been established on the border SRB-MNE by the end of 2021. The EKC has developed the study related to the benefits of the RIN, ordered by EnC.

CGES is a member of the Med-TSO, Association of the Mediterranean Transmission System Operators (TSOs) for electricity and Multilateral Cooperation platform among the TSOs operating the High Voltage Transmission Networks of 19 Mediterranean Countries, including Montenegro. Med-TSO is engaged in facing this challenging evolution of the regional power sector by facilitating the creation of a Mediterranean energy market, through the definition of common methodologies, rules, sharing costs, risks and best practices for optimizing the operation of the existing infrastructures and facilitating the development of new ones.
Transmission losses analysis is developed for the period of three years, the last until 2022, the next is going to include the period 2023-2025. Conclusions of the last study for the period 2020-2022 are:

- It is noted that the level of losses as opposed to the total energy in the system is moderate in the last five years –beneath 2.3 %, despite the tendency to rise appeared in the period 2016-2018;
- Based on the calculation of losses 2019-2022, it has been determined that the level of losses as opposed to the total energy in the system goes from 2.05% (2019) to 1.79% (2022), reporting to a small decline;

- In comparison with either other neighboring countries, or within the EU, the level of losses is within acceptable limits, not considerably deviating from the level of losses in other countries.

Regional cooperation on share and exchange of auxiliary services (power control reserves and balancing energy) between Serbia, North Macedonia and Montenegro (SMM) control block will increase flexibility for more RES and decrease the operating costs. Market integration is an important element to promote network flexibility and integration of renewables. The advanced option of SMM control block is expected to increase market flexibility and decrease reserve allocation costs. The goal is to provide all the auxiliary services to the extent that is sufficient for reliable operation of the electric power system and reliable power supply at the lowest possible price. TSOs from Serbia, North Macedonia and Montenegro form a control block which is in line with the target model of regional integration of electricity balancing markets by ENTSO-E network code on electricity balancing. For individual balancing of each country, total amount of balancing reserves equals 1000 MW and for SMM control block it equals 700 MW. Therefore, by advanced operation of SMM block in regard to share and exchange of auxiliary services, the costs for ensuring balancing capacity would reduce and part of generation capacity would be freed to provide energy on the commercial market. Additionally, the SMM block is also important from the perspective of electricity cross-border balancing. With the future introduction of RES, especially wind and PV generation capacities, market integration in terms of the SMM block will allow for more efficient balancing of generation and demand. An access to the IGCC platform is expected during 2023.

In relation to the dimension Decarbonisation and dimension Research & Innovation it is important to mention the establishment of the Draught Management Centre for South-Eastern Europe (DMCSEE), and South-East European Multi-Hazard Early Warning Advisory System (SEE-SHPPWS-A) initiated by the World Meteorological Organisation (WMO). The South-East European Consortium for Operational Weather Prediction (SEECOP) was established in March 2015 and supported by the directors of hydro-meteorological services of the WB economies.

Medium to long-term weather forecasting, which includes statistical assessment, finds its use in planning of activities, particularly in agriculture and energy sector, providing data necessary for risk and financial loss reduction. Responsible institution for climate monitoring and long-term forecast in the region is South East European Virtual Climate Change Centre (SEEVCCC) hosted by the Hydrometeorological Institute of Serbia. Expansion of these regional initiatives and ensuring dissemination of information to serve the regional needs and priorities, including those in the energy sector, are expected.

### *iv. Administrative structure of implementing national energy and climate policies*

**The Ministry of Energy** is in charge of energy and energy efficiency policy adoption, implementation and monitoring**.** The Ministry of Energy prepares energy and energy efficiency laws and regulations, strategies and programmes is responsible for creating policies and measures to achieve the set energy savings and renewable energy targets.

**Ministry of Ecology, Sustainable Development and Development of the North** is the main national entity responsible for climate change policy and the National Focal Point to the UNFCCC.

The **Environment and Nature Protection Agency (ENPA)** is the responsible authority and main body for coordinating and articulating GHG inventory development, implementing

inventory quality assurance procedures, maintain activity database, processing, storage and inventory reporting, data collection and data quality improvement, implementation of QA/QC procedures and uncertainty assessments, archiving data as well as keeping records.

The **Energy and Water Regulatory Agency of Montenegro (REGAGEN)** regulates energy activities and is responsible for the Drafting, adoption and enforcement of by-laws is also in its competence, as defined in the Law, improvement and implementation of by-laws, issuing licenses, setting tariffs, certifying the eligible producer status, as well as water activities, etc.

The **Hydrocarbon Authority** provides operational support to competent bodies for activities related to hydrocarbon exploration and exploitation, activities for ensuring compulsory stocks of oil and petroleum products, hydrocarbon operations safety, hydrocarbon resource management and monitoring the concession agreement.

The **Electricity Market Operator (COTEE)** performs the public service of organizing the electricity market and analysing and proposing measures for its improvement. It also performs tasks related to the system of incentives for electricity production from renewable energy sources and cogeneration, which involves collecting compensation from suppliers and calculating and allocating funds on the basis of concluded contracts with eligible producers entitled to an incentive, and issuing guarantees of origin for electricity produced from renewable sources and highly efficient cogeneration.

The **transmission/distribution system operators (CGES/CEDIS)** are responsible for transmission and distribution of electricity within the grid.

The **Fund for Environmental Protection (Eco Fund)** was formally established in November 2018, as a limited liability company 100% owned by the Government of Montenegro. Eco-Fund started operating in March 2020 when has been entered in the central register of business entities. The main activity of the Eco Fund is financing the preparation, implementation and development of programmes, projects and similar activities in the field of the preservation, sustainable use, protection and improvement of the environment, energy efficiency and the use of renewable energy sources at the national and local levels.

Eco fund may also participate in the co-financing of aforementioned programmes, projects and activities which are conducted on the territory of Montenegro, organized and financed by international organizations, financial institutions and bodies, as well as other foreign legal entities.

The beneficiaries of the Eco-Fund funds can be: companies and other legal and natural persons registered in accordance with the law, local self-government, state administration bodies and other independent legal entities financed from the state budget, non-profit organizations and individuals.

Chaired by the President of Montenegro, a high level multi-institutional **National Council for Sustainable Development, Climate Change and Integrated Coastal Area Zone Management (NCSDCCICZAM)** has been established as an advisory body to the Government of Montenegro aiming at inter-institutional coordination and cooperation. The NCSDCCICZAM considers national documents and provides suggestions and endorsement to the Government before their adoption.

Having in mind the new structural reforms in the Government of Montenegro, which occurred after the Parliamentary elections in September 2020, the Decision will be harmonized in the coming period, but we are still waiting for the position of the Department for Sustainable Development in the General Secretariat of the Government of Montenegro.

Within the existing institutional framework, there are four working groups for: 1) implementation of the National Strategy for Sustainable Development, 2) sustainable

management of resources, 3) mitigation and adaptation to climate change and 4) integrated coastal zone management, as expert working bodies of the National Council. They consist of representatives of state administration bodies, local self-government and independent experts. The key tasks of the working groups are to provide opinions and recommendations from the aspect of improving the materials submitted to the National Council. The Department for Sustainable Development in the Ministry of Ecology, Sustainable Development and Development of the North performs the role of the Secretariat of the National Council.
The Working Group on Climate Change Mitigation and Adaptation (WGCCMA) meets between two and four times a year (prior to the sessions of the Council) and usually gives guidance and feedback on all strategic documents related to climate change. It is co-chaired by the Director of The Institute for Hydrometeorology and Seismology and UNFCCC Focal Point. The group gathers representatives of national institutions (e.g. relevant ministries, ENPA), local authorities and NGOs. However, this working group needs to be strengthened with technical expertise to inform the Council's decision makers on Montenegro's progress and challenges on climate change actions and theirs links to other national strategies and sustainable development goals. Furthermore, WGCCMA needs to further contribute to the definition and implementation of actions in its NDC and adaptation activities, and eventually inform the Council with regular, reliable and continuously improving information on Montenegro's progress with its NDC and adaptation activities. Other ministries with responsibilities related to climate change are the Ministry of Energy and the Ministry of Agriculture, Forestry and Water Management.
The Working Group for Climate Change Mitigation and Adaptation is a good basis for close cooperation of implementing entities for meeting both NDC and sustainable development goals. This body will contribute to the development of the NECP via regular consultations.
The Council for Innovation and Smart Specialisation is a body which should coordinate policies and funding sources under the sustainable smart specialization, approve programmes and budget of the Innovation Fund and make informed decisions based on the continuous Entrepreneurial Discovery Process. The Council under the new Law on Innovation Activity 2020 was constituted in 2021.

## 1.3 Consultations and involvement of national entities and their outcome

The draft NECP is the subject of hearings, discussions, opinion exchanges with the following stakeholder groups: different ministries/agencies affected directly or indirectly by the NECP Ministry of Energy, Ministry of Ecology, Sustainable Development and Development of the North , Ministry of Agriculture, Forestry and Water Management, Ministry of Education, Science and Innovation, Ministry of Finance, EPA, Eco Fund, CGES, EPCG, CEDIS, REGAGEN, COTEE, Hydrocarbon Authority), local government, civil society, energy experts, and different associations of businesses. Stakeholders are involved partly or entirely through the cycle of the compilation, implementation and monitoring of the NECP.

### *i. Involvement of the national parliament*

A plenary session with the Parliament on the NECP is organized, to explain that a successful NECP is based on ambitious targets, clear policies and measures, a sufficient investment package (a part provided by state budget), implementation of measures, naming the

responsible institutions, and an effective monitoring process. According to the Law, the NECP is adopted by the Government. Presentation in Parliament is not mandatory (not envisaged in the Law), therefore involvement and support of the Parliament, although welcome, should be elaborated procedurally and substantially.

### *ii. Involvement of local and regional authorities*

The local governments are active stakeholders during the process of drafting and implementing the NECP as they play a key role for the implementation of the EE measures in building projects, transport and services areas. In line with the Energy Law, the local authority is obliged to consult the Ministry and State aid authority when developing the local energy plan and to report on its implementation.

### *iii. Consultations of stakeholders, including the social partners, and engagement of civil society and the general Public*

Consumers association, other non-governmental associations, etc. are informed through Social Media channels.
Through the work of the Technical Working Group, the two local NGOs dealing mostly with energy, climate and environment issues but also with social and health issues, are involved with very active participation and engagement. The NGOs are addressing problems with lignite and generally fossil fuels combustion, providing the possible solutions for the phasing the coal out. The NGO sector is involved in the NECP technical Working Group (tWG) from the very beginning, being invited to the consultations along with the public institutions representatives. The civil society organizations remain an important partner within the whole NECP process.

### *iv. Consultations of other Contracting Parties*

Consultation of other Contracting parties takes place on specific topics with cross-border relevance and on specific topics where sharing good practices is helpful. Consultation on the NECP has been also envisaged.
More information on policies and measures implemented based on a cross-border or regional collaboration is available in the respective chapter 1.4.

### *v. Iterative process with the Energy Community Secretariat*

The Energy Community Secretariat has been involved from the beginning and has supported the NECP technical Working Group with input in the drafting phase, the discussion of preliminary versions and consultations with EnCS in accordance with the Recommendations 2018/01.
The Secretariat has participated in the following meetings:

- Virtual meetings for informal coordination among the members of the core team
- NECP technical Working Group meetings
- Other coordination meetings

## 1.4 Regional cooperation in preparing the plan

### *i. Elements subject to joint or coordinated planning with other Contracting Parties*

The Energy Community and the Transport Community are an important basis for regional cooperation:
Established in 2005, the **Energy Community** brings together the European Union and its neighbours to create an integrated pan-European energy market. Its key objective is to extend the EU internal energy market rules and principles to South East Europe, the Black Sea region and beyond on the basis of a legally binding framework. A stable regulatory and market framework capable of attracting investment in power generation and networks, right conditions for cross-border energy trade, enhanced security of supply and increased uptake of renewable energy and energy efficiency are the Community's core axes of focus. It will remain a crucial promoter of clean energy transition rules and standards in the Western Balkan region.
The **Transport Community Treaty** in force since 2017 aims at the integration of the Western Balkan transport market systems in the EU. To achieve this, the Treaty foresees the setting up of technical committees to assist partners in transposing the acquis and implementing appropriate reforms. The Transport Community can be instrumental in identifying the priority transport investments with a focus on the TEN-T, addressing regulatory barriers to green transition, and promoting and developing green mobility strategies and investments throughout the region, as well as mainstreaming the environment in all aspects of transport. In this vein, the **Transport Community** is developing a rolling work plan for the development of priority projects, which shall contribute, to a balanced sustainable development in terms of economics, spatial integration, environmental and social impact.

Joint or coordinated planning with other Contracting Parties is based also on the following policies shown in the table below.

| Policies | NECP dimensions of joint or coordinated planning |
|---|---|
| The **Western Balkans Strategy** acknowledges the efforts the countries need to do to progress with alignment in the field of environment. The Strategy also prioritises to expand the Energy Union to the Western Balkans. | Energy Union (all dimensions of the NECP) |
| The **Declaration of the EU-Western Balkans Summit** in Sofia in May 2018 specifically refers to helping the Western Balkans move faster towards sustainable and climate friendly societies in line with the Paris Agreement. | Decarbonisation, Energy Security, Research, Innovation and Competitiveness |
| The 2019 **Communication on EU Enlargement Policy** confirmed that there is considerable scope for the Western Balkans to embark on a Green Agenda, for the region to address environmental issues such as waste management, air pollution and climate change. | Decarbonisation |
| In the joint **"Statement on Clean Energy Transition for the Western Balkans"** signed in Podgorica on 21 February 2019, the Western Balkans ministers of energy and of environment confirmed their will to align as swiftly as possible with the EU's energy, climate and environmental policies and the long-term objectives of the Paris | Decarbonisation, Energy Security, Research, Innovation and Competitiveness |

| | |
|---|---|
| Agreement, by this contributing to the well-being of citizens and the sustainable development of the region. This transition should reduce energy imports, develop renewable energy sources, strengthen regional energy security, unlock greater economic growth, and address persistent air and related health pollution challenges. | |
| In the **conclusions of the Berlin 6 Summit in Poznań in July 2019**, the Western Balkans leaders expressed their willingness "to work together for the launching of an ambitious Green Agenda, to contribute to the leading efforts of the EU in fighting climate change, protecting the environment and to unlock the economic potential of the green, low carbon and circular economy in the region. The Leaders confirmed their readiness to meaningfully contribute to such an agenda, which was presented at the EU Western Balkans Summit being hosted by Croatia in May 2020." | Decarbonisation, Research, Innovation and Competitiveness |
| The **Zagreb Summit Declaration (May 6, 2020)** concludes that a prominent role should be given to the association of the region to the EU's climate-related ambitions, in line with the Paris Agreement, to promoting the Green Agenda for the Western Balkans, as well as to furthering the digital economy and, strengthening connectivity in all its dimensions: transport, energy, digital and people-to-people, including tourism and culture. Energy security should be prioritised, including the diversification of sources and routes. | Decarbonisation, Energy Security, Research, Innovation and Competitiveness |

*Table 1.6: Policies and NECP elements of joint or coordinated planning*

Regional cooperation provides the opportunity for tackling common problems and for sharing knowledge and good practice. The EU has been financing dedicated regional cooperation projects in the area of environment and climate for a number of years shown in the table below.

| Projects | NECP dimensions |
|---|---|
| **The Regional Environmental Network for Accession (RENA)** project contributed to environmental and climate improvements in the Western Balkans and approximation of the region to EU standards. | Decarbonisation |
| **The Environment and Climate Regional Accession Network (ECRAN)** which provided a link between regional aspects and national priorities in these areas, continued to strengthen regional cooperation between the candidate countries and potential candidates. The continuation of ECRAN was achieved through the **Regional Implementation of Paris Agreement Project (RIPAP)** project in 2018 where regional cooperation in the field of climate change was achieved. It is currently followed up by the **EU Environment Partnership Programme for Accession** and the **EU Support for Climate Action in IPA II beneficiaries "Transition towards the low emissions and climate-resilient economy" (TRATOLOW)**, which supports the EU integration of the Western Balkan partners in the field of environment and climate. | Decarbonisation |
| **The Regional Cooperation Council (RCC)** could play an important role in building the regional dimension of the Green Agenda. The RCC is a regionally owned and led cooperation framework aiming at advancing the European and Euro-Atlantic integration of the region. It works to develop and maintain a political climate of dialogue, reconciliation, tolerance and openness towards cooperation through the implementation of regional initiatives aimed at | Decarbonisation |

| | |
|---|---|
| economic and social development. In terms of environment and climate change, RCC maintains a permanent high-level regional policy dialogue and supports regional cooperation towards achieving Paris Climate commitments and 2030 energy and climate targets. | |

*Table 1.7: Projects and affected NECP dimensions*

**Capacity building** and **financing** are the pillars for planning and implementing joint or coordinated activities and are described in more detail in the sections below.

Capacity building for regional cooperation

The Energy Community will keep monitoring the implementation of an expanding EU acquis and will engage in the newly launched initiative for **Coal Regions in Transition Platform for the Western Balkans and Ukraine**. Many of the actions proposed here will require strong capacity building components. In addition to the traditional consultancy-type assistance, DG NEAR oversees two important instruments for administrative capacity building which can be useful in the delivery of the Agenda. **The Technical Assistance and Information Exchange (TAIEX)** supports public administrations with regard to the approximation, application and enforcement of EU legislation as well as facilitating the sharing of EU best practices. It is needs-driven and delivers short-term tailor-made expertise on the transposition, implementation or enforcement of a specific part of EU legislation. **Twinning** is a European Union instrument for institutional cooperation between Public Administrations in the Member States and the beneficiaries. It brings together public sector expertise to achieve concrete results through peer to peer activities defined in a medium term programme. Both TAIEX and Twinning are important instruments when it comes to capacity building in the Western Balkans.
Energy and climate planning issues related with the Energy Market are consulted with other Contracting Parties: In terms of promoting and further facilitating the implementation of the Gas Master Plan, inter-ministerial cooperation has already been established between Albania, Montenegro, Bosnia and Herzegovina and Croatia on the IAP (Ionian Adriatic Pipeline) project.

Financing regional cooperation

On 16 July 2019, in her **Political Guidelines for the Commission**, the European Commission President Ursula von der Leyen announced as her priority the need to develop a **European Green Deal** and reaffirmed the European perspective of the Western Balkans, pointing out to the important role of continuing the reform process across the region. Finally, the action is fully in line with the communication of the European Green Deal, adopted by the European Commission on 11 December 2019. This strategic document acknowledges that the ecological transition for Europe can only be fully effective if the EU's immediate neighbourhood also takes effective action. The Green Agenda for the Western Balkans is one of the key actions listed in the annex to be achieved. In October 2020, the Commission prepared **An Economic and Investment Plan for the Western Balkans** aiming to spur the long-term recovery - backed by a green and digital transition - leading to sustained economic growth, implementation of reforms required to move forward on the EU path, and bringing the Western Balkans closer to the EU Single Market. In addition to this and based on the approach of the European Green Deal, a **Staff Working Document setting out a Green Agenda for the Western Balkans** is also prepared, containing relevant actions and recommendations, including alignment with the EU standards and the acquis.
During the **Western Balkans Sofia Summit**, held on 10 November 2020, the region reached an important milestone by endorsing the Leaders' Declaration on the Green Agenda that aligns

with EU Green Deal. Declaration is to support and accelerate changes and processes in the region with the overarching goal of addressing climate change. Also, the Global Climate Summit was held on December 12, 2020 where national governments leaders were invited to present more ambitious and high-quality climate plans at the summit, as well as the private sector and civil society.

**Key topics for regional cooperation:**

- Infrastructure projects
- Fossil fuel phase out, including elaboration on aspects such as base load coverage and just transition, to support the change of paradigm.
- Research, innovation and competitiveness: Research infrastructure is expensive and hardly affordable for small countries. Regional collaboration among Western Balkan countries could contribute to innovation and competitiveness of the participating countries.

**Challenges for regional cooperation:**

- Coverage of upfront transaction cost (project development cost needed to start an activity)
- Lack of alignment of government programs
- Government programs are geared towards the short term, while the priority issues described above are long-term in nature

### *ii. Explanation of how regional cooperation is considered in the plan*

Regional cooperation is facilitated by working group meetings organised by the Energy Community Secretariat.
The CDCP III project has facilitated regional cooperation between Montenegro and Albania to exchange information and experience especially about Modelling approaches for Part B of the NECP. GIZ implements the regional program "Capacity Development for Climate Policy in the Countries of South East, Eastern Europe, the South Caucasus and Central Asia, Phase III (CDCP III)".

At the regional level (Energy Community), regulatory bodies harmonize the concepts of implementation of EU legislation through the Energy Community Regulatory Board (ECRB) or the ECRB working groups. These working groups provide a platform for discussing NECP topics of regional importance.

# 2 NATIONAL OBJECTIVES AND TARGETS

Definition of national objectives and targets is largely based on Part B of the NECP, where PaMs are modelled in the WEM scenario and WAM scenario. PaMs considered in the scenarios are shown in table 4.3 including descriptions of the effects on variables.

The operation of the Thermal Power Plant (TPP) Pljevlja plays a key role in achieving the NECP targets. It should be noted that there is a conflict of objectives between GHG savings and contributing to energy security in Montenegro, which can only be resolved with a long-term time horizon.

Comparison of NECP 2030 targets with EnC targets according to Decision 2022/02/MC-EnC[12] demonstrates compliance as shown in the next table.

The EnC targets for Montenegro are also presented to demonstrate compliance with the EnC provisions respectively to show that the targets are in the same order of magnitude as the results of the WAM scenario.

| Key Objectives | EnC Targets for Montenegro [13] | National targets | WEM scenario in 2030 | WAM scenario in 2030 |
|---|---|---|---|---|
| Primary energy consumption | 0,92 Mtoe | 0.92 Mtoe | 1.04 Mtoe | 0.97 Mtoe |
| Final energy consumption | 0,73 Mtoe | 0.73 Mtoe | 0.82 Mtoe | 0.77 Mtoe |
| Share of renewables in the gross final energy consumption | 50 % | 50 % | 43 % | 53 % |
| GHG emission decrease[14] | 55 % (total 2.42 $MtCO_{2eq}$) | 55 % (total 2.42 $MtCO_{2eq}$) | total 3.06 $MtCO_{2eq}$ | total 2.40 $MtCO_{2eq}$ |

*Table 2.1: Comparison of NECP Targets with EnC Targets*

## 2.1 Dimension Decarbonisation

### 2.1.1 GHG emissions and removals

Basic information from Part B of the NECP regarding the national target for GHG emissions by 2030 is shown in the tables below.

Total GHG emissions (kt CO2eq with LULUCF) as projected for 2030 with existing measures amounts to 618.3 kt CO2eq, whereas the values in WAM reach -216 kt CO2eq, which corresponds to a reduction of -101.5% relative to WEM values. In comparison with 2022, WAM entails a decrease of emissions of -126.3% in 2030, later -181.8% in 2040, and -333.2% in

[12] https://www.energy-community.org/implementation/package/CEP.html
[13] https://www.energy-community.org/implementation/package/CEP.html
[14] This target excludes LULUCF emissions and removals.

2050. The WEM scenario sees a decrease of emissions by -24.7% in 2030 compared to 2022, and a decrease by -81.7% in 2050.
The analysis shows that highest emissions are generated by the sectors Transformation (mainly electricity production) and Demand, and within Demand, Transport and Industry are the main emitter of greenhouse gases. These sectors require special attention.
The following tables show an overview of GHG emissions as projected by WEM and WAM scenario.

| Sector | WEM 2030 | **WAM 2030** |
|---|---|---|
| Demand | 1,049.1 | 814 |
| Transformation (mainly electricity production) | 1,280.6 | 1,014 |
| Non-Energy | -1,711.4 | -2,043 |
| Total | 618.3 | -216 |

*Table 2.2: GHG emissions [kt CO2eq] as projected with existing measures (WEM) and with additional measures (WAM) for 2030 for the Whole economy*

| Sector | WEM 2030 | **WAM 2030** |
|---|---|---|
| Residential | 11.4 | 1.4 |
| Services | 33.6 | 33.6 |
| Industry | 250.2 | 206.8 |
| Transport | 742.7 | 610.2 |
| Agriculture Forestry | 11.2 | 10.6 |
| Total | 1,049.1 | **813.5** |

*Table 2.3: GHG emissions [kt CO2eq] as projected with existing measures (WEM) and with additional measures (WAM) for 2030 for the specific Demand sectors*

| Sector | WEM 2030 | **WAM 2030** |
|---|---|---|
| IPPU (Industrial Processes and Product Use) | 186.5 | 183.9 |
| Agriculture | 204.9 | 205.8 |
| LULUCF | -2,440.4 | -2,616.9 |
| Waste | 337.6 | 183.8 |
| Total | -1,711.4 | -2,043.4 |

*Table 2.4: GHG emissions [kt CO2eq] as projected with existing measures and with additional measures for 2030 for the specific Non-Energy sectors*

For the purpose of the NDC revision, a background paper has been prepared. The updated NDC target, adopted in June 2021 of **-35% by 2030 compared to 1990** is an increase in ambition compared to the INDC and seems with the measures already planned possible to be achieved. An uncertainty must be attributed to the economic development, globally severely affected by the COVID-19 pandemic.

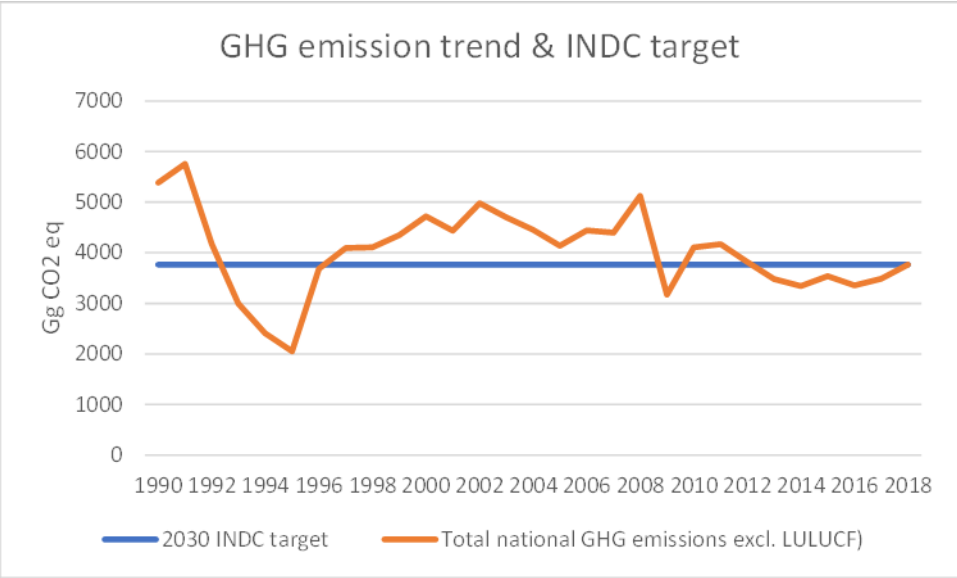



*Figure 6: Comparison of past emission trend and INDC target (-30% by 2030 compared to 1990)*

Regarding data and methods applied to the GHG inventory to calculate emissions, removals in the LULUCF sector have been removed. There are remaining substantial question marks to the development of the LULUCF sector in the future. For this reason, no measures have been taken into account, and the proposed revised NDC target does NOT consider the LULUCF sector.

*Other national objectives and targets consistent with the Paris Agreement and the existing long-term strategies*

**ICAO National Action Plan for reducing $CO_2$ Emissions in Civil aviation** was approved in July 2013.
The Low-Carbon Development Strategy (LCDS) until 2050 as well as National Adaptation Plan (NAP) have not been prepared so far, but envisaged by the Law on the Protection against adverse impacts of Climate Change.

**Regulation on Activities or Operations Emitting Greenhouse Gases for Which the Permit for Greenhouse Gas Emissions has been Issued** shall govern activities or operations emitting greenhouse gases for which the permit for greenhouse gas emissions has been issued, the total amount of emission allowances to be allocated in relation to the initial status of the greenhouse gas emissions, the method of carrying out the auction for allocation of emission allowances, the minimum price of emission allowances offered in the auction, allocation of emission allowances free of charge, use of funds collected through the auction for allocation of emission allowances, and the method of keeping records of allocated emission allowances, their transfer and use.

*Outlook up to 2050*

The outlook to 2050 shows that existing policies and measures (WEM scenario) are appropriate to reduce GHG emissions in the demand sectors and to increase the carbon sinks, with the exception of Transformation (mainly electricity production), where the emissions remain the

same. The WAM scenario shows a major change in the Transformation sector which is attributed to the change in operation of TPP Pljevlja.

| Sector | WEM 2050 | **WAM 2050** |
|---|---|---|
| Demand | 838.3 | 412.6 |
| Transformation | 1,261.0 | 36.5 |
| Non Energy | -1,948.7 | -2,364.9 |
| Total | 150.6 | -1,915.8 |

*Table 2.5: GHG emissions [kt CO2eq] as projected with existing measures and with additional measures for 2050 for the Whole economy*

Until 2040 the largest part of emissions reduction appears in the non-energy and demand sectors, while by 2045 the largest part of emissions reduction is due to the transformation sector and the phasing out of the thermal power plant.

| Sector | WEM 2050 | **WAM 2050** |
|---|---|---|
| Residential | 7.4 | 0.9 |
| Services | 27.2 | 27.2 |
| Industry | 306.0 | 153.0 |
| Transport | 486.9 | 221.4 |
| Agriculture Forestry | 10.7 | 10.1 |
| 838.3Total | 838.3 | 412.6 |

*Table 2.6: GHG emissions [kt CO2eq] as projected with existing measures and with additional measures for 2050 for the specific Demand sectors*

| Sector | WEM 2050 | **WAM 2050** |
|---|---|---|
| IPPU (Industrial Processes and Product Use) | 85.6 | 82.2 |
| Agriculture | 133.3 | 144.5 |
| LULUCF | -2,416.8 | -2,642.6 |
| Waste | 249.2 | 51.0 |
| Total | -1,948.7 | -2,364.9 |

*Table 2.7: GHG emissions [kt CO2eq] as projected with existing measures and with additional measures for 2050 for the specific Non-Energy sectors*

**Sector Transformation/TPP Pljevlja:** In addition to the Project of Environmental Retrofitting that has been necessary for lignite-fired TPP Pljevlja to be able to operate during the mentioned period and contribute to the implementation of a successful and just energy transition, plans for phasing out lignite have been under discussion and preparation. There have been plans for the construction of new renewable energy plants as well as an indication of the possible use of gas, which would provide a temporary solution for the transition. In cooperation with its partnership company EPCG considers the possibility of implementing the pilot project on usage of TPP Pljevlja's capacity as an energy to storage.

### 2.1.2 Renewable energy

Basic information from Part B of the NECP regarding the national target for RES shares by 2030 is shown in the table below.

**RES shares in final energy demand**
In overall terms, the additional measures increase the share of renewables in final energy from 42.8% (WEM scenario) in 2030 to 53.3% (WAM scenario).
The table below shows RES shares in final energy demand, calculated according to EUROSTAT SHARES methodology with existing (WEM) and additional measures (WAM) in 2030.

| Sector | WEM 2030 | WAM 2030 |
|---|---|---|
| RES E | 66.3 | 79.4 |
| RES T | 7.2 | 24.4 |
| RES HC | 48.8 | 49.2 |
| RES | 42.5 | 53.3 |

*Table 2.8: Renewable shares (%) in 2030 in final energy demand*

In terms of renewable energy supply, hydropower accounts for the lion's share, followed at some distance by wind and solar energy.

*Estimated trajectories for the sectoral share of renewable energy in final energy consumption from 2021 to 2030 in the electricity, heating and cooling, and transport sector*

Estimated trajectories by renewable energy technology are available in Part B of the NECP in Table 4.9.

*Estimated trajectories by renewable energy technology*

Estimated trajectories by renewable energy technology are available in Part B of the NECP in Table 4.10.

*Estimated trajectories on bioenergy demand*

Estimated trajectories on bioenergy demand are available in Part B of the NECP. Table 4.12 presents the Shares of wood final energy demand by sectors Residential, Services, Industry, Agriculture/Forestry.

## 2.2 Dimension Energy Efficiency

*National target of increase in energy efficiency by 2030*

Basic information from Part B of the NECP regarding the national target for increasing energy efficiency by 2030 is shown in the tables below.

Primary energy supply
In both the WEM and WAM scenarios, net energy demand is slightly decreasing in total towards 2050. In the WEM scenario, net primary energy consumption increases (compared to 2022) by 0.5 % until 2030 and decreases by 8.4 % until 2050. In the WAM scenario, it decreases by 6.4% in 2030 compared to 2022 and decreases by 32% in 2050. Comparatively, the consumption in the WAM scenario decreases compared to the WEM scenario by 6.9 % in 2030 and 23.6 % in 2050.

Final energy demand
In the WEM scenario, final energy consumption increases (compared to 2022) by 7.3 % until 2030 but then decreases by 3.8 % in 2050. WAM scenario increases by 1.3 % until 2030 and then decreases by 14.2 % in 2050. Comparatively, the final energy consumption in the WAM scenario decreases compared to the WEM scenario by 6 % in 2030 and 10.4 % in 2050.

| **Targets 2030** | **WEM 2030 Ktoe** | **WAM 2030 Ktoe** |
|---|---|---|
| Total Primary Energy Supply (Production) | 1,037.9 | 966.6 |
| Final Energy Consumption | 817.3 | *771.6* |

*Table 2.9: Indicative national energy efficiency targets in 2030*

The table below shows Final energy consumption (ktoe) for different demand sectors and as projected until 2030 and 2050.

| Sector | WEM 2030 | WEM 2050 | **WAM 2030** | WAM 2050 |
|---|---|---|---|---|
| Residential | 231.5 | 162.4 | 231.5 | 162.4 |
| Services | 92.4 | 82.1 | 92.4 | 82.1 |
| Industry | 181.9 | 224.4 | 179.2 | 222.4 |
| Transport | 252.2 | 185.6 | 210.2 | 111.7 |
| Agriculture Forestry | 5.5 | 5.3 | 5.5 | 5.3 |
| Non energy | 53.8 | 72.6 | 52.8 | 69.7 |
| Total [ktoe] | 817.3 | 732.4 | 771.6 | 653.6 |
| Total [Mtoe] | 0.817 | 0.732 | 0.772 | 0. 654 |

*Table 2.10: Final energy consumption [ktoe] as projected with existing and additional measures for different scenarios*

The major reduction in final energy consumption between the two scenarios is attributed to the transportation sector.

*Cumulative energy savings in the period 2021-2030 in accordance with Article 7 (1) (b) on the energy efficiency obligation scheme of Directive 2018/2002 amending Directive 2012/27/EU on energy efficiency*

Detailed information regarding EEO schemes and alternative measures is given in the 4th EEAP – Chapter 3.1.1 and Annex 1.

| Targets 2030 | Annual savings | Cumulative savings |
|---|---|---|
| According to Article 7 (3a) (b) (With the exceptions referred to in Articles 7 (2)) | 3.72 | 204.59 |

*Table 2.11: Indicative annual and cumulative savings in 2030*

*Indicative targets of the long-term strategy of renovation of the national residential and non-residential building stock*

Addressed by PaM EO4b "Development and implementation of energy efficiency regulatory framework in buildings: Long term renovation strategy and inspection of technical building systems".

*The total area of public administration buildings that are being renovated or equivalent savings in the period 2021-2030*

Article 8 of the Law on efficient use of energy stipulates that state-owned, administrative buildings which are used by state authorities have to meet minimum energy efficiency requirements. The same article stipulates, that the Ministry in cooperation with administration body, which is competent for property affairs, shall prepare a three-year plan for reconstruction of administrative buildings.

Article 5 focuses on the annual renovation of 1% of the total treated (heated / cooled) space of buildings owned by central administration bodies and occupied by members of the central authorities in Montenegro. According to the available data on inventory of buildings of the central administrative buildings, the total heated area is 72,235 $m^2$.

Considering the preliminary estimations and the condition of the existing buildings including space heating and cooling systems, a unit final energy savings of 130 kWh/$m^2$ has been estimated. The renovation of 1% of the heated space results in an annual mandatory share of 722.35 $m^2$, which, taking into account the adopted assumptions, results in an annual saving of 93.9 MWh or 0.008 ktoe annually.

*Long-term renovation strategies for the national stock of residential and non-residential buildings*

Pursuant to Article 2a of Directive 2018/844 amending Directive 2010/31/EU on the energy performance of buildings, Montenegro has developed a new Long-term strategy for promotion of investments in the renovation of the national building stock with a plan of measures and indicators for 2030, 2040 and 2050, which will be aligned with the National Energy and Climate Plan and Low-Carbon Development Strategy.

Addressed by PaM EO4b "Development and implementation of energy efficiency regulatory framework in buildings: Long term renovation strategy and inspection of technical building systems".

*National objectives in areas such as energy efficiency in the transport sector and with regard to heating and cooling*

No long-term targets or strategies and sectoral targets in the transport sector and with regard to heating and cooling planned.

Certain activities were initiated in the previous period with the aim of meeting the obligations from Article 14 EED, that stipulates that member countries shall prepare an overall analysis of potential of high-efficiency cogeneration, as well as efficient systems of district heating and air conditioning. According to the Energy Law, Article 20, a special Action Plan for the development and use of district heating and/or cooling and high-efficiency cogeneration, has been adopted by the Government for a ten-year period.

## 2.3 Dimension Energy Security

This dimension includes targets on security of supply, which is ensured by generation adequacy and network and system operation security.

A risk analysis and assessment of security in several scenarios to select the most sustainable policy and roadmap is not yet available as this is a project on its own.

The target is 100% security of supply that should be achieved by managing the availability of fluctuating renewable electricity, diversification of energy sources for base load coverage, and ensuring the stability of the electricity grid. In this regard, TPP Pljevlja and the electricification of the transport sector play important roles.

The sections below present relevant background information.

**Electricity**

The main characteristics of the Montenegrin power system in the recent years is a dynamic increase of domestic electricity production which results in the decrease of import dependency. All new power plants are RES and it is expected that the present trend further evolves.

The current electricity production mix is represented by:

- 2 large hydropower plants (307+342 MW),
- 1 large thermal plant (225 MW),
- 2 wind power plants (72+46 MW)
- 3 small solar power plants (cca 2 MW) and
- 30 small hydropower plants (cca 39.4 MW).

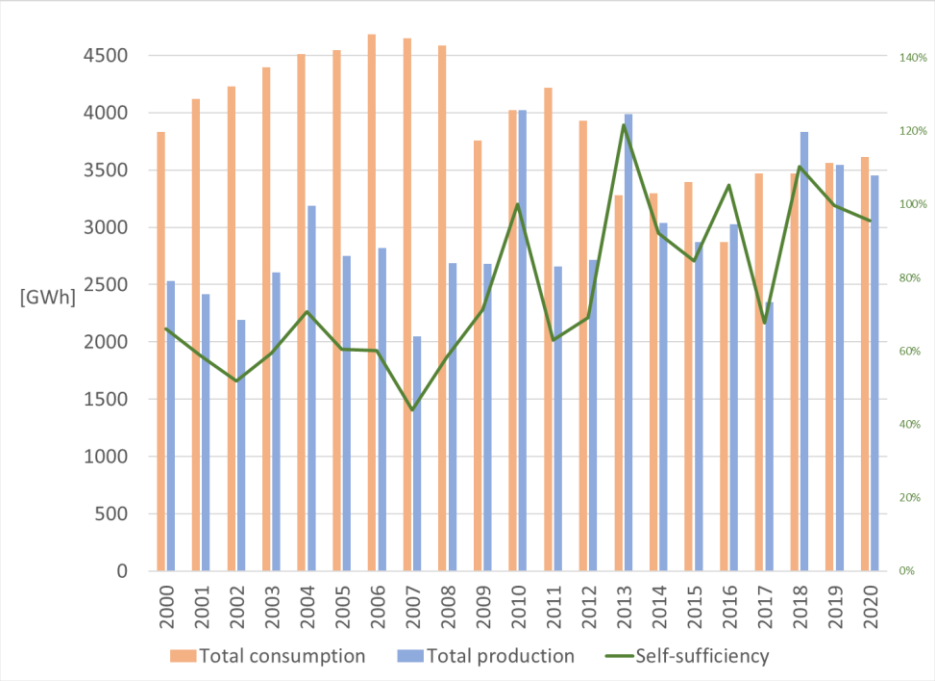



*Figure 7: Electricity balance of Montenegro*

The most dominant share in electricity production corresponds to 2 large HPPs (Figure 8), but TPP Pljevlja has also a very important share in the total annual electricity production. In recent years, HPPs have been the most popular new sources and their share in annual electricity production has been constantly increasing. Also, sHPPs were popular due to the incentives, but their impact will decrease in future.

The potential opt-out of TPP Pljevlja and the increasing problems with lack of precipitation regarding HPP make it clear that the expansion of solar power and wind power are important targets.

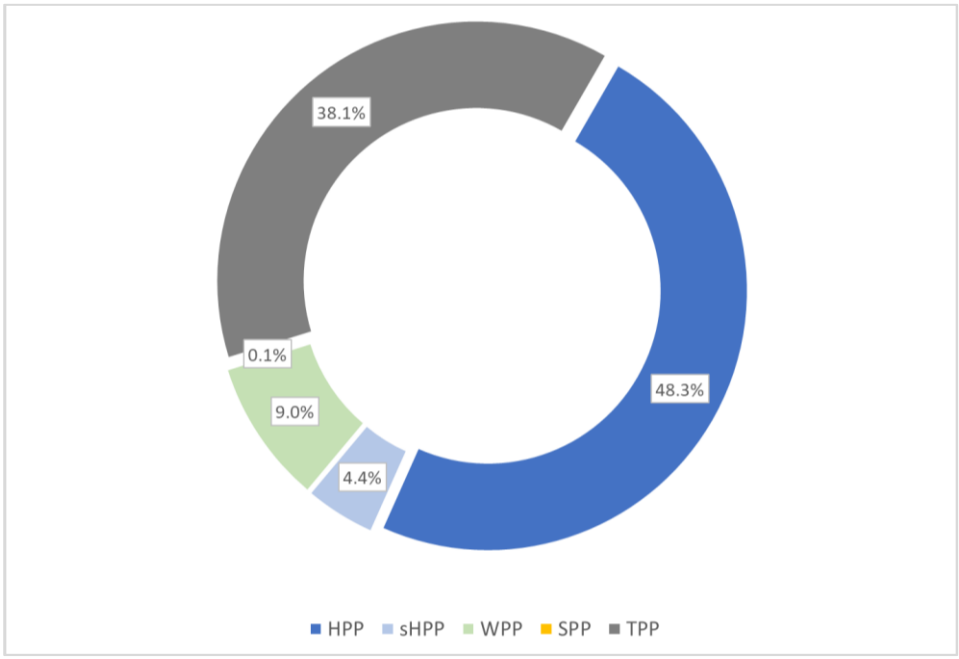



*Figure 8: Electricity production structure in 2020*

The share of RES in annual electricity production is highly dependent on hydrological situation (Figure 9), and it can reach 77 %, but the typical share of RES is about 60 %. It is expected that this share would further increase in the following years.

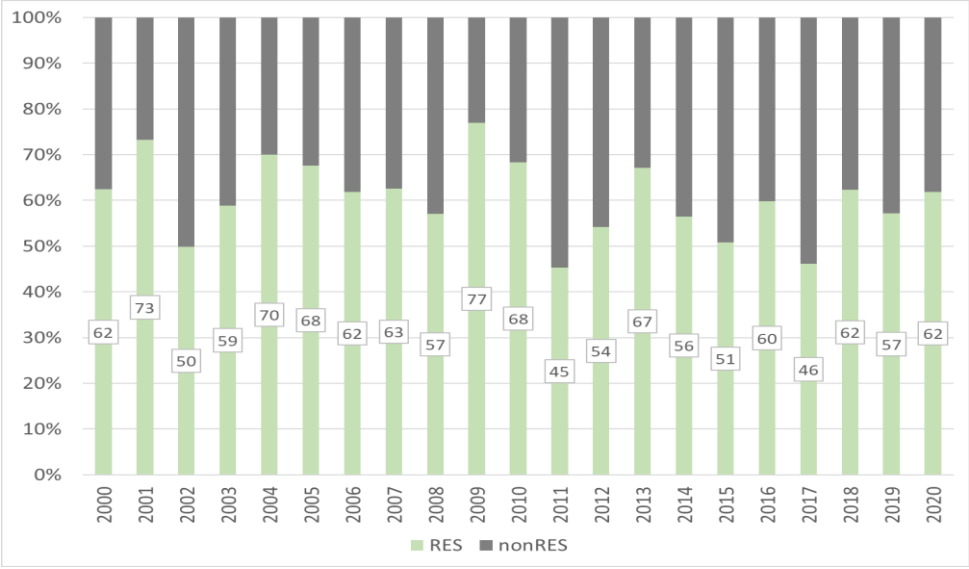



*Figure 9: The share of RES electricity production in Montenegro*

There are plans for several new wind power plants of similar size and solar PVs are recognized as power plants that will expand with the greatest dynamics since the utilization of their potential is currently very low.

## Coal

The total Montenegrin needs for coal are produced in Montenegro. There are two main areas where the coal is exploited in Montenegro: Pljevlja area and Berane area. In these areas two types of coal are registered: lignite (Pljevlja) and brown coal (Berane). Currently, coal still plays an important role for energy security reasons, but due to climate impact a JUST TRANSITION process needs to be initiated in Pljevlja and Berane area. Coal phase out is planned by 2035.

Almost total annual consumption of the coal in Montenegro corresponds to TPP Pljevlja (1.4 million tons). The rest of it is consumed in local domestic or industrial boilers in Pljevlja.

## Distribution network (SAIDI SAIFI)

It is an important target to improve the electricity distribution grid because it is very heterogeneous with respect to the network configuration, capacity, location, geographical consumption distribution, etc. which leads to challenging tasks in its exploitation and development planning.

The distribution network consists of the following voltage levels: 35 kV, 10 kV and 0.4 kV. Recently there is also 20 kV voltage level which is used for supplying highway infrastructure. Also, there are small parts of 6 kV voltage level as a remainder of old industrial grids.

The total length of medium voltage lines is 6,258.88 km (1,043.06 km (35 kV) + 5,215.82 km (10 kV)) in 2020. The share of cables is 27.67%, and it is increasing. The length of low voltage grid is 13,302.51 km. The share of low voltage cables is 15.63%. Total number of power substations (including 4 SS 110/10 kV) is 5,069, with installed power of 3,169.29 MVA.

There are 396,462 distribution network users in Montenegro. The most used indicators of operational quality of a distribution system are SAIFI and SAIDI. Their values for 2019 in Montenegro are 3,258.88 min and 34.51 respectively. However, due to the regional grid characteristics the mentioned parameters are regionally monitored (Figure 10, Figure 11). It is evident that the performance of the grid is significantly better in central and southern regions of the country.

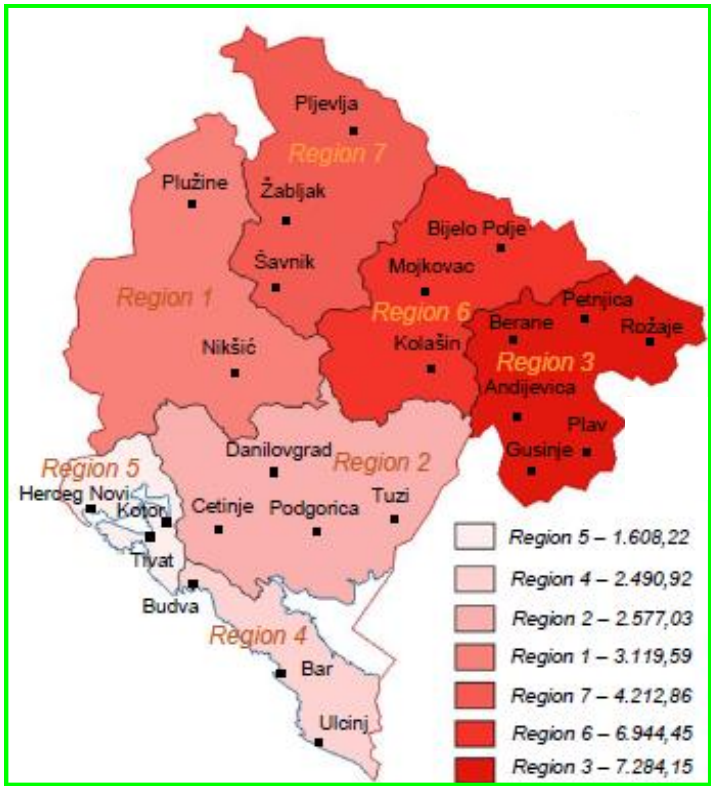



*Figure 10: SAIFI values per distribution network regions*

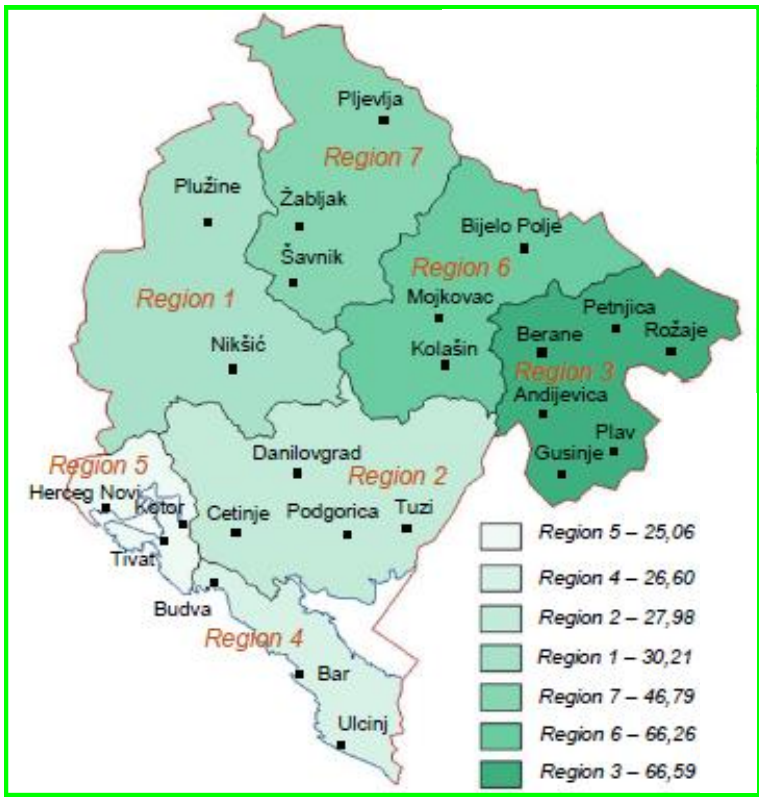



*Figure 11: SAIDI values per distribution network regions*

The 'Rules of minimum quality of supply of electricity' (Officially published 31st July 2017) prescribe a rule according to which the Distribution System Operator is obligated to keep records of system reliability indicators, which are related to the operation and functioning of the system (SAIFI and SAIDI). The first year in which the SAIFI and SAIDI indicators were calculated is 2018, by manual collection at 35kV, 10kV and 0.4kV voltage levels. Such data collection carries risk of certain errors but CEDIS is certainly obliged to publish official data in its website of the values of the SAIFI and SAIDI reliability indicators at the end of the year.

The Network Management Sector in CEDIS has implemented the ISSCEDIS software solution, which one of the modules would be used for automated record keeping of interruptions throughout the territory of Montenegro. With the development of this software, the accuracy and acquisition of the data would be raised to a higher level, which would contribute to more efficient data processing, as well as system calculation at the level of all organization units.

Although there are no plans and projections for reducing SAIFI and SAIDI reliability indicators, as they have not been imposed by Energy Regulatory Agency, CEDIS is doing their best to reduce reliability indicators. The previous three-year period of data collection and processing and calculation of reliability indicators will serve CEDIS and the Energy Regulatory Agency to set achievable goals, all with the aim of better reliability and quality of delivered energy to the end consumers.

According to the Law on Energy of Montenegro, which is harmonized with the Energy Policy until 2030, Article 4 stipulates that "providing sufficient quantities of energy necessary for the life and work of citizens and business and development of economic entities and their safe supply, a safe, reliable and quality way, as well as energy development are in the public interest.

Article 116 of the Energy Law stipulates respective obligations the Distribution System Operator (DSO) has to comply with.

The Energy Development Strategy of Montenegro until 2030 states that the development of the ED network in recent years is not sufficiently harmonized with spatial planning documents, as a result of which EDS is not able to adequately respond to increasing consumption requirements, i.e. very intensive construction, especially in Podgorica and the coastal part of Montenegro, which often leads to investor dissatisfaction. At the same time, electrical losses in ED networks are still significantly above acceptable international standards. In a number of cases, especially suburban and rural networks, unsatisfactory voltage quality and longer power outages are recorded, which also leads to dissatisfaction of electricity customers.

In accordance with the Energy Development Strategy of Montenegro until 2030, the development of the ED network until 2030 should be planned so as to increase security of supply (provision of two-way power supply, especially in the most important points of the ED network) and reduce losses (technical and commercial) below 10%. To this end, it is necessary to envisage the construction of new 110/35 kV substations, reconstruction of existing 110/35 kV substations, expansion of 35/10 kV and 110/10 kV substations and reconstructions aimed at increasing the capacity of existing 35/10 kV substations. With the increase in electricity needs, the concept of ED network with two medium voltages (35 and 10 kV) has become

inadequate, especially in urban areas with higher load density. Conducted analyzes and international experiences have indicated the need to introduce direct 110/10 kV transformation, which began in Montenegro in the 1980s with the construction of the first 110/10 kV substations in Podgorica.

In the case of reconstructions and new constructions, all substations 35/10 kV will be prepared for remote control with the installation of numerical control, protection and measurement systems. In the future, the ED network will switch to remote control from a modern control center, which is envisaged by the Energy Development Strategy of Montenegro until 2030.

Due to global structural changes in the economy, energy sector and customer requirements, electricity distribution in general, and thus CEDIS, faces completely new challenges. The development of the national economy will significantly depend on the manner and dynamics in which CEDIS will solve the new challenges. Therefore, in addition to the current goals, it is necessary to introduce new elements in the development of CEDIS that will:

- create conditions for more intensive introduction of distributed RES plants into the ED network,
- support the development of new products on the electricity market with smart metering systems,
- create conditions for the introduction of DSM with modern communication systems and smart local and remote control,
- support the construction of infrastructure for the introduction of places for charging batteries of electric vehicles in road traffic.

In addition to investing in the so-called primary equipment, ED activities entail considerable investments in other segments. Particular emphasis is placed on investments in dispatch centers and communication equipment, remote control system, as well as electricity meters

It is generally recommended to use modern ("smart") electronic meters that enable remote reading and consumption management, because in this way the wider issue of connection arrangement (metering point) in terms of access to the meter and reduction of commercial losses due to unauthorized consumption, etc..

Taking into account the basic principles and guidelines of network development, as well as the applied criteria for the reconstruction and construction of the elements, it is possible to single out the general types of projects that are candidates in this Plan. All projects can be divided into 3 groups according to the part of the electricity distribution network to which they refer:

- Network construction, reconstruction and revitalization projects (35 kV, 10 kV and LV): Construction of groundwater, construction of overhead line, network relocation, cable line replacement, replacement of poles, suspension equipment, conductors, installation of reclosers, installation of line disconnector.
- Projects for construction, reconstruction and revitalization of substations (TS 35 / X kV, TS 10 / 0.4 kV and TS 110 / X kV): Construction of substations, complete reconstruction of substations, replacement of MV plants, replacement of LV plants, replacement of MV and LV plants, replacement of transformers, replacement of transformers and MV plants, replacement of transformers and LV plants, reconstruction of relay protection and control of substations, procurement of industrial computers with software,

replacement of circuit breakers and reconstruction of relay protection and control of substations, equipping of MV cells, installation of circuit breakers, rehabilitation / reconstruction of the construction part of substations.

- Other projects related to the improvement of the network operator's business as a whole: Reconstruction of connections for the needs of relocation of measuring points, installation of measuring equipment, procurement of personal computers, procurement and installation of server computer and communication equipment, procurement of instruments, auxiliary equipment of tools and software, procurement of vehicles, rehabilitation / reconstruction of work premises, protection at work and environmental protection, supervision and management of the electricity distribution network, improvement of business processes.

The largest number of projects per year refers to the 10 kV network and the transformation of 10 / 0.4 kV, especially in the first half of the planning period. In the second half of the plan, the focus is on the 35 kV network. When it comes to the distribution of projects by region, it follows the characteristics of the region (size, number of consumers and expected increase in consumption), so most projects follow regions of the coastal area, which are characterized by a pronounced trend of increasing consumption in the planning period. Other regions, due to a slight trend of growth or stagnation of consumption, are characterized mainly by projects of reconstruction and revitalization of network capacities with investments aimed at improving the reliability and quality of electricity supply.

The prices of electricity for households in Montenegro are significantly lower than EU average (Figure 12).

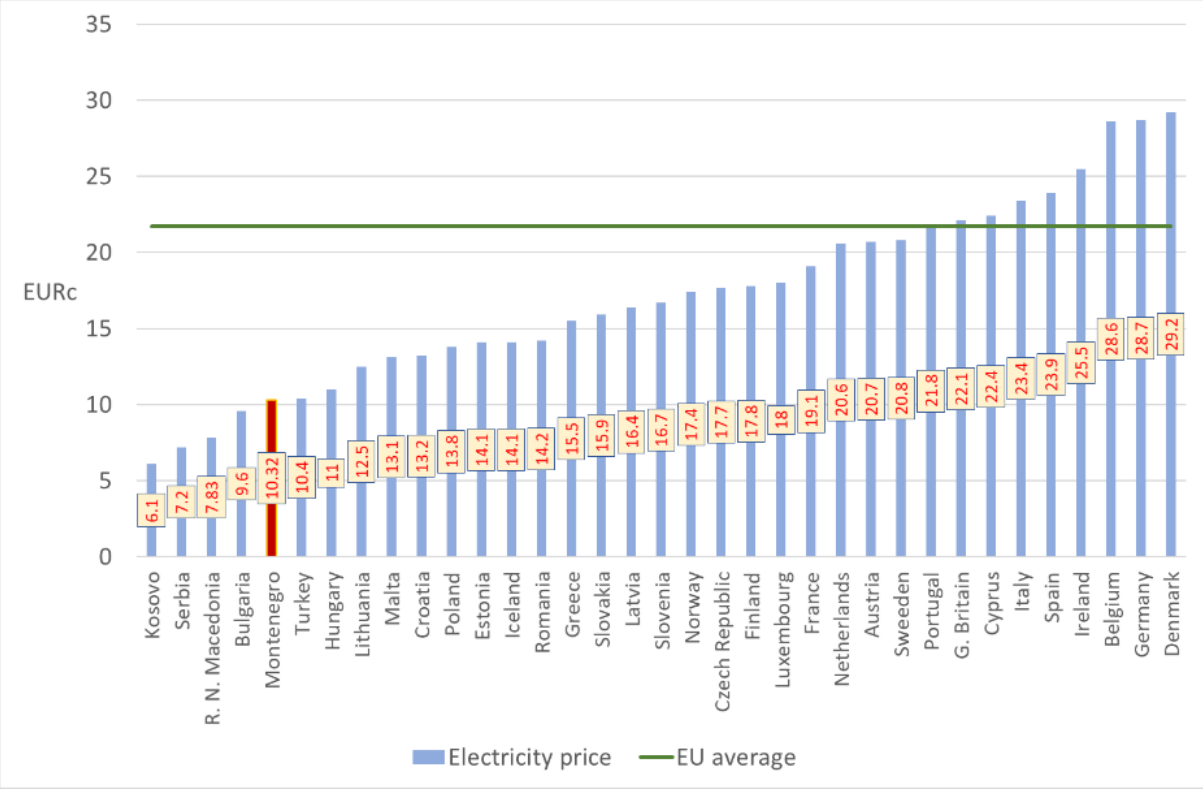



*Figure 12: Average electricity price for households in 2019*

**Natural gas**

Montenegro currently does not have access to natural gas sources, nor infrastructure to support its use. The Energy Development Strategy until 2030 clearly recognizes natural gas as an important energy source, which would contribute to the diversification of the Montenegrin energy mix. It is planned to use natural gas as a substitute for other forms of energy, especially for the use of electricity and to substitute coal for heating and cooling.

In 2017, the Government of Montenegro adopted the Master Plan for Gasification of Montenegro, which together with the Report on Strategic Environmental Assessment and Guidelines for Planning Priority Investments in Gas Pipeline Projects forms the umbrella document for the natural gas sector in Montenegro. The Master Plan considers possible scenarios for Montenegro's gas supply and concludes that it is most realistic for Montenegro to be supplied with natural gas by building the Ionian-Adriatic Gas Pipeline (IAP) and valorizing its gas reserves from the Adriatic submarine.

However, the drilling projects have not been successful so far, so that the valorisation of the gas reserves only appears possible in the long term, if at all, in view of the phase-out of fossil fuels and the negative environmental impacts that are being investigated using the Strategic Environmental Assessment (SEA).

In 2016, the Project Management Unit (PMU) was established, consisting of one representative of the state body responsible for energy and one representative of the Transmission System of Natural Gas (TSO) from all four signatory countries of Memorandum of Understanding and Cooperation on the implementation of the IAP project - Albania, Bosnia and Herzegovina, Montenegro and Croatia. The Azerbaijani company SOCAR and the Secretariat of the Energy Community have the status of observers in the PMU, without the right to vote. The Ministry of Energy is in charge of coordinating all activities and represents the permanent Secretariat of the PMU.

During 2019, the IAP project activities included the following activities:

- Resuming activities on establishing a joint company Gas Transmission System Operator for Albania, Montenegro, Bosnia & Herzegovina and Croatia.
- Preparation of Preliminary design of the Ionian-Adriatic gas pipeline on the territory of Albania and Montenegro.

**Oil and petroleum products**

In the previous period, concession agreements were signed for the production of hydrocarbons, with a total area of 1,228 $km^2$, with the companies Eni Montenegro, BV Netherlands and Novatek Montenegro, BV Netherlands, with a share of 50% each, as well as with Energean Montenegro Limited Cyprus for blocks with a total area of 338 $km^2$. However, the drilling projects have not been successful so far, so that the valorisation of the oil reserves only appears possible in the long term, if at all, in view of the phase-out of fossil fuels and the negative environmental impacts that are being investigated using the Strategic Environmental Assessment (SEA).

The total storage capacities of petroleum products and LPG at the end of 2019 amounted to 143,685 $m^3$, of which the storage capacities of petroleum products amounted to 141,116 $m^3$, while the capacities for storage of LPG amounted to 2,569 $m^3$. The total storage capacity in 2019 was increased by 1,358 $m^3$.

**District heating**

District heating (lignite-fired) is operational only in Pljevlja, but covers only a minor part of the town. Significant expansion of district Pljevlja heating has been envisaged after the planned TPP refurbishment, to supply heating to households currently using individual boilers.

Currently, there are further plans for biomass district heating development in several towns, such as Nikšić, Rožaje, Bijelo Polje, Kolašin i Žabljak.

*National objectives with regard to reducing energy import dependency from third countries, for the purpose of increasing the resilience of regional and national energy systems*

Reduction of electricity import shares is another specific target. The electricity import share is already very low in the WEM scenario (2.7% in 2030 and 4.8% in 2050) and can be reduced to 0% in the WAM scenario.
PaMs addressing energy efficiency in the demand sectors and additional renewable energy production are essential in this context.

*National objectives with regard to increasing the diversification of energy sources and supply from third countries for the purpose of increasing the resilience of regional and national energy systems*

According to Article 8 of the Energy Law (**Objectives of the energy sector development**):
(1) Long-term goals, economic and institutional-organizational framework of energy development are determined by general guidelines of energy policy.
(2) The guidelines referred to in paragraph 1 of this Article shall be adopted by the Government of Montenegro (hereinafter: the Government).
(3) The guidelines referred to in paragraph 1 of this Article shall be further elaborated and implemented by the National Energy and Climate Plan of Montenegro (hereinafter: the National Energy and Climate Plan), the action plan for the development and use of district heating and / or cooling and highly efficient cogeneration energy plans and energy balance.
(4) The plans referred to in paragraph 3 of this Article shall be published on the website of the state administration body responsible for energy affairs (hereinafter: the Ministry).

According to Article 7 of the Energy Law (**Long-term energy development objectives**):
Development of the energy sector is planned with the following objective:
1) ensuring of regular, secure and quality energy supply;
2) ensuring sustainable and efficient generation and use of energy;
3) developing and usage of different energy sources;
4) increasing production and/or use of energy from renewable sources and high-efficiency cogeneration;

5) efficient carrying out of energy activities and public services while ensuring sustainable development;
6) environmental protection in all areas of the energy activities;
7) ensuring competition on the energy market based on the principles of objectivity, transparency and non-discrimination;
8) maintaining stable business conditions and encouraging public, private and public-private investment and business in the field of energy;
9) protecting final energy customers;
10) connecting of the Montenegrin energy system with the European energy systems and systems of the neighbouring countries in accordance with energy requirements and requirements in economic development;
11) developing energy market and its connecting with regional and internal European Union market;
12) creating conditions for investments in the energy sector.
13) developing of gas systems and their connection with neighbouring gas systems, so as to cover domestic requirements for natural gas and diversification of energy sources.

*National objectives with regard to increasing the flexibility of the national energy system, in particular by means of deploying domestic energy sources, demand response and energy storage*

The first priority of the Energy Policy of Montenegro by 2030 is security of energy supply, which means permanent, secure, quality and diversified energy supply in order to balance supply with customer's requirements.
According to the recently amended Energy Law, security of system functioning means a continuous managing over transmission and, if necessary, distribution system under the forecasted circumstances, while security in supply means capability of energy or gas system to provide adequate quantity of energy or gas to continuously service the needs of final customers, as well as capability of transmission and distribution systems to ensure delivery of energy to the final customers.
According to article 112 of the Energy Law, Transmission System Operator shall: ensure security of operation of electric power system, revise operation plans for power plants in case of a threat to security of operation of electric power system, failures, big deviations from planned demand, ensure cross-border cooperation including allocation of cross-border capacity in order to check security of the grid.
According to article 142 of the Energy Law, Gas Transmission System Operator shall: provide distribution system operators, neighbouring transmission system operators or other gas undertakings with required information to ensure system inter-operability and secure and efficient operations of the interconnected system

In line with the Master plan for the development of the gas transmission system (Montenegro gasification) November 2015, the dynamics of the planned connection to the IAP and TAP is possible earliest from 2020 onwards, as well as the potentially discovery and exploitation of domestic gas would determine the later specifics of the natural gas market.

Within the European Investment and Recovery Plan, in the area of renewable energy, the Commission suggests the flagship project: The Piva Hydro Power System in Montenegro will be expanded with the start of the construction of the Komarnica Hydro Power Plant. In 2020, the Government of Montenegro approved concession act to the EPCG for construction of the plant with installed power of 172 MW and expected annual production of electricity up to 213 GWh.

## 2.4 Dimension Internal energy market

### 2.4.1 Electricity interconnectivity

There are several parameters that indicate the state of electricity connectivity of Montenegrin power system. The voltage level of interconnections with neighboring systems are: 400 kV (3), 220 kV (5), 110 kV (3) and a single 500 kV HVDC link. The total installed transmission capacities of existing interconnectors which amounts up to 8186 MVA. However, there is only 2500 MW of the total available cross-border capacity for import and export.

Taking into account that there is 1028.7 MW of the total installed capacity of power plants (88 % are RES), it is evident that the EU target (related to the desired level of electricity interconnection of at least 15% compared to installed power of power plants in the observed member state by 2030) is more than achieved. Also, average system peak load amounts up to 600 MW which is expected to rise with lower gradient than installed capacity of power plants which will enable self-sufficiency of electricity supply. The low NTCs will be improved through the changeover from the NTC to the flow-based methodology that will be addressed in accordance with the EU regulations, soon. Besides, the preparation of the Study for resource adequacy and flexibility in duration of 12 months has commenced in Sept 2021 through the EMI (USAID/ESEA) project.

### 2.4.2 Energy transmission infrastructure

Montenegrin transmission network consists of lines operating on voltages: 400 kV, 220 kV and 110 kV, and substations with transformation ratio: 400/X kV, 220/X kV and 110/X kV. Within all lines the most dominant ones are OHL with the total length of 1,403.9 km, i.e. per voltage levels:

- 6 400 kV OHL with length of 355.3 km;
- 8 220 kV OHL with length of 338 km;
- 35 110 kV OHL (3 of which are double system lines) with length of 613.3 km;
- 4 110 kV OHL that operate on 35 kV with length of 97 km;
- 2 110 kV power cables with length of 7.3 km.

As for power substations, transmission system operator operates with:

- 4 400/X kV substations,
- 2 220/X kV substations, and
- 19 110/X kV substations,

with 54 transformers. Their total installed power is 3,866.5 MVA.

The two indicators that are used for evaluation of the transmission system operation quality are Energy Not Supplied (ENS) and Average Interruption Time (AIT), and their values for 2019 were: 706.42 MWh and 113.83 min. There is still no policy that would establish rules on the minimum quality of delivery, but methodology for the calculation of ENS and AIT exists within the Rule on minimum quality of delivery and supply for electricity dated from 2017. Based on this methodology the calculation of ENS and AIT is done monthly and yearly. An update will be done very soon.
There are several interconnections on various voltage levels with the neighboring systems:

- Serbia
  - 220 kV OHL Pljevlja 2 – Bajina Basta
  - 220 kV OHL Pljevlja 2 – Pozega
  - 110 kV OHL Pljevlja 1 – Potpec
- Bosnia & Herzegovina
  - 400 kV OHL Lastva – Trebinje
  - 220 kV OHL HPP Perucica – Trebinje
  - 220 kV OHL Buk Bijela – HPP Piva
  - 110 kV OHL Herceg Novi – Trebinje
  - 110 kV OHL KT Vilusi – Bileca
- Albania
  - 400 kV OHL Podgorica 2 – Tirana 2
  - 220 kV OHL Podgorica 1 – Koplik
- Kosovo
  - 400 kV OHL Ribarevine – Pec 3
- Italia
- HVDC 500 kV submarine cable

### *Key electricity and gas transmission infrastructure projects*

There are two main directions of further improvement of the Montenegrin power system interconnectivity:

- HVDC cable MONITA – This project is in the PCI list. Currently, only 600 MW of the link capacity is operational, but it is planned that full capacity of the interconnection reaches 1000 MW in the following years, in accordance with the Contract. TERNA and CGES have jointly ordered the Study, being developed by CESI and EKC, which examines the justification of technical preconditions for the installation of the second pole of the submarine cable between Italy and Montenegro
- 400 kV OHL Bajina Basta – Pljevlja – Visegrad – This project is a part of Trans-Balkan Corridor which is a major electricity transmission backbone in the Western Balkans region. Taking in the account the mentioned HVDC link, this project is of a significant pan-European interest. The development of new interconnection projects will be starting soon, based on technical and economic considerations and based on cost-benefit analysis in accordance with the ENTSO-E methodology.

*Main infrastructure projects envisaged other than Projects of Common Interest (PCIs)*

Both electricity projects are of regional significance and the first one has been listed as a Projects of Common Interest (PCI) and the second one as a Project of Energy Community Interest (PECI).

### 2.4.3 Market integration

*National objectives related to other aspects of the internal energy market*

The liberalisation of the electricity market in Montenegro started with the Energy Law entering into force in 2003. In December 2015, Montenegro adopted a new Energy Law followed by adoption of numerous pieces of secondary legislation in relation to electricity, which transposed the main pieces of legislation from the Third Energy Package for Electricity and Gas Markets-TPEGM (Directive 2009/72/EC, Regulation (EC) No 714/2009, Regulation (EC) No 713/2009 and Regulation No 543/2013). Montenegro established the Montenegrin Electricity Market Operator (COTEE) in July 2011 as a fully state-owned limited liability company. Its responsibility is to create conditions for enabling the competitiveness of the electricity market in Montenegro, functioning in a public, non-discriminatory and impartial manner, in accordance with the Law on Energy, Market Rules and International Standards and market access to all participants under equal conditions. Market Rules were adopted in July 2017. They define (inter alia) the admission and registration of market participants, the rights, obligations and responsibilities of participants in the electricity market, and the balancing mechanism. Balancing mechanism is regulated according to the Methodology for setting prices and conditions for provision of ancillary and system services and balancing services for electricity transmission system. Montenegro's electricity market consists of the wholesale and retail markets. The market was opened for all non-household customers on 1 January 2009 and for households on 1 January 2015. Electricity trading in Montenegro is dominantly bilateral, and the establishment of an organised power market began in 2017 when, according to the Energy Law and the decision of Montenegrin Government, three main Montenegrin power entities: power producer and supplier Elektroprivreda Crne Gore (EPCG), transmission system operator Crnogorski elektroprenosni sistem (CGES) and market operator (COTEE) jointly founded a company Berza električne energije d.o.o. (BELEN) in June 2017, with the goal to establish and operate an organised day-ahead power market in Montenegro and, in later phase, its coupling with the neighbouring WB6 and EU markets, according to EU regulations in the field of energy. BELEN, the operator of the Montenegrin Power Exchange or MEPX launched the day-ahead market on 26 April 2023 for the territory of Montenegro. The launch of the intraday market is still pending.

The National Regulatory Authority (NRA) is the Energy Regulatory Agency, which was established in 2004. It is legally distinct and functionally independent from other public or private bodies in Montenegro. The Energy Law defines its responsibilities and the means to guarantee its independence and transparency of its decisions.

Montenegro has an active role for cross-border electricity exchange. CGES as the transmission system operator in Montenegro is responsible for the allocation of rights to use the available

cross-border transmission capacity on interconnections of the transmission system of Montenegro. Joint auctions are organized on border with Serbia. Based on the agreement on organizing joint auctions/allocations with the transmission system operator of Serbia, CGES is responsible for organizing day ahead and intraday explicit auctions on border with Serbia while EMS performs yearly and monthly explicit auctions on the aforementioned border. Based on the Service Agreement between CGES and Coordinated Auction Office in South East Europe (SEE CAO) and the agreement on organizing joint auctions/allocations with the neighbouring TSOs, SEE CAO is responsible for organizing yearly, monthly and daily explicit auctions on borders with Bosnia and Herzegovina, Kosovo, Albania and Italy. The method of payment on all long term and daily auctions for all borders is according to the last accepted price ("marginal price"). In 2016 CGES became a founding partner of the SEE CAO (South East Europe Coordinated Auction Office). SEE CAO facilitates cross-border electricity trade, through alignment of technical, financial and legal prerequisites among participants, which allows for simpler and cost effective trade process. From 2019 electrical power trade on the ME-IT border is organized by SEE CAO. For other borders which are not part of the SEE CAO contract, CGES has appropriate Auction Rules for allocation of cross-border transmission capacities.


*Figure 13: Current state in cross-border capacities auctions*

CGES is responsible for administration of bilateral electricity market between balancing groups. Administration is conducted according to the Grid Code and Market Code through Scheduling process which is part of ESS (ENTSO-E scheduling system). Nominations are carried out daily by BRP, with hourly values.

Balancing group daily schedules among other contains:

- production responsible schedule (PRS);
- consumption responsible schedule (CRS);
- internal trade schedules between balancing groups;
- cross border schedules.

Scheduling system is used for supervising submission, validation and confirmation of aforementioned elements of daily schedule. Internal transactions can only be submitted between balance groups, and in order to be properly validated and confirmed both parties must have matching transaction. Cross-border transactions can be submitted only if at least one BRP have capacity rights for the requested capacity. Schedules are validated and confirmed when the transaction is matched with neighbouring TSO.
A long-term market being governed by the stock market BELEN was established in November 2020. In connection with the DA market (day ahead), BELEN has reached the phase of signing the contract with the service provider whose assignment is to render and implement the DA platform. The tentative date for DA go-live is within 2022, and for ID (intra-day) go-live is within 2023.

| Year | External transactions | | | | Internal transactions |
|---|---|---|---|---|---|
| | day-ahead | | Intraday | | day-ahead and intraday [MWh] |
| | In [MWh] | Out [MWh] | In [MWh] | Out [MWh] | |
| 2018 | 2.420.918 | 513.497 | 18.128 | 18.538 | 1.611.384 |
| 2019 | 1.266.490 | 1.328.177 | 40.931 | 43.579 | 1.619.410 |

*Figure 14: Total exchange on the bilateral and organized electricity market in 2018-2019*

Regional cooperation on imbalance netting, share and exchange of auxiliary services (power control reserves and balancing energy) between Serbia, North Macedonia and Montenegro (SMM) control block will increase flexibility for more RES and decrease the operating costs. Market integration is an important element to promote network flexibility and integration of renewables. The advanced option of SMM control block is expected to increase market flexibility and decrease reserve allocation costs. The goal is to provide all the auxiliary services to the extent that is sufficient for reliable operation of the electric power system and reliable power supply at the lowest possible price. TSOs from Serbia, North Macedonia and Montenegro form a control block which is in line with the target model of regional integration of electricity balancing markets by ENTSO-E network code on electricity balancing. For individual balancing of each country, total amount of balancing reserves equals 1000 MW and for SMM control block it equals 700 MW. Additionally, the SMM block is also important from the perspective of electricity cross-border balancing. With the future introduction of RES, especially wind and PV generation capacities, market integration in terms of the SMM block will allow for more efficient balancing of generation and demand.
According to Energy Law, organized power market in Montenegro consists of Balancing energy market and Power exchange market.

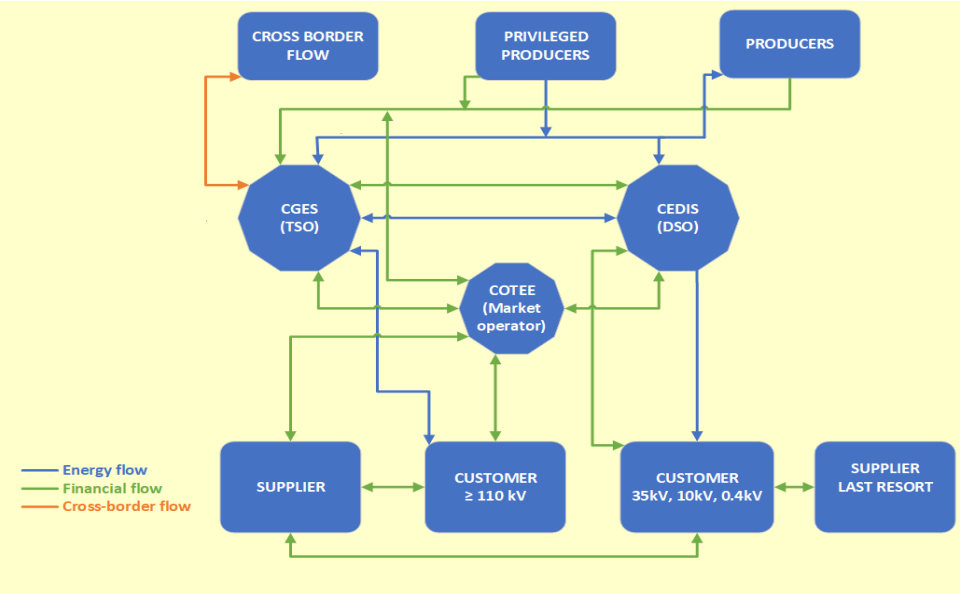



*Figure 15: Montenegrin Electricity market model*

The potential for the development of small electricity markets, such as Montenegrin market, can be realised through the market coupling with the regional markets and with the single pan-European cross zonal day-ahead electricity market. Creating a liquid wholesale market is a prerequisite for the development of a competitive retail electricity market. By market coupling, a more reliable electricity supply and greater competition in performing power market activities is achieved. It enables overcoming the problem of unattractiveness of small markets, which due to their size do not attract a sufficient number of traders and suppliers. Liquidity attracts liquidity, which gives special importance for coupling of Montenegrin power market with stable and liquid Italian market. Finally, in 2021, BELEN has selected the service provider and started implementation of the new service.

Day-ahead market (DAM) coupling with Italy, Serbia and Albania is the important regional integration initiative (AIMS). The precondition analysis phase of the AIMS project has been finished, while the important step for the whole project was made by commencing an operation of a submarine power cable between Montenegro and Italy, thus creating a physical power connection between Western Balkan and EU markets.

Frequency Restoration Reserve (mFRR) and aFRR has to be at least equal to the size of the largest production unit in TSO, but being part of SMM block, this amounts only to 50MW and remaining amount is shared between SMM members. Prices for reservation of capacity is set on a yearly basis by the NRA's Decision on determination of prices for auxiliary and balancing services according to the formula proscribed in Methodology for setting prices and conditions for provision of ancillary and system services and balancing services for electricity transmission system. CGES pays for aFRR in upward direction as well as for the reservation of upward mFRR. Downward aFRR and mFRR are free of charge. For every hour of unavailability or inadequacy of delivered mFRR by BSP, CGES is entitled to compensation which equals double the amount of price of reserved capacity.

*National objectives with regard to ensuring that consumers participate in the energy system and benefit from self-generation and new technologies, including smart meters*

By completing the third phase of the Measurement System improvement (AMM-III phase), about 80% (325.000 smart meters) of the total number of active electricity meters in Montenegro will be covered by the modern metering devices (AMM).

*National objectives to protect energy consumers and improve the competitiveness of the retail energy sector*

Protection of customers is regulated by Article 205 of the Energy Law in the following way:
(1) Supplier shall publish prices for households and other final customers that it supplies on its web page at least 15 days prior to initiation of supply.
(2) Supplier shall publish each change of prices and fees on its web page, in a timely manner, not later than expiry of calculation period after the change has come into force, and shall inform customers about the possibility of termination of the contract in case they refuse to accept changed prices.
(3) Supplier shall publish information on the rights of customers, including the procedures for submitting and resolving appeals, on its webpage at least once a year.
(4) Supplier is obliged to make available on the invoice or promotional material with the invoice to the end customer at least once a year information on environmental impacts, in relation to carbon dioxide emissions and other harmful emissions arising from electricity production from all energy sources used for supplying customers with electricity in the previous year.
(5) Supplier shall calculate and collect the following from all final customers:

1) Use of electricity or gas transmission and distribution systems;
2) Charge for incentives for generation of electricity from renewable sources;
3) Other charges in line with the Law.

(6) Supplier shall charge electricity and services based on invoices which ought to be clear and articulate, with indication of the consumption profile of the customer.
(7) Supplier shall pay for the use of the system, services and charges to operators and other entities for which charges are collected in line with this Law.

### 2.4.4 Energy poverty

*National objectives with regard to energy poverty*

There is no Poverty Reduction Strategy in Montenegro, nor is there a defined method for identifying and monitoring energy poverty, and there are currently no programs aimed specifically at energy-poor households.
In line with the Study on Addressing Energy Poverty in the Energy Community Contracting Parties, prepared by DOOR, EIHP in Dec 2021, according to the available data, the share of energy-poor households in Montenegro ranges (8-15) % of all households. This percentage implies that there are between 16,000 and 30,000 energy-poor households in Montenegro.
Based on the definition of energy vulnerable consumers and current legislation (The Energy Act (OG 5/16, 51/17, and 82/20) and the Ordinance on the Supply of Electricity to Vulnerable Consumers (OG 81/2018), Montenegro has already taken the first important step in protecting

vulnerable consumers. Its legislation recognizes the issue of energy vulnerability and the need of offering protection, which at the moment is only in the form of direct financial support for the most vulnerable groups. However, no long-term measures have been set for alleviating energy poverty.
The fact that only short-term measures aiding socially vulnerable consumers are currently in place, and due to the low energy efficiency of dwellings located in certain parts of the country with a significant number of HDD and CDD in others, all this indicates the need for energy efficiency improvements in homes of the energy-poor and energy vulnerable. Therefore, most of the measures we propose relate to long-term measures aimed at improving the energy efficiency of dwellings and reducing the energy needs of households.

*Short term measures*

Protection measures
Importantly, utility disconnection of vulnerable groups in case of non-payment is an important issue. If fulfilling vulnerability criteria, disconnections from an electricity grid should be prohibited, especially during the winter months. Currently, Article 198 (5) of the Energy Acts prohibits disconnecting vulnerable consumers that fulfill eligibility criteria, from electricity and gas network in the period from October to April. Therefore, Montenegro has the required measures in place for vulnerable consumers, though it is suggested disconnections from the grid should be prohibited for all household consumers during the winter months.

Direct financial support
There are two measures aimed at directly subsidizing energy costs for vulnerable consumers. These financial measures should be limited only to the most socially vulnerable consumers and implemented alongside infrastructural measures aimed at alleviating the main causes of energy poverty. Furthermore, direct financial support should be provided for those households, which after receiving long-term measures, still required support as they are unable to cover their energy-related expenses.

*Long term measures*
The main approach to mitigating energy poverty in Montenegro should be targeted at improving the energy efficiency of the dwellings of energy-poor households. In addition, due to the specific climate and diversity of the three climate zones in Montenegro, measures should also vary across the climate zones. Though energy efficiency improvements should be the main measure for all three zones, depending on the zone the improvements should be followed by (1) heating system improvements along with fuel switching - for those vulnerable households situated in the zone with longer and colder winters and reliant on traditional inefficient stoves, or (2) the provision of cooling systems for those facing hot and long summers. Furthermore, the use of RES should be considered given the favorable climate in Montenegro.
The primary measures should provide long-term effects in contributing to eliminating the root causes of energy poverty. The proposed measures focus primarily on providing maximum benefits for households while easing the burden on the national budget in the long run. Where applicable, we have indicated whether similar measures exist in the specific CP complementary to the proposed measure and the possibility of expanding it to accommodate measures for energy poor households.
Accordingly, we propose the long-term measures given below:

1. Programme for Mitigating Energy poverty. Our observation is that there is no systematic approach to addressing the issue of energy poverty in Montenegro. We propose the drafting and adoption of a formal document that provides a detailed plan for implementing measures to address energy poverty. The program should go beyond income support and incentivize energy efficiency improvements as well as targeted measures for vulnerable households.
2. Energy Retrofitting of Buildings. The major cause of energy poverty is the low energy efficiency of homes. We propose measures aimed at improving the energy efficiency of homes, hence reducing energy demand. This measure is to some extent complimentary to the R2 Financial support for EE investments for physical persons from the 4th NEEAP.
However, energy retrofits aimed at mitigating energy poverty need to be delivered through more comprehensive co-financing schemes and support mechanisms.
3. Replacement of Household Appliances via the Old for New Scheme. Due to low disposable income, energy-poor households own low efficient appliances that contribute to increased energy demand and hence energy poverty. We propose measures that assist energy-poor households in replacing aging home appliances.
4. Heating System Improvements (HSI) in Households, including: (i) HSI 1: Improving the energy efficiency of the system; (ii) HSI 2: Modernization and expansion of the heating system. This measure is to some extent complimentary to the R2 Financial support for EE investments for physical persons from the 4th NEEAP.
5. Implementation of Low-Cost Energy Efficiency and Energy Advice (EEEA), including: (i) EEEA1: Implementing simple and low-cost energy efficiency measures; (ii) EEEA2: Undertaking simple energy audits with education
6. Support for Renewable Energy Sources, including the following measures: (i) RES 1 Incentives for installing photovoltaic panels; (ii) RES 2 Incentives for installing solar thermal collectors. This measure is to some extent complimentary to R2 Financial support for EE investments for physical persons and measure E7 Development of Decentralized Energy Consumption through prosumers from the 4th NEEAP. This measure in the 4th NEEAP specifically mentions the possible benefit of mitigating energy poverty.
Though some of the proposed measures are in line with the existing framework and are viewed as complementary to already proposed measures available in the 4th NEEAP, making those measures accessible to the energy poor requires taking into consideration vulnerability criteria and the provision of higher co-financing rates. Furthermore, unlike for general public, designing schemes to implement measures aimed at alleviating energy poverty requires devising and putting into place support systems. This should be elaborated in the Programme for Mitigating Energy Poverty. The aim of these support systems is to identify persons in need and provide them with support in applying to and accessing the available measures.

Based on the EU directives on the internal market in electricity (2009/72/EC) and gas (2009/73/EC), Montenegro should define energy poverty and protect vulnerable energy consumers.

The Energy Law in its articles 198-200 defines supply of vulnerable customers, request for supply of vulnerable customers and procedure on selection of the supplier of last resort and vulnerable customers. Vulnerable customers which need health and social care, in terms of this Law, represent households with disabled persons, persons with special needs and persons of poor health condition, who may be exposed to a threat to life or health as a result of a limitation or suspension of energy supply, and persons who need social care as determined by the state

authority competent for social care affairs. In its further regulations, the Government shall define the criteria for customers from above categories, amount of subvention for such customers, as well as limit of monthly electricity or gas consumption for which the right on subvention can be acquired.

The study on energy poverty in the Energy Community Contracting Parties was developed and further EnCS support is expected: development of policy guidelines, database, improving statistics where possible, continuous monitoring.

## 2.5 Dimension Research, innovation and competitiveness

*National objectives and funding targets for research and innovation relating to the Energy Union*

The main strategic framework that integrates the research and innovation dimension within energy sector is the Smart Specialisation Strategy.
It however defines a more general key performance indicator: Number of enterprises in the field of renewable energy sources 2019: 50 / 2024: 80. The output and outcome indicators, specifically for R&I in the energy area are not defined in relevant strategic documents, which is an area indicated for improvement by the European Commission. The creation of an Operational Programme of the S3 strategy was in course (2021) and is clearly linked to the NECP PaMs.

The Programme of Economic Reform of Montenegro 2021-2023 has foreseen the establishment of intermediary organisations – centres, institutes, hubs, which can promote the integration of the "knowledge triangle" within the S3 priority domains. The Action Document for IPA III encompasses this objective of the Government of Montenegro. The Programme of Cluster Development in Montenegro foresees the establishment of strong innovation clusters in smart specialization priorities. These policy directions reflect the findings from the Entrepreneurial Discovery Process, where it has been recognized that stronger institutional backbone is necessary for technology transfer and other strategic decision making based on scientific knowledge and evidence. The IPA III funding is a competitive process on the regional scale and timely preparation of projects will be important, therefore we cannot be sure that such centres for strategic energy studies and research-business-education cooperation will be established from these funds.

The Balkan Institute of Science and Innovation was established in 2019 by the University of Montenegro and Université Côte d'Azur. The objective of the Institute is to strengthen and structure these collaborations, particularly as regards scientific and educational cooperation with special attention to the topics of **smart territories**, health, **energy**, materials sciences and tourism. Initial activities have put the topic of „smart cities" at the forefront of this collaboration, which has also been recognised through the EDP process.

The Capital City Podgorica in cooperation with the company Siemens developed the Study: "Smart City Podgorica - Development of energy efficient infrastructure" which is the first step in the developing Podgorica as a "smart city". It identifies a list of priority projects for Podgorica, focused on technological solutions for a smart city.

Montenegro expressed the intention to be associated in the EU Framework Programme for Research and Innovation, Horizon Europe (2021 - 2027), where energy research and innovation will be realized under the headings of two (out of five) EU missions: 1. Accelerating the transition to a climate prepared and resilient Europe. Targets by 2030: prepare Europe to deal with climate disruptions, accelerate the transition to a healthy and prosperous future within safe planetary boundaries and scale up solutions for resilience triggering transformations in society; 2. 100 Climate-Neutral Cities by 2030 – by and for the citizens. Targets by 2030: support, promote and showcase 100 European cities in their systemic transformation towards climate neutrality by 2030 and turn these cities into experimentation and innovation hubs. A special "widening" package is foreseen in the programme, for R&I underperforming countries and their strategic networking with EU counterparts.

The Industrial Policy of Montenegro 2019-2023 in one of its strategic goals, identifies the objective of Stimulating development of green economy, with the key issues:

- Efficient use of resources and sustainability, with a particular emphasis on the energy efficiency of the industry and the transition to a low-carbon economy; and
- Reducing greenhouse gas emissions from waste, and stimulating the use of biotic materials with recycled waste, and the use of waste instead of fossil fuels for energy production.

Activities within this operational objective include specific activities of improving the legislation framework in the field of industrial pollution, identification of facilities which fall under provisions of the Law on industrial emissions, establishing the fund for the protection of environment (Eko-Fund has been established in 2018) and realization of dedicated projects from those sources, conducting programme activities for realising measures of energy efficiency and increasing the share of renewable energy sources (RES), supporting innovative investment projects – application of solar systems for heating water and efficient energy systems, stimulating the introduction of international ecological standards, remediation of industrial waste dumps, environmentally friendly waste management in Montenegro and other activities.

The current largest investments are related to the treatment of some of the largest industrial waste dumps, where Montenegro has not yet had investments with circular economy model, but rather remediation or export of the waste.

The outcome indicators of this objective of the Industrial Policy are as shown in the table below.

| Industrial policy objective: Stimulating development of green economy | | | | |
|---|---|---|---|---|
| Outcome | Indicator | Baseline 2018 | Target 2020 | Target 2023 |
| Reducing the amount of waste generated at the territory of Montenegro | Percentage of internal removed industrial waste | 3.4% | 3.6% | 3.8% |
| Reduction of GHG emissions from industrial plants and total | Level of GHG emissions | 3,494 Gg CO2 eq (industry 411 Gg CO2 eq) (2015) | Reduction of GHG emissions by 3% | Reduction of GHG emissions by 5% |

*Table 2.12: Industrial policy indicators*

The Industrial Policy of Montenegro 2024-2028 pursues the following strategic goals:

- Improving the environment for the digital and green transition of the industry;
- Growth of investments and financing models for long-term competitiveness of the industry;
- Encouraging innovation based on the principles of smart and sustainable industry development;
- Improving access to the EU single market and strengthening regional economic cooperation.

Montenegro has still not got a single public procurement of R&D or innovation, whereas according to the data from PPP Knowledge Lab only two PPP projects were developed in Montenegro, both in the sector of Electricity, Krnovo Wind Farm and Montenegro Mozura Wind Farm. These are surely areas with huge opportunities for improvement and directed development of energy sector.

Montenegro started the development of a specific policy for circular economy. In 2020, the Montenegrin Government approved the preparation of the Circular Economy Roadmap, a process led by UNDP with participation of the Chamber of Commerce and Institute Circular Change from Slovenia. The national Circular Economy Roadmap [15] includes a set of recommendations with an Action Plan and a Communication Plan that would enable the implementation of the Roadmap. The CE Roadmap was finalized and presented in April 2022 on a dedicated event organized by UNDP and Chamber of Economy.
The CE Roadmap identifies the potentials for future actions that would lead to the CE principles being integrated into the Montenegrin economy. A first study, Development of Food Waste Assessment for Montenegro, was commissioned in 2019 by UNDP.

[15] https://circulareconomy.europa.eu/platform/sites/default/files/roadmap_to_circular_economy_-_web_-_single_0.pdf

# 3 POLICIES AND MEASURES

**Scope of chapter 3**

Article 7 Governance Regulation specifies that **the NECP should contain "the main existing and planned policies and measures to achieve in particular the objectives set out in the national plan,** including, where applicable, measures providing for regional cooperation and appropriate financing at national and regional level, including mobilisation of Union programmes and instruments." It is also stated that a general overview should be provided of the investments needed to achieve the objectives and targets/contributions set out in the national plan, as well as a general assessment on the sources of those investments. According to Governance Regulation it is not the objective to provide a full overview of policies and measures.

The Policies and Measures (PaMs) presented in this chapter have been developed based on the following set of criteria:

- Considered in which scenario: WEM scenario or WAM scenario
- Single PaM or part of a group of PaMs
- "General context", here one could describe the history of the project/ PaM/ company
- "Description of the PaM": a few sentences on what is planned to be implemented:
  - Legal, technical, financial, informational, regulatory policy or measure
  - Problem the policy or measure is addressing
  - Objective of the policy or measure
- "Steps in implementation – implementation process": in combination with actions taken, this allows for easy progress reporting
- "Implementation period": From when to when will the PaM be implemented and how long will it have an effect?
  - Policy or measure's (expected) starting date
  - If relevant the expected end date
- "Status of implementation": planned, started, stopped, finalized etc.
- "Responsible for implementation:" Entity(ies) responsible for Setting the regulation(s), Providing the funding, Planning, Monitoring, Evaluation
- "Actions taken": What steps in the implementation process (described earlier) have already been taken?
- "Impact": What impact will the PaM have on different dimensions of the Energy Union e.g. energy or GHG savings
  - Energy Union Dimension(s) affected
  - Sectors affected
  - GHG areas and greenhouse gases covered by the policy or measure: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), F-gases, CO2 Land use land use change and forestry (LULUCF), non-CO2 LULUCF
- Costs – associated costs of the PaM
- Who provides the funding: state budget, financing organization, etc.

- Please specify (in net present value terms) the annual public budgetary impacts (expenditure-revenues) the policy or measure is expected to have over its expected operational lifetime
  - Year(s) for which costs and benefits have been calculated
  - Price reference year used
- References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure

**However, it must be noted that often, the requested level of detail is not yet available, and sometimes specific studies will be needed for which resources have not been available.**

**Definitions according to Article 2 Governance Regulation**

The following definitions apply:
(1) **'policies and measures'** means all instruments which contribute to meeting the objectives of the integrated national energy and climate plans and/or to implement commitments under points (a) and (b) of Article 4(2) of the UNFCCC, which may include those that do not have the limitation and reduction of greenhouse gas emissions or change in the energy system as a primary objective;
(2) **'existing policies and measures'** means implemented policies and measures and adopted policies and measures;
(3) **'implemented policies and measures'** means policies and measures for which one or more of the following applies at the date of submission of the integrated national energy and climate plan or of the integrated national energy and climate progress report: directly applicable Union or national law is in force, one or more voluntary agreements have been established, financial resources have been allocated, human resources have been mobilised;
(4) **'adopted policies and measures'** means policies and measures for which an official government decision has been made by the date of submission of the integrated national energy and climate plan or of the integrated national energy and climate progress report and there is a clear commitment to proceed with implementation;
(5) **'planned policies and measures'** means options that are under discussion and that have a realistic chance of being adopted and implemented after the date of submission of the integrated national energy and climate plan or of the integrated national energy and climate progress report;

**Types of Policies and Measures (PaM) in the Montenegrin NECP**

In addition to the types of **existing and planned PaMs** as defined above, **suggestions for new PaMs** are also presented. These suggestions result from the analysis of status quo, targets, existing and planned PaMs. Suggestions for new PaMs have been drafted by consultants to address conflicting targets and PaMs, and to respond to stakeholder feedback received during the NECP drafting process. As the government has not yet made any binding commitments in this regard, the proposals for new policies and measures as well as a corresponding modelling scenario are not included in the main text but in the annex to the draft NECP. They can be used in the further elaboration of the current draft NECP.

Policies and Measures either result in direct impact in terms of achieving the targets on national level or enable the achievement of direct impact.

Types of PaM:

- Legal
- Technical
- Financial
- Informational
- Regulatory

**Financing of Measures**

Successful implementation of PaMs is only possible if financing is secured. Financing of measures can be through state budget, private capital, targeted European programmes[16], and Sovereign green bonds[17].

Eco Fund

The Eco Fund is financing the preparation, implementation and development of programmes, projects and similar activities in the field of preservation, sustainable use, protection and improvement of the environment, energy efficiency and use of renewable sources and energy at the state and local level, as follows:

- implementation of national strategic planning documents in the field of environmental protection, sustainable development and energy efficiency;
- mediation related to financing of environmental protection, energy efficiency and renewable energy sources from funds provided from loans, donations and assistance, instruments, programmes and funds of the European Union, United Nations and international organizations, foreign investments intended for environmental protection, from foreign countries, financial institutions and domestic and foreign legal and natural persons;
- maintaining a database of programmes, projects and similar activities in the field of environmental protection and energy efficiency, the necessary and available financial resources for their implementation;
- establishing cooperation with international and domestic financial institutions and other legal and natural persons, in order to finance environmental protection and energy efficiency, in accordance with national strategic planning documents in the field of environmental protection, energy efficiency and renewable energy sources; and
- other activities related to financing environmental protection and energy efficiency.

The Eco Fund carries out its activities in cooperation with the Ministry of Ecology, Sustainable Development and Development of the North, Ministry of Finance, Ministry of Economic Development, Ministry of Energy, other state administration bodies, local self-government

[16] For example: https://ec.europa.eu/info/horizon-europe-next-research-and-innovation-framework-programme_en (last access 31.03.2022)

[17] For example: https://www.climatebonds.net/certification/netherlands_sovereign (last access 31.03.2022)

units, professional, scientific and financial institutions, as well as in cooperation with international organizations and financial institutions.

The mission of the Eco Fund is to raise and invest funds in building a sustainable society in Montenegro, which will be based on the efficient use of all natural resources and low-carbon development.

The vision of the Eco Fund is to position itself as a leading professional and financial institution in the field of environmental protection and sustainable development in Montenegro.

In order to fulfill its mission and vision, the Eco Fund defines the following priorities on which it will work through defining programme areas, measures and activities:

- Ensuring the income of the Eco Fund
- Co-financing of projects, programmes and other activities within the scope of work of the Eco Fund
- Implementation of the Decree on activities or activities that emit greenhouse gases for which a permit for the emission of greenhouse gases is issued
- Institutional strengthening and recognizability of the institution

The information and inputs for long-term projections of financing instrument, amount, and donors, Eco Fund is not in the position to provide in this moment, having in mind that the document for developing the roadmap for the Eco Fund is not yet available. At the national level, the reliable national plans, programmes and strategies are not yet developed or are in process of preparation (for example the National strategy for development of e-mobility, National study for energy efficiency in residential buildings etc.).

The NECP needs to identify the potential source of funding, namely national contribution, donors, and international financing institutions (EU funds, international banks), as well as to identify the institutional framework and obligations. The NECP gives the overview in defining medium- and long-term projections of financing instruments with full support of national decision making bodies, so that the Eco Fund can take the role of the leading financial institution for the realization of concrete measures, as presented in the NECP.

The present situation is, that Eco Fund started with operations last year, and still struggles with short term fund providing from eco tax fees, in accordance with the Law on environment protection.

*Eco fees tax in accordance with the Law*

The eco fees tax issued in 2020:

2018 – EUR 300,525.24

2019 – EUR 497,221.75

In 2020 Eco Fund charged: EUR 491,629.31 of aforementioned amounts for 2018 and 2019.

For 2020 was issued eco tax fees in amount of EUR 395,686.63, of which Eco Fund already charged EUR 303,071.03.

The charge of emission credits in accordance with REGULATION ON ACTIVITIES which EMITTING GREENHOUSE GASES is EUR 7,368 for 2020, the same amount in 2021.

Preparation work is being done on developing bylaws, rulebooks and regulation for providing the eco fees which represent the basics of Eco Fund sustainability (change of regulation on activities which emit greenhouse gases by the Government of Montenegro and regulation on the amount of fees, method of calculation and payment of fees due to environmental pollution,

as well as inclusion of Eco Fund in the management systems of special waste categories and regulation on fee levels).

The projections and the amount that should be provided through this source are still unknown.

Please have in mind that eco tax fees represent the only reliable financial source for Eco Fund in this moment.

Green Climate fund

An initiative has been launched towards the Green Climate Fund (GCF) to obtain accreditation, which will provide access to an international fund to finance projects in the field of environmental protection and energy efficiency in Montenegro. Through the National Programme of Priority Activities in the Field of Climate Change Mitigation and Adaptation within the Cooperation with the Green Climate Fund, the Eco Fund has been recognized as a potentially accredited body for direct access to the GCF. Through selected project proposals within the Programme of Priority Activities, where it is identified as a potential implementing partner in projects related to: increasing climate resilience of health care institutions, implementation of EE measures and introduction of RES in the housing sector, as well as low-carbon transport. During the accreditation process, it is necessary to adopt certain prescribed GCF policies and procedures, as well as to present the capacity to implement projects and programmes of various financial instruments from the categories of environmental and social risk that are assessed according to GCF standards. The outcome of the accreditation process will determine the size of the project or programme; fiduciary functions, which will shape the way of its business using the resources of the Eco Fund (grants, loans and guarantees).

Eco fund started the procedure for accreditation on Green Climate fund. The first phase of the accreditation document procedure Financial Management Capacity Assessment has been submitted to GCF.

The focal point for GCF is from Ministry of Ecology, Sustainable Development and Development of the North.

Climate Fund of Slovenia

Eco Fund has also established communication with the Eco Fund of the Republic of Slovenia (Eko sklad), which is also the basis for initiating cooperation with the Climate Fund of Slovenia. Through this cooperation, financial resources in the amount of EUR 1,500,000 for the period of 3 (three) years, will be provided for projects in the field of energy efficiency, e-mobility, as well as development and capacity building within the Eco Fund. Having in mind the positive response from the Slovenian partners, in 2021, the official signing of the Memorandum of Cooperation between the Government of Montenegro and the Government of Slovenia is expected. The Ministry of Foreign Affairs of Montenegro is responsible for further formalization of the negotiation process, so that the Eco Fund can conclude a financing agreement with the Climate Fund of Slovenia.

Croatian Fund for the environment protection

Also, trough communication with the Croatian Fund for the environment protection there is a potential for provision of grant financial support for the projects to Eco Fund. The details of cooperation are not yet defined and officially formalised.

In addition to activities related to cooperation with international financial institutions and organizations, as well as bilateral cooperation, the decision makers need to strive Eco Fund to be involved in the processes of planning and programming the use of EU pre-accession funds.

**Description of existing and planned PaMs for WEM and WAM scenario**

For consideration of PaMs in scenario modelling two requirements must be met: (a) direct impact on GHG and energy, and (b) a certain level of detail regarding the information available about the PaM.

The description of measures contains information on financing. If the financing is not yet secured, necessary activities to secure the financing are described, such as conducting studies on changes in tax revenues, feasibility studies for the preparation of pilot activities, and carrying out pilot projects demonstrating the feasibility of measures.

The tables below show the overview of key policies and measures affecting the national climate target to 2030. PaMs considered in the scenario with existing measures (WEM) are marked in column WEM, and PaMs considered in the scenario with additional measures (WAM) are marked in column WAM. Some measures can be allocated to more than one dimension. The description is included in the dimension listed in the first place.

The majority of measures are aligned with NDCII. Alignment is also planned for the rest of measures.

| Policies and measures | Dimensions | Target sector | WEM | WAM |
|---|---|---|---|---|
| Environmental refurbishment of Thermal Power Plant (TPP) Pljevlja | Decarbonisation | Energy industries / electricity generation | × | |
| New renewable power plants | Decarbonisation | Energy industries / electricity generation | × | |
| Additional renewable power plants | Decarbonisation | Energy industries / electricity generation | | × |
| Refurbishment of small hydro power plants (increased EE) | Decarbonisation | Energy industries / electricity generation | × | |
| Development of decentralized energy generation (distribution medium voltage connection) | Decarbonisation | Energy industries / electricity generation | × | |
| Additional development of decentralized energy generation (distribution medium voltage connection) | Decarbonisation | Energy industries / electricity generation | | × |
| Promotion of e-mobility | Decarbonisation | Transport | | × |
| Introduction of mandatory share of biofuels in fuel supply | Decarbonisation | Transport | | × |
| Uniprom KAP: electrolysis cells replacement and overhauling | Decarbonisation | Industry | × | |
| Uniprom KAP: Cell hibernation | Decarbonisation | Industry | | × |
| Reduction of HFCs in line with the Law Acknowledging Amendments to the Montreal Protocol on Substances that Deplete the Ozone Layer | Decarbonisation | Industry | × | |
| Prosumers in industry | Decarbonisation | Industry | | × |
| Biofuels in industry | Decarbonisation | Industry | | × |
| Financial incentives for introduction of hybrid special working machines in industry sector | Decarbonisation | Industry | | × |
| Development of decentralized energy generation by producer - customers (prosumer) | Decarbonisation | Residential / commercial sector | × | |
| Additional development of decentralized energy generation by producer - customers (prosumer) | Decarbonisation | Residential / commercial sector | | × |
| Support for organic agricultural production | Decarbonisation | Agriculture | | × |
| Support to Manure Management | Decarbonisation | Agriculture | | × |
| Reduction of bio-waste in municipal waste | Decarbonisation | Waste | × | |
| Increase of connection rate to sewage system (target 93% by 2035) | Decarbonisation | Waste | × | |
| Increase of CH4 recovery in landfills | Decarbonisation | Waste | | × |
| Reduction in the area annually affected by wildfires | Decarbonisation | LULUCF | | × |
| Further increases in the share of industrial round wood used for long-term products | Decarbonisation | LULUCF | | × |

*Table 3.1: Overview table of key policies affecting the national climate target to 2030: Dimension Decarbonisation*

| Policies and measures | Dimensions | Target sector | WEM | WAM |
|---|---|---|---|---|
| Environmental refurbishment of Thermal Power Plant (TPP) Pljevlja | Decarbonisation | Energy industries / electricity generation | × | |
| New renewable power plants | Decarbonisation | Energy industries / electricity generation | × | |
| Additional renewable power plants | Decarbonisation | Energy industries / electricity generation | | × |
| District Heating in Pljevlja | Energy efficiency | Energy industries / heat generation | | × |
| Reduction of losses in the electricity transmission power network | Energy efficiency | Energy industries / electricity transformation | × | |
| Reduction of losses in the electricity distribution power network | Energy efficiency | Energy industries / electricity transformation | × | |
| Ban on import of old vehicles (Euro 4 or lower standard) | Energy efficiency | Transport | | × |
| Passenger transport modal shift to public bus transport | Energy efficiency | Transport | | × |
| Passenger and freight transport modal shift to rail | Energy efficiency | Transport | | × |
| Development and implementation of energy efficiency regulatory framework in buildings | Energy efficiency | Residential / public / commercial | × | |

| Policies and measures | Dimensions | Target sector | WEM | WAM |
|---|---|---|---|---|
| Increased energy efficiency in public buildings | Energy efficiency | Public | × | |
| Energy labeling and ecodesign requirements for energy related products | Energy efficiency | Residential / public / commercial | × | |
| Establishment and implementation of EE criteria in public tendering | Energy efficiency | Residential / public | × | |
| Implementation of energy efficiency measures in public municipal companies | Energy efficiency | Public | × | |
| Establishment and development of energy management in public sector | Energy efficiency | Public | × | |
| Financial incentives for citizens/private households (for energy efficiency investments) | Energy efficiency | Residential | × | |

*Table 3.2: Overview table of key policies affecting the national climate target to 2030: Dimension Energy Efficiency*

| Policies and measures | Dimensions | Target sector | WEM | WAM |
|---|---|---|---|---|
| Development of electricity transmission power network | Energy Security | Energy industries / electricity transformation | × | |
| Development of electricity distribution power network | Energy Security | Energy industries / electricity transformation | × | |
| Developing battery electric storage systems (BESS) | Energy Security | Energy industries / electricity transformation | | × |

*Table 3.3 Overview table of key policies affecting the national climate target to 2030: Dimension Energy Security*

| Policies and measures | Dimensions | Target sector | WEM | WAM |
|---|---|---|---|---|
| Market coupling | Internal Energy Market | Energy industries / electricity transformation | × | |
| Imbalance netting | Internal Energy Market | Energy industries / electricity transformation | × | |

*Table 3.4: Overview table of key policies affecting the national climate target to 2030: Dimension Internal Energy Market*

| Policies and measures | Dimensions | Target sector | WEM | WAM |
|---|---|---|---|---|
| Smart Specialisation Strategy of Montenegro 2019-2024 | Research, Innovation & Competitiveness | All sectors | × | |
| Law on incentives for research and innovation development | Research, Innovation & Competitiveness | All sectors | × | |
| Programme for improvement of competitiveness of Montenegrin economy and Industrial Policy of Montenegro – Programme line for incentivising circular economy (link to PaM Transition to circular economy) | Research, Innovation & Competitiveness | All sectors | × | |
| Continuation of Programme for improvement of competitiveness of Montenegrin economy and Industrial Policy of Montenegro – Programme line for energy efficiency in industry | Research, Innovation & Competitiveness | All sectors | × | |

*Table 3.5: Overview table of key policies affecting the national climate target to 2030: Dimension Research, Innovation & Competitiveness*

## 3.1 Dimension Decarbonisation

### 3.1.1 GHG emissions and removals

#### *3.1.1.1 Energy sector*

***Exact name:*** Ecological refurbishment of Thermal Power Plant (TPP) Pljevlja

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
The ecological refurbishment of TPP Pljevlja aims to address non-compliance with air quality standards and extend the lifespan of the power plant. This refurbishment includes the installation of modern flue gas treatment technologies in line with EU environmental standards (Industrial Emissions Directive – IED). TPP Pljevlja has the greatest impact on stable electricity production and affordability of electricity in Montenegro. Additionally it directly and indirectly impacts more than 3000 jobs and it is the main economy driver in northern part of the country. It is expected that this plant is operational up to 2040 but with certain lowering of operating hours over year which is necessary to help meeting the national goals.

**Description of the PaM**:
The measure involves the construction of a de-sulfurization (FGD) and de-nitrification (SCR) installation, the upgrade of electro-filtering equipment, the construction of a wastewater treatment facility, and the reconstruction of the internal system for transporting by-products. Additionally, a heating station will be built as part of the district heating system. These changes are aimed at reducing sulfur oxides (SOx) and nitrogen oxides (NOx) emissions from the power plant. Also the energy efficiency of the plant will be slightly increased.

**Legal, technical, financial, informational, regulatory policy or measure**: Legal and technical measure (compliance with IED Law).

**Problem the policy or measure is addressing**: Air pollution and non-compliance with the IED Law.

**Objective of the policy or measure**: Reduction of SOx and NOx emissions to comply with IED standards (SOx ≤ 130 mg/Nm$^3$ and NOx ≤ 150 mg/Nm$^3$). Slight increase in energy efficiency of the power plant (from 34.1% to 34.5 %).

**Implementation process**:
- June 2020: EPCG (Electricity Power Utility of Montenegro) signed an agreement for the ecological refurbishment.
- 2021-2022: The contract for the equipment supplier and installer was awarded and implementation began.

**Implementation period**:
- Expected starting date: 2025
- Expected end date: 2025
- The measures will have long-term effects, significantly reducing emissions and improving air quality and efficiency after installation.

**Status of implementation**:
- The project is ongoing, with the equipment installation scheduled to be completed within the specified period.

**Responsible for implementation**:

- EPCG (Electricity Power Utility of Montenegro) is responsible for setting regulations, providing funding, and overseeing the implementation process.

**Actions taken**:

- Agreement signed with EPCG in June 2020.
- Public procurement procedure initiated for the selection of the equipment supplier and installer.
- Contract awarded for installation of flue gas desulfurization and denitrification systems.

**Impact**:

- Energy Union Dimension(s) affected: Decarbonisation, Energy security, Energy efficiency.
- Sectors affected: Energy generation (IPCC sector: 1A Energy, subcategory: 1A1 Energy industries).
- GHG areas and greenhouse gases[18] covered: This measure targets sulfur oxides (SOx) and nitrogen oxides (NOx) emissions rather than direct GHG reductions, but because of slight increase of energy efficiency of the plant it will contribute to GHG emission decrease (cca 200 Gg $CO_{2eq}$ per year with respect to the base year).

**Costs**:

- The total budget for the project is EUR 54.45 million, spread over 2 years (2024-2025).

**Funding**:

- EPCG is providing the funding, which will be financed through the company's budget.

**Annual public budgetary impacts**:

- None.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:

- The project is designed in line with the Industrial Emissions Directive (IED) and follows the legal requirements for reducing sulfur and nitrogen oxide emissions. All technical and financial information regarding PaM is defined in the Main design of Ecological refurbishment of Thermal Power Plant (TPP) Pljevlja.

#### *3.1.1.2 Transport sector*

***Exact name:*** Promotion of e-mobility

**Considered in which scenario**: WAM scenario

**Single PaM or part of a group of PaMs**: Single PaM

[18] Quantification of the PaM impact on GHG emission decrease is given for target year (2030) with respect to the last known historical year (2022).

**General context**:
Transport sector is the second most important source of GHG emissions with share of 23 % in the total GHG emissions. The main reason for this is the fuel mix used in the sector. The most dominant share (energy wise) corresponds to diesel (80 %), then follows gasoline (15 %), LPG (4 %) and very low usage of electricity (1 %). There is no usage of bio fuels. This kind of energy mix greatly impacts GHG emissions. Therefore, PaMs targeting emissions decrease in transport sector may greatly contribute to the national goal. Dominant usage of diesel leads to 83 % share in total GHG emissions from the transport sector. Passenger cars are responsible for 96 % of the total GHG emissions in transport sector. Acceptable fuel economy is the main motivation for usage of vehicles powered by diesel in Montenegro. Fuel switch of diesel to electricity improves the economy of vehicle stock, increases RES share and enables significant decrease of GHG emissions. However, high cost of electric vehicles and low availability of charging infrastructure present great challenges.

**Description of the PaM**:
Mitigation of the recognized challenges in order to support promotion of e-mobility is done in the following manner:

- Financial incentives for e-vehicles
- Financial incentives for e-vehicles charging infrastructure.

The financial framework to encourage e-mobility typically includes investment incentives to purchase e-vehicles and / or to build e-charging infrastructure or tax policy measures that favor e-vehicles. The tax on the motor vehicles use is paid annually according to the engine cc for passenger motor vehicles. This tax is paid by legal and natural persons who are owners of registered passenger cars according to the prescribed tariff. This tax is not paid for e-vehicles, so this tax relief is the only financial incentive for e-vehicles and e-mobility in general that currently exists in Montenegro. The most effective financial incentive is a subsidy when purchasing e-vehicle:

- Electric vehicles - EUR 10,000.00
- Hybrid electric plug-in vehicles - EUR 5,000.00
- Hybrid “full hybrid” vehicles - EUR 2,500.00.

In order to reach the national goal regarding GHG emissions it is necessary to have dynamic development of e-mobility until 2030. At least 35000 passenger cars within the total vehicle stock have to be electric until 2030.
The following incentives could be considered: reduced VAT rate when buying new e-vehicles, reduced tax rate when buying used e-vehicle vehicles, reduced tax rate for vehicle registration, vehicle use, road use. The same could apply for plug-in hybrid electric vehicle (PHEV), as well.
Transposition of Directive 2014/94/EU on the establishment of infrastructure for alternative fuels and development of the National Policy Framework for the establishment of infrastructure for alternative fuels in transport is the prerequisite for further e-mobility development. In order to enable necessary dynamics of the electric vehicles share increase until 2030, charging infrastructure should be equally developed. Currently, there are around 90 charging stations (mostly slow charging). Low number of electric vehicles impacts feasibility of investments in charging infrastructure and there is a need for financial incentives until the number of vehicles is great enough to enable profitable operation of charging stations. Therefore, in order to enable fast development of e-charging infrastructure a financial incentive is needed:

- Slow chargers - EUR 5,000.00
- Fast chargers (DC chargers) - EUR 15,000.00.

The number of chargers included by the PaM are 50 fast charging stations and 500 slow charging stations.

**Legal, technical, financial, informational, regulatory policy or measure**: Financial measure.

**Problem the policy or measure is addressing**: Diesel fuel substitution, low RES share in transport sector.

**Objective of the policy or measure**: New technologies, financial incentives for cleaner traffic and the use of alternative fuels in traffic, decrease of GHG emissions.

**Implementation process**:
- Obtaining funding.
- Preparation of the calls.
- Monitoring and reporting on implementation.

**Implementation period**:
- Expected starting date: 2025
- Expected end date: 2030
- The measures will have long-term effects, significantly affecting RES share in the energy consumption as well as decrease of GHG emissions.

**Status of implementation**:
- Preparatory phase.

**Responsible for implementation**:
- Ministry of Energy, Ministry of Transport, Eco Fund.

**Actions taken**:
- Environmental Protection Fund (Eco-Fund) already realized similar calls.
- The Eco Fund has announced a new programme for subsidising electric, plug-in hybrid and full hybrid vehicles, both for citizens and companies / entrepreneurs.

**Impact**:
- Energy Union Dimension(s) affected: Decarbonisation, Energy efficiency.
- Sectors affected: Energy demand (IPCC sector: 1A Energy, subcategory: 1A3 Transport).
- GHG areas and greenhouse gases covered: This measure targets all GHG and it enables decrease of 195 Gg $CO_{2eq}$.

**Costs**:
- The total budget for the project is EUR 353 million, spread over 6 years (2025-2030).

**Funding**:
- International donors, funds collected from carbon taxes.

**Annual public budgetary impacts**:

- None.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:

- For the purpose of e-mobility development in Montenegro, Energy Institute Hrvoje Požar Zagreb, Croatia has developed four comprehensive studies in 2019.

***Exact name:*** Introduction of mandatory share of biofuels in fuel supply

**Considered in which scenario**: WAM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
Transport sector is the second most important source of GHG emissions with share of 23 % in the total GHG emissions. The main reason for this is the fuel mix used in the sector. The most dominant share (energy wise) corresponds to diesel (80 %), then follows gasoline (15 %), LPG (4 %) and very low usage of electricity (1 %). There is no usage of bio fuels. This kind of energy mix greatly impacts GHG emissions. Therefore, PaMs targeting emissions decrease in transport sector may greatly contribute to the national goal. Dominant usage of diesel leads to 83 % share in total GHG emissions from the transport sector. Diesel substitution with cleaner fuels helps reaching of the national targets.

**Description of the PaM**:
All needs for diesel and gasoline are supplied from imports. In the oil and gas sector, there are 61 entities engaged in trade, storage and/or transportation of oil derivatives, LPG and natural gas. Creating the regulation that impacts the diesel and gasoline mix supplied to final consumers directly impacts RES share and therefore GHG emissions. This PaM envisages introduction of mandatory share of biodiesel and biogasoline in the total supply of diesel and gasoline in the following amount:

- 6 % of biodiesel until 2030
- 10 % of biogasoline until 2034.

The shares are introduced gradually starting from 2025 (1 % increase each year).

**Legal, technical, financial, informational, regulatory policy or measure**: Legal measure.

**Problem the policy or measure is addressing**: Diesel fuel substitution, low RES share in transport sector.

**Objective of the policy or measure**: Decrease of GHG emissions, increasing RES share.

**Implementation process**:

- Preparation of the first draft.
- Consultations with stakeholders.
- Finalization of the draft.

- Adoption procedure.

**Implementation period**:
- Expected starting date: 2025
- Expected end date: -
- The measures will have long-term effects, affecting the RES share in the energy consumption as well as decrease of GHG emissions.

**Status of implementation**:
- Preparatory phase.

**Responsible for implementation**:
- Ministry of Energy, Ministry of transport.

**Actions taken**:
- Initial phase of consultations with stakeholders.

**Impact**:
- Energy Union Dimension(s) affected: Decarbonisation.
- Sectors affected: Energy demand (IPCC sector: 1A Energy, subcategory: 1A3 Transport).
- GHG areas and greenhouse gases covered: This measure targets all GHG and it enables decrease of 46 Gg $CO_{2eq}$.

**Costs**:
- There is no estimation of the costs.

**Funding**:
- None.

**Annual public budgetary impacts**:
- None.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- The PaM is developed as an additional measure in order to reach national GHG target. All analyses are prepared basing on historical data and typical technology characteristics during modelling of the PaM as a part of WAM scenario.

#### *3.1.1.3 Building sector*

***Exact name:*** *Development of decentralized energy generation by producer - customers (prosumer)*

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
Recently amended national Energy Law and new Law on renewable energy usage have established legal basis for prosumers installment in housing/commercial/public sector, while the Govt. has announced intention to subsidise such installations to citizen. The legislation offers the possibility for each household/commercial buyer to generate electricity from renewable sources and high efficient cogeneration and supply electricity grid. Also, recently amended Spatial Planning Law eliminates detected barriers for expansion of small photovoltaic systems and introduces a simple procedure for building systems up to 10 kW installed power on its own or on the roof of an auxiliary building. The procedure for larger installations mainly applicable to commercial electricity buyers is also facilitated by the same Law. The most effective manner to target all national goals is including renewable electricity generation at locations where the electricity is consumed. This directly affects national RES share since electricity produced by prosumers has the highest priority in the national energy mix (the first order in dispatching). The connection issue, that is one of the greatest challenges for integration of large-scale RES, is significantly easier to overcome. However, it is needed to develop hosting capacity calculation procedures in order to enable efficient implementation of the PaM. Currently, there are no specific hosting capacity calculation methodology, an empirical approach is used. It is very limiting but there are intentions for improvement of the methodology.

**Description of the PaM**:
EPCG (Montenegrin power company) is the main driver of prosumer concept development in Montenegro. This company offers all necessary technical services and financing (in a form of a loan which is repaid through electricity bills in a manner that part of a bill is the investment). Currently, this concept is mainly targeting residential sector but it can be effectively applied to larger consumers also. There is a lot of interest expressed by consumers (potential 26000 prosumers) and power-wise it is expected that there is a total power of close to 250 MW by 2030. There are plans for even greater integration of prosumers, but there is a need for hosting capacity methodology development as well as for inclusion of battery electric storage systems as a mandatory part of a prosumer installation.

**Legal, technical, financial, informational, regulatory policy or measure**: Technical and financial measure.

**Problem the policy or measure is addressing**: Energy mix diversification.

**Objective of the policy or measure**: Decrease of GHG emissions, increasing RES share.

**Implementation process**:
- Preparation of call for equipment.
- Obtaining funding.
- Consultations with stakeholders (connection issues).
- Public call for prosumers from the sector.

**Implementation period**:
- Expected starting date: 2023
- Expected end date: 2030

- The measure will have long-term effects, affecting the RES share in the energy consumption as well as decrease of GHG emissions.

**Status of implementation**:
- Ongoing.
- More than 26000 consumers expressed interest to become prosumers.
- 70 MW of installed power of prosumers is mounted.

**Responsible for implementation**:
- EPCG.

**Actions taken**:
- Several public calls for equipment are finalized.
- Continious communication with DSO regarding connection issues.

**Impact**:
- Energy Union Dimension(s) affected: Decarbonisation.
- Sectors affected: Energy generation (IPCC sector: 1A Energy, subcategory: 1A1 Energy industries).
- GHG areas and greenhouse gases covered: This measure targets all GHG because it leads to RES share increase. There is a direct impact on GHG emission decrease from residential sector because of fuel switch (electricity becomes dominant fuel in the sector with respect to wood and coal). Residential sector has a very small impact on total GHG emissions because it relies on electricity and wood fuels (and very small share of coal). An estimate of GHG decrease is about 10 Gg $CO_{2eq}$.

**Costs**:
- The total budget for the project is EUR 220 million, spread over 8 years (2023-2030).

**Funding**:
- IFIs, commercial banks.

**Annual public budgetary impacts**:
- None.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- The PaM is developed by Montenegrin power company (EPCG) in order to improve electricity generation mix by high expansion of electricity generation from RES (solar) at location of consumption.

***Exact name:*** *Additional development of decentralized energy generation by producer - customers (prosumer)*

**Considered in which scenario**: WAM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
In order to additionally support development of prosumers as it was proposed with the previous PaM targeting residential/service/public sector, this PaM takes into account evident connection issues because there is not clearly defined hosting capacity. Distribution grid was developed for consumption and although there is a necessary grid capacity the operation of prosumers follows significantly different patterns which limit the capacity of prosumers to be connected to the existing grid. Also, prosumers have proven their impact on RES share, and therefore their impact on all other national goals. In order to enable additional prosumers, there is a need for similar support mechanism (as for the previous PaM) but with inclusion of battery electric storage systems at prosumer site. It increases the investment in a certain extent, but it provides necessary flexibility.

**Description of the PaM**:
EPCG (Montenegrin power company) is the main driver of prosumer concept development in Montenegro. This company offers all necessary technical services and financing (in a form of a loan which is repaid through electricity bills in a manner that part of a bill is the investment). Currently, this concept is mainly targeting residential sector but it can be effectively applied to larger consumers also. There is a lot of interest expressed by consumers (potential 26000 prosumers) and power-wise it is expected that there is a total additional power of close to 140 MW by 2030. In order to integrate this additional capacity of prosumers inclusion of battery electric storage systems should become a mandatory part of a prosumer installation. EPCG is planning to extend their technical and financial offer for all prosumers with battery electric storage systems in order to reach planned level of prosumers installed power.

**Legal, technical, financial, informational, regulatory policy or measure**: Technical and financial measure.

**Problem the policy or measure is addressing**: Energy mix diversification.

**Objective of the policy or measure**: Decrease of GHG emissions, increasing RES share.

**Implementation process**:
- Preparation of call for equipment.
- Obtaining funding.
- Consultations with stakeholders (connection issues).
- Public call for prosumers from the sector.

**Implementation period**:
- Expected starting date: 2025
- Expected end date: 2030
- The measure will have long-term effects, affecting the RES share in the energy consumption as well as decrease of GHG emissions.

**Status of implementation**:
- Ongoing.

- More than 26000 consumers expressed interest to become prosumers.
- 70 MW of installed power of prosumers is mounted.

**Responsible for implementation**:
- EPCG.

**Actions taken**:
- Several public calls for equipment are finalized.
- Continious communication with DSO regarding connection issues.

**Impact**:
- Energy Union Dimension(s) affected: Decarbonisation.
- Sectors affected: Energy generation (IPCC sector: 1A Energy, subcategory: 1A1 Energy industries).
- GHG areas and greenhouse gases covered: This measure targets all GHG because it leads to RES share increase. There is a direct impact on GHG emission decrease from residential sector because of fuel switch (electricity becomes dominant fuel in the sector with respect to wood and coal). Residential sector has a very small impact on total GHG emissions because it relies on electricity and wood fuels (and very small share of coal). An estimate of GHG decrease is about 10 Gg $CO_{2eq}$.

**Costs**:
- The total budget for the project is EUR 130 million, spread over 6 years (2025-2030).

**Funding**:
- IFIs, commercial banks.

**Annual public budgetary impacts**:
- None.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- The PaM is developed by Montenegrin power company (EPCG) in order to improve electricity generation mix by high expansion of electricity generation from RES (solar) at location of consumption.

#### *3.1.1.4 Industrial sector*

***Exact name:*** Uniprom KAP: electrolysis cells replacement and overhauling

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:

Although bankruptcy was instituted in July 2013, the new owner Uniprom, who bought the KAP factory (Aluminum Smelter Podgorica) in 2014, has invested a lot in technological processes improvements, since then. The newly installed plants are BAT BREF technics, so with limited emissions and in line with new IED Law (transposed IED directive) requirements. Altogether, four aluminum processing plants are being built, which will exclusively work for the automotive industry. The small ingot alloy plant (equipped for the production of 30,000 tons of special alloys) and new production line for aluminum alloys have been opened. Besides, all the necessary installations for use of liquefied natural gas (LNG), replacing heavy and light fuel oil for production at Anode, Smelter and future plants, are in operation since October 2018 (LNG supplied to the Plant by rail). This investment has already largely decreased both air emissions as well as GHGs. Further investments worth EUR 30 million in a new billet production plant with a capacity of 60,000 tons as well as a new plant with state-of-the-art technology for the production of fences and wires will be built in 2 years.

**Description of the PaM**:
Since end 2015, outdated series A assembly line in electrolysis plant is out of operation, which is reflected in lowering PFC emission from the electrolysis plant, starting from 2016. Only operating series B assembly line in electrolysis plant has installed automatized control of number and duration of anode effects on the cells, so the duration is up to several times shorter (less than a minute) and number of anode effects per cell per day is more than 10 times smaller, compared to dismantled series A assembly line. Furthermore, 24 out of 264 cells in series B assembly line are ADG type having spot dosing of alumina that result in decreased F gases emissions. Currently 155, out of 264 cells are in operation, while the remaining cells have to be either overhauled or replaced by 2024, when electrolysis plant will achieve full capacity of liquid metal production (65,000 t). According to the operator development plan, the technological improvements on the electrolysis cells have been considered so achieving increase of production output and better metal quality. Starting from 2019, only electricity and LNG have been used in the facility's technological processes.

**Legal, technical, financial, informational, regulatory policy or measure**: Legal and technical measure (compliance with IED Law).

**Problem the policy or measure is addressing**: Anode effect in the production and decrease of PFCs emissions which are known by high GWP.

**Objective of the policy or measure**: New electrolysis cells technologies, improved product quality, PFCs decrease.

**Implementation process**:
- New billet production plant with a capacity of 60,000 tons as
- New plant with state-of-the-art technology for the production of fences and wires
- 109 cells have to be either overhauled or replaced, when electrolysis plant will achieve full capacity of liquid metal production (65,000 t)

**Implementation period**:
- Expected starting date: 2026
- Expected end date: 2028
- The measures will have long-term effects in reducing emissions.

**Status of implementation**:
- Currently on hold due to unfavorable market conditions.

**Responsible for implementation**:
- Aluminum plant operator Uniprom KAP.

**Actions taken**:
- All the necessary installations for use of liquefied natural gas (LNG), replacing heavy and light fuel oil for production at Anode, Smelter and future plants, are in operation.
- Starting from 2022, there is no production of liquid metal (electrolysis plant is not operating).

**Impact**:
- Energy Union Dimension(s) affected: Decarbonisation.
- Sectors affected: Industry (IPCC sector: 2C Metal Industry, subcategory: 2C3 PFC emissions from primary aluminum production).
- GHG areas and greenhouse gases covered: This measure targets tetrafluoromethane ($CF_4$ i.e. PFC - 14) and it enables cca 95 % of decrease of $CF_4$ emissions per year with respect to the base year.

**Costs**:
- Project total budget amounts EUR 30 mil. spread over the whole period (2026-2028).

**Funding**:
- Uniprom KAP.

**Annual public budgetary impacts**:
- None.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- The project is prepared according to an internal study prepared by Uniprom KAP.

***Exact name:*** Uniprom KAP: Cell hibernation

**Considered in which scenario**: WAM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
Company Uniprom KAP has desided to test new technologies that can improve the productivity, energy intensity and lowering of GHG emissions. Therefore the target is to implement only BAT BREF technics in line with new IED Law (transposed IED directive) requirements. Since the goal is to increase the production level, it is planned to fulfill that goal in the optimal manner taking into account the energy use and GHG emissions. Therefore, it is planned to test the efficiency and feasibility of PFCs capturing technologies (so called “cell hibernation”) on a

limited number of cells in the electrolysis plant prior to the extending the new technology on all the cells.

**Description of the PaM**:
According to the installation business plan, after the testing phase, it is envisaged to invest in PFCs capturing technology in all cells (approximately 33 cells per year), starting from 2022. In such case, by 2030, all cells will be covered, so the zero PFCs will occur in the electrolysis plant and at the same time there will be savings in electricity consumption (5.5%).

**Legal, technical, financial, informational, regulatory policy or measure**: Legal and technical measure (compliance with IED Law).

**Problem the policy or measure is addressing**: Anode effect in the production and decrease of PFCs emissions which are known by high GWP.

**Objective of the policy or measure**: New electrolysis cells technologies, PFCs decrease, energy savings.

**Implementation process**:
- Testing phase – implementation of the new technology for PFCs capturing on 2 cells.
- Extension of the technology on all cells of the electrolysis plant.

**Implementation period**:
- Expected starting date: 2022
- Expected end date: 2030
- The measures will have long-term effects in reducing emissions.

**Status of implementation**:
- Currently on hold due to unfavorable market conditions.

**Responsible for implementation**:
- Aluminum plant operator Uniprom KAP.

**Actions taken**:
- Testing phase on 2 cells.
- Starting from 2022, there is no production of liquid metal (electrolysis plant is not operating).

**Impact**:
- Energy Union Dimension(s) affected: Decarbonisation.
- Sectors affected: Industry (IPCC sector: 2C Metal Industry, subcategory: 2C3 PFC emissions from primary aluminum production).
- GHG areas and greenhouse gases covered: This measure targets tetrafluoromethane ($CF_4$ i.e. PFC - 14) and Hexafluoroethane ($C_2F_6$ i.e. PFC - 116). It enables cca total elimination of these GHG with respect to the base year.

**Costs**:
- Project total budget amounts EUR 32 mil. spread over the whole period (2022-2024).

**Funding**:
- Uniprom KAP.

**Annual public budgetary impacts**:
- None.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- The project is prepared according to an internal study prepared by Uniprom KAP.

***Exact name:*** Reduction of HFCs in line with the Law Acknowledging Amendments to the Montreal Protocol on Substances that Deplete the Ozone Layer

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
In April 2019, Montenegro officially became a member of the Kigali Amendment. The obligations arising from the Amendment is to reduce the consumption of HFC substances. IPPU sector is responsible for 18 % share of total emissions of Non energy sector and almost all emissions are caused by usage of HFCs.

**Description of the PaM**:
The Government is obliged to develop a Plan for the gradual reduction of consumption of HFC substances. After the Plan development and adoption, the Government would apply for financial resources for the Plan implementation. Targeted decrease of all HFCs (HFC 32, HFC 125, HFC 134a, HFC 143a and HFC 227ea) by 2030 is 10 % and by 2045 is 80 %.

**Legal, technical, financial, informational, regulatory policy or measure**: Legal, regulatory measure (compliance with Kigali Amendment).

**Problem the policy or measure is addressing**: Decrease of HFCs in accordance with Kigali Amendment.

**Objective of the policy or measure**: Reduction of HFCs, new technologies of refrigeration and air conditioning devices due to more advanced refrigerants.

**Implementation process**:
- Law Acknowledging Amendments to the Montreal Protocol on Substances that Deplete the Ozone Layer adoption.

**Implementation period**:
- Expected starting date: 2025
- Expected end date: 2045
- The measures will have long-term effects, significantly reducing emissions of HFCs.

**Status of implementation**:
- The project is ongoing.

**Responsible for implementation**:
- Agency for Nature and Environmental Protection.

**Actions taken**:
- Law Acknowledging Amendments to the Montreal Protocol on Substances that Deplete the Ozone Layer adoption.

**Impact**:
- Energy Union Dimension(s) affected: Decarbonisation.
- Sectors affected: Demand sectors (IPCC sector: 2F Product Uses as Substitutes for Ozone Depleting Substances, subcategory: 2F1 Refrigeration and Air Conditioning).
- GHG areas and greenhouse gases covered: HFC 32, HFC 125, HFC 134a, HFC 143a and HFC 227ea. Expected impact on total emissions is 30 Gg $CO_{2eq}$.

**Costs**:
- Negligible. However, it can be expected that technology owners/end users will have to bear additional cost when substituting appliances.

**Funding**:
- Multilateral Fund for the Implementation of the Montreal Protocol.

**Annual public budgetary impacts**:
- Negligible.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- Montreal Protocol
- Kigali Amendment
- All analyses are prepared basing on historical data, set targets and typical technology characteristics during modelling of the PaM as a part of WAM scenario.

***Exact name:*** *Prosumers in industry*

**Considered in which scenario**: WAM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
The most effective manner to target all national goals is including renewable electricity generation at locations where the electricity is consumed. This directly affects national RES share since electricity produced by prosumers has the highest priority in the national energy mix (the first order in dispatching). The connection issue, that is one of the greatest challenges for integration of large-scale RES, is significantly easier to overcome. However, it is needed to

develop hosting capacity calculation procedures in order to enable efficient implementation of the PaM. Currently, there are no specific hosting capacity calculation methodology, an empirical approach is used. It is very limiting but there are intentions for improvement of methodology.

**Description of the PaM**:
EPCG (Montenegrin power company) is the main driver of prosumer concept development in Montenegro. This company offers all necessary technical services and financing (in a form of a loan which is repaid through electricity bills in a manner that part of a bill is the investment). Currently, this concept is mainly targeting residential sector but it can be effectively applied to larger consumers also. Although current level of industrial activity is not high in Montenegro, its impact on energy consumption is significant and there is a need to improve diversification of the energy mix in the sector which will lead to the increase of the RES share, improvement of energy efficiency and decrease of GHG emissions. In order to help reaching of the national GHG target, total of 60 MW of installed power is needed by 2030. This will lead to a slight increase of electricity consumption in the sector (about 5 %) and decrease of other fuels (diesel has the most dominant share).

**Legal, technical, financial, informational, regulatory policy or measure**: Technical and financial measure.

**Problem the policy or measure is addressing**: Energy mix diversification, Diesel fuel substitution.

**Objective of the policy or measure**: Decrease of GHG emissions, increasing RES share.

**Implementation process**:
- Preparation of call for equipment.
- Obtaining funding.
- Consultations with stakeholders (connection issues).
- Public call for prosumers from the sector.

**Implementation period**:
- Expected starting date: 2026
- Expected end date: -
- The measure will have long-term effects, affecting the RES share in the energy consumption as well as decrease of GHG emissions.

**Status of implementation**:
- Preparatory phase.

**Responsible for implementation**:
- Ministry of Energy, EPCG.

**Actions taken**:
- Market analysis regarding equipment availability, funding possibilities.
- Initial phase of consultations with stakeholders.

**Impact**:

- Energy Union Dimension(s) affected: Decarbonisation.
- Sectors affected: Energy generation (IPCC sector: 1A Energy, subcategory: 1A2 Manufacturing Industries and Construction).
- GHG areas and greenhouse gases covered: This measure targets all GHG because it leads to RES share increase.

**Costs**:
- The total budget for the project is EUR 50 million, spread over 5 years (2026-2030).

**Funding**:
- IFIs, private investors.

**Annual public budgetary impacts**:
- None.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- The PaM is developed as an additional measure in order to reach national GHG target. All analyses are prepared basing on historical data and typical technology characteristics during modelling of the PaM as a part of WAM scenario.

***Exact name:*** *Biofuels in industry*

**Considered in which scenario**: WAM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
Diesel usage is the second most important reason for GHG emissions in Montenegro (23 % share in total emissions). Although its main usage corresponds to transport sector, the share of diesel usage that corresponds to Industry is also important (16 %). Diesel fuel plays a vital role in the industrial sector, powering a wide range of machinery and equipment. Diesel generators are widely used in industries as a backup or emergency power source. They provide electricity when the main power supply fails, ensuring continuous operation. Diesel fuel is used to power heavy machinery such as bulldozers, excavators, cranes, and dump trucks. These machines require significant power for earth-moving and construction tasks, which diesel engines can efficiently deliver. Diesel engines drive large mining trucks, drills, and other equipment used in extracting minerals and ores. Diesel's high energy density is ideal for the rugged and demanding environment of mining operations. Therefore, diesel substitution in this sector also leads to more efficient achieving of the national goals regarding GHG emissions.

**Description of the PaM**:
Creating the regulation that impacts the diesel used in industry sector impacts RES share and therefore GHG emissions. This PaM envisages introduction of mandatory share of biodiesel in the total supply of diesel in industrz sector in the following amount:
- 25 % of biodiesel until 2030.

The share is introduced gradually starting from 2026.

**Legal, technical, financial, informational, regulatory policy or measure**: Legal measure.

**Problem the policy or measure is addressing**: Diesel fuel substitution.

**Objective of the policy or measure**: Decrease of GHG emissions, increasing RES share.

**Implementation process**:
- Preparation of the first draft.
- Consultations with stakeholders.
- Finalization of the draft.
- Adoption procedure.

**Implementation period**:
- Expected starting date: 2026
- Expected end date: -
- The measure will have long-term effects, affecting the RES share in the energy consumption as well as decrease of GHG emissions.

**Status of implementation**:
- Preparatory phase.

**Responsible for implementation**:
- Ministry of Energy.

**Actions taken**:
- Initial phase of consultations with stakeholders.

**Impact**:
- Energy Union Dimension(s) affected: Decarbonisation.
- Sectors affected: Energy demand (IPCC sector: 1A Energy, subcategory: 1A2 Manufacturing Industries and Construction).
- GHG areas and greenhouse gases covered: This measure targets all GHG and it enables decrease of 40 Gg $CO_{2eq}$.

**Costs**:
- There is no estimation of the costs.

**Funding**:
- None.

**Annual public budgetary impacts**:
- None.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:

- The PaM is developed as an additional measure in order to reach national GHG target. All analyses are prepared basing on historical data and typical technology characteristics during modelling of the PaM as a part of WAM scenario.

***Exact name:*** *Financial incentives for introduction of hybrid special working machines in industry sector*

**Considered in which scenario**: WAM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
Diesel usage is the second most important reason for GHG emissions in Montenegro (23 % share in total emissions). Although its main usage corresponds to transport sector, the share of diesel usage that corresponds to Industry is also important (16 %). Diesel fuel plays a vital role in the industrial sector, powering a wide range of machinery and equipment. Diesel fuel is used to power heavy machinery such as bulldozers, excavators, cranes, and dump trucks. There is cca 250 of heavy machinery vehicles in Montenegro. These machines require significant power for earth-moving and construction tasks, which diesel engines can efficiently deliver. Diesel engines drive large mining trucks, drills, and other equipment used in extracting minerals and ores. Diesel's high energy density is ideal for the rugged and demanding environment of mining operations. However, diesel combustion heavily increases the challenges of reaching the national goals regarding GHG emissions. Therefore, any decrease of diesel usage is a means to reach the goal. Hybrid heavy machinery offers a promising solution for industries looking to reduce fuel consumption, emissions, and noise pollution while maintaining performance. Hybrid systems use less fuel by relying on electric power during low-load operations, leading to fuel savings of 15% to 30% compared to diesel-only models. Although there are challenges, the continued development of hybrid technology and the increasing demand for environmentally friendly solutions point to a growing role for hybrids in the future of heavy equipment. The price of hybrid equipment is usually 10% to 30% higher than the equivalent standard diesel-powered machinery.

**Description of the PaM**:
Hybrid heavy machinery tends to have a higher initial purchase price compared to traditional diesel-powered equipment. However, the long-term operational savings can offset this cost. Therefore, a financial incentive for hybrid heavy machinery is needed in order to promote usage of hybrid heavy machinery in the sector. This PaM envisages a subsidy of 15 % when purchasing hybrid heavy machinery.

**Legal, technical, financial, informational, regulatory policy or measure**: Financial measure.

**Problem the policy or measure is addressing**: Diesel fuel substitution.

**Objective of the policy or measure**: Decrease of GHG emissions, increasing RES share.

**Implementation process**:
- Obtaining funding.
- Preparation of the calls.
- Monitoring and reporting on implementation.

**Implementation period**:
- Expected starting date: 2026
- Expected end date: -
- The measure will have long-term effects, affecting the RES share in the energy consumption as well as decrease of GHG emissions.

**Status of implementation**:
- Preparatory phase.

**Responsible for implementation**:
- Ministry of Energy, Eco Fund.

**Actions taken**:
- Initial phase of consultations with stakeholders.

**Impact**:
- Energy Union Dimension(s) affected: Decarbonisation.
- Sectors affected: Energy demand (IPCC sector: 1A Energy, subcategory: 1A2 Manufacturing Industries and Construction).
- GHG areas and greenhouse gases covered: This measure targets all GHG and it enables decrease of 15 Gg $CO_{2eq}$.

**Costs**:
- The total budget for the project is EUR 5 million, spread over 5 years (2026-2030).

**Funding**:
- None.

**Annual public budgetary impacts**:
- None.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- The PaM is developed as an additional measure in order to reach national GHG target. All analyses are prepared basing on historical data and typical technology characteristics during modelling of the PaM as a part of WAM scenario.

#### *3.1.1.5 Agriculture sector*

***Exact name:*** *Support for organic agricultural production*

**Considered in which scenario**: WAM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
The impact of $N_2O$ emissions from managed soils on all GHG emissions in Agriculture sector is represented by close to 15 % share in the base year. Since the usage of synthetic fertilizer is the main driver of increasing $N_2O$ emissions from managed soils, there is a possibility to impact the decrease of emissions by better control of synthetic fertilizer usage.

**Description of the PaM**:
Support to organic production is leading to the decrease of usage of synthetic fertilizers. The impact of this measure has been estimated by assuming that between 2015 and 2020 the amount of synthetic fertiliser used is reduced by 20%, and the amount of manure applied to soils remains unchanged. Besides, ammonia emission abatement techniques applying manure to soils also reduce indirect $N_2O$ emissions.

**Legal, technical, financial, informational, regulatory policy or measure**: Legal and financial measure.

**Problem the policy or measure is addressing**: Sustainable management of natural resources, reduction of adverse impacts of agriculture on the environment, biodiversity preservation, upgrading the quality of agricultural produce.

**Objective of the policy or measure**: Reduced amount of synthetic fertiliser used, decrease of $N_2O$ emissions.

**Implementation process**:
- Montenegro prepared an Organic Production Development Action Plan 2012-2017 and is following the objectives therein up.
- Support to organic production is a measure included in the Agrobudget 2020 (Measure 2.2.2).
- Extension of the financial mechanism implementation.

**Implementation period**:
- Expected starting date: 2022
- Expected end date: 2030
- The measures will have long-term effects, reducing emissions of $N_2O$.

**Status of implementation**:
- The project is ongoing.

**Responsible for implementation**:
- Ministry of Agriculture, Forestry and Water Management (MAFWM), Monteorganica.

**Actions taken**:
- Financial support is provided to producers who produce organic products in accordance with the Organic Production Act (Official Gazette MNE No. 56/13), per hectare or by a minimum number of specific livestock.

- Certification procedure in the field of protected agricultural and food products performs accredited certification body Monteorganica on the basis of the authorization of Ministry of Agriculture, Forestry and Water Management, in accordance with the Law on Quality Schemes of Agricultural and Food Products (Official Gazette MNE, No. 22/17) and in accordance with the requirements of the standard MESTEN ISO / IEC 17 065: 2013.

**Impact**:
- Energy Union Dimension(s) affected: Decarbonisation.
- Sectors affected: Agriculture sector (IPCC sector: 3D Agriculture, subcategory: 3.D.a Direct $N_2O$ emissions from managed soils – Inorganic N-fertiliser, N2O 3.D.b Indirect $N_2O$ emissions from managed soils, $N_2O$).
- GHG areas and greenhouse gases covered: Direct and indirect Nitrous oxide ($N_2O$) emissions from managed soils. Total decrease of $N_2O$ emissions from managed soils with respect to the base year is 15 %.

**Costs**:
- Project total budget amounts EUR 4.4 mil.. The budget forecast up to 2030 is based on annual financial support allocation in recent Agrobudget 2020 (EUR 400k).

**Funding**:
- MARD/ IFI loans, IPARD EU funds and other international donors.

**Annual public budgetary impacts**:
- EUR 4.4 mil. spread over the whole period 2022-2030.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- The impact of this measure is estimated according to the historical data regarding soil management and usage of fertilizers. It is included in Agrobudget 2020 (it includes elaboration of various measures, incentives in agriculture sector).

***Exact name:*** *Support to Manure Management*

**Considered in which scenario**: WAM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
The impact of direct $N_2O$ emissions from manure management on all GHG emissions in Agriculture sector is represented by close to 6 % share in the base year. The change in cattle manure management systems leads to decrease of $N_2O$ emissions.

**Description of the PaM**:
The measure leads to a change in cattle manure management systems from liquid/slurry to liquid with natural crust (i.e. all liquid system have natural crust in 2030) and to treatment of

swine manure in pit storage, rather than solid storage, a linear change from 2015 to 2030 is applied. This measure foresees financial support for construction and/or reconstruction of facilities (basins) for storing manure or the procurement of specialized manure tanks to prevent negative environmental effects.

**Legal, technical, financial, informational, regulatory policy or measure**: Financial measure.

**Problem the policy or measure is addressing**: Air quality problems due to ammonia (NH3) emissions, underground waters pollution.

**Objective of the policy or measure**: New technologies, reduced $N_2O$ emissions, improved air quality due to reduced ammonia (NH3) emissions, less water pollution due to less nitrogen losses.

**Implementation process**:

- Support to manure management is a measure included in the Agrobudget 2020 (Measure 2.2.2).
- Extension of the financial mechanism implementation.

**Implementation period**:

- Expected starting date: 2022
- Expected end date: 2030
- The measures will have long-term effects, reducing emissions of $N_2O$.

**Status of implementation**:

- The project is ongoing.

**Responsible for implementation**:

- Ministry of Agriculture, Forestry and Water Management (MAFWM), Monteorganica.

**Actions taken**:

- Support to manure management is a measure included in the Agrobudget 2020 (Measure 2.2.4).

**Impact**:

- Energy Union Dimension(s) affected: Decarbonisation.
- Sectors affected: Agriculture sector (IPCC sector: 3D Agriculture, subcategory: 3.B Manure Management, direct $N_2O$).
- GHG areas and greenhouse gases covered: Direct Nitrous oxide ($N_2O$) emissions from manure management. Total decrease of $N_2O$ emissions from manure management with respect to the base year is 15 %.

**Costs**:

- Project total budget amounts EUR 0.99 mil.. The budget forecast up to 2030 is based on annual financial support allocation in recent Agrobudget 2020 (EUR 90k).

**Funding**:

- MARD/ IFI loans, IPARD EU funds and other international donors.

**Annual public budgetary impacts**:
- EUR 0.99 mil. spread over the whole period 2022-2030.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- The impact of this measure is estimated according to the historical data regarding manure management. It is included in Agrobudget 2020 (it includes elaboration of various measures, incentives in agriculture sector).

#### *3.1.1.6 Waste management*

***Exact name:*** *Reduction of bio-waste in municipal waste*

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
Waste sector is the most intensive Non energy sector in terms of GHG emissions with 49 % share, and almost all the emissions are coming from the solid waste (92 % share). Therefore, improvement of solid waste management will lead to significant results with respect to the emission levels decrease. The installation of separate waste collection system has the following co-benefits: moving towards a circular economy, recovery and recycling of materials (e.g. metals, glass, plastics, …), potential use of waste as a renewable energy source (e.g. anaerobic digestion), recycling of biowaste by composting creates nutrient rich soil and reduced risk of releasing harmful substances to the environment by separate collection of hazardous waste.

**Description of the PaM**:
Greater separate collection of municipal waste leads to a decrease of organic waste being disposed to landfills. This is to be achieved by a system of primary separation (2 bins – dry and wet), network of waste collection in rural areas, construction of recycling yards in municipalities, equipment for waste collection, as well as educational and awareness raising activities. This directly impacts $CH_4$ emissions which represent almost all of the emissions from Waste sector. The goal is to significantly decrease (by 50 % until 2029 with respect to the base year) the contents of paper, food and garden waste within the total amount of deposited solid waste.

**Legal, technical, financial, informational, regulatory policy or measure**: Legal (Landfill Directive (1999/31/EC) implementation).

**Problem the policy or measure is addressing**: Unsustainable waste management.

**Objective of the policy or measure**: Reduced $CH_4$ emissions.

**Implementation process**:

- Educational and awareness raising activities.
- Public calls for equipment.
- Monitoring of implementation.

**Implementation period**:

- Expected starting date: 2023
- Expected end date: 2033
- The measures will have long-term effects, reducing emissions of $CH_4$.

**Status of implementation**:

- The implementation of this measure is ongoing and will be continued to achieve defined milestones in 2025, 2029, and 2033, i.e. reduction of biodegradable waste by 35 %, 50 % and 75 %, respectfully.

**Responsible for implementation**:

- Ministry of Ecology, Sustainable Development and Development of the North.

**Actions taken**:

- Educational and awareness raising activities.

**Impact**:

- Energy Union Dimension(s) affected: Decarbonisation.
- Sectors affected: Waste sector (IPCC sector: 5A – Solid Waste Disposal on Land).
- GHG areas and greenhouse gases covered: Methane ($CH_4$) emissions from solid waste. Total decrease of $CH_4$ emissions from solid waste with respect to the base year is 10 %.

**Costs**:

- No information on costs available.

**Funding**:

- Ministry of Ecology, Sustainable Development and Development of the North, local governments / EU funds, other international donors and IFIs.

**Annual public budgetary impacts**:

- No information on costs available.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:

- The impact of this measure is estimated according to the targeted content of biodegradable waste within deposited municipal solid waste which is defined for years 2025, 2029 and 2033.

***Exact name:*** *Increase of connection rate to sewage system*

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
Although waste water has a low impact on total GHG emissions from waste sector with 8 % share in the total emissions, there is a possibility to decrease their impact on $CH_4$ emissions by decreasing the number of septic tanks, i.e. increasing of connection rate to sewage system. The construction of sewage connection systems and wastewater treatment plants in recent years has led to decreased amount of wastewater collected in septic tanks and released untreated to aquatic environment. In Montenegro, there are currently ten wastewater treatment plants that are in operation or in trial operation. According to the Negotiation Chapter 27 (February 2018), Montenegro sets the target that by 2035 93% of the population (37 city cores with suburbs) will be connected to sewage systems with wastewater treatment plants except of agglomerations of less than 2000 PE which are not obliged to comply with the UWWTD. Remaining percentage of population, which is not possible to be connected to the network for technical reasons, will be achieved with the individual systems according to UWWTD. With this approach, until the end of 2035, wastewater management in all agglomerations will be provided, according to the UWWTD.

**Description of the PaM**:
The manner waste water is treated in Montenegro is through sewage systems connected to treatment plants and septic tanks. Technology used in treatment plants is characterized by great methane emission factor. Current share of waste water managed by sewage systems in total generated waste water is 60 %. It is planned to increase the share to 93 % by 2035 through construction of sewage connection systems and modern wastewater treatment plants. This will have a significant impact on decrease of $CH_4$ emissions (close to 80 %) from waste water treatment.
**Legal, technical, financial, informational, regulatory policy or measure**: Legal (UWWTD Directive (91/271/EEC, 98/15/EC) implementation).

**Problem the policy or measure is addressing**: Unsustainable wastewater management.

**Objective of the policy or measure**: Reduced $CH_4$ emissions.

**Implementation process**:
- Development of technical design.
- Public calls for equipment and construction works.
- Monitoring of implementation.

**Implementation period**:
- Expected starting date: 2020
- Expected end date: 2035
- The measures will have long-term effects, reducing emissions of $CH_4$.

**Status of implementation**:
- Project is ongoing.

**Responsible for implementation**:
- Ministry of Ecology, Sustainable Development and Development of the North.

**Actions taken**:

- Realised 42% of total investments planned for central and northern part of the country.
- Realised 66% of total investments planned for coastal part of the country and Municipality of Cetinje
- Municipal Wastewater Management Plan of Montenegro (2020-2035) is adopted.

**Impact**:

- Energy Union Dimension(s) affected: Decarbonisation.
- Sectors affected: Waste sector (IPCC sector: 5D1 Domestic Wastewater Handling, $CH_4$).
- GHG areas and greenhouse gases covered: Methane ($CH_4$) emissions from waste water. Total decrease of $CH_4$ emissions from waste water with respect to the base year is 77 %.

**Costs**:

- EUR 553.9 million (including the costs of maintaining and constructing the system).

**Funding**:

- Ministry of Ecology, Sustainable Development and Development of the North, local governments / EU funds, other international donors and IFIs.

**Annual public budgetary impacts**:

- EUR 553.9 million spread over the period 2020-2035.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:

- Strategic Master Plan for Sewerage and Wastewater in the Central and Northern Region of Montenegro (2005-2029).
- Strategic Master Plan for Sewerage and Wastewater in the Coastal Region of Montenegro and Municipality of Cetinje (2005-2029).
- Municipal Wastewater Management Plan of Montenegro (2020-2035).

***Exact name:*** *Increase of CH4 recovery in landfills*

**Considered in which scenario**: WAM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:

Waste sector is the most intensive Non energy sector in terms of GHG emissions with 49 % share, and almost all the emissions are coming from the solid waste (92 % share) and it all corresponds to methane emissions ($CH_4$). In the landfill, the waste undergoes series of decomposition processes generating various gases. The landfill gas (LFG) mainly comprises of 50–55% methane (CH4), 45–55% carbon dioxide (CO2), less than 1% non-methane organic compounds (NMOCs), and trace amounts of inorganic compounds. Collecting LFG not only reduces the problems of odor and hazardous effect of LFG but also provides opportunity to use it as an alternative source of energy. Since, the landfills are highly heterogeneous and the gas production rate and gas composition may vary significantly, it is very important to assess the

viability of the gas extraction from a particular landfill. In this regard, site assessment is crucial to obtain basic information on the landfill and its LFG generation potential. Historically, in Montenegro, there is some $CH_4$ recovery, but it is very low (between 2 % and 4 % of available emissions). Total amount of $CH_4$ emissions from solid waste management amounts up to 11.4 kt. Therefore, there is a large potential for CH4 recovery in landfills.

**Description of the PaM**:
Conduct a study to assess the viability of the gas extraction from all landfills in Montenegro and select the most promising locations for development of $CH_4$ recovery systems. Creating designs of LFG recovery system for selected landfills. A LFG collection system is made up of vertical wells and or horizontal collectors that cover 100% of all waste areas within one year after the waste is deposited in a landfill. A landfill recovery collection system is designed to extract the LFG to further use it in energy projects. It includes wells and piping systems for collecting and transporting the gas to the processing location. The LFG can be used to fuel the electricity generation equipment on site or can be supplied to the grid. Electricity can be generated by either internal combustion engines, gas turbines or microturbines. If it is assumed a typical requirement of an internal combustion engine for generating 1 MW of electricity as 500 $m^3/h$ of LFG at 50% $CH_4$ to generate 1MW of electricity, the total potential of $CH_4$ recovery and its usage for electricity production in Montenegro can be estimated to 5 – 7 MW of installed power (taking into account current annual $CH_4$ emissions). This PaM aims to utilize available $CH_4$ emissions to produce electricity in plants (at selected locations) with total installed power of 2 MW by 2030, and using the experience from the process to extend it further after 2030 in order to recover $CH_4$ from landfills as much as it is possible.
**Legal, technical, financial, informational, regulatory policy or measure**: Technical.

**Problem the policy or measure is addressing**: Unsustainable waste management, electricity production.

**Objective of the policy or measure**: Reduced $CH_4$ emissions, decentralized electricity production.

**Implementation process**:
- Prepare a study on feasibility of gas extraction from all landfills in Montenegro.
- Prepare inception designs for LFG recovery systems and its usage for electricity production.
- Public calls for equipment and construction works.
- Monitoring of implementation.

**Implementation period**:
- Expected starting date: 2023
- Expected end date: 2030
- The measures will have long-term effects, reducing emissions of $CH_4$.

**Status of implementation**:
- Preparation of a public call for development of feasibility study.

**Responsible for implementation**:
- Ministry of Ecology, Sustainable Development and Development of the North.

**Actions taken**:

- The implementation has not yet started.

**Impact**:

- Energy Union Dimension(s) affected: Decarbonisation.
- Sectors affected: Waste sector (IPCC sector: 5A – Solid Waste Disposal on Land).
- GHG areas and greenhouse gases covered: Methane ($CH_4$) emissions from solid waste management. Total decrease of $CH_4$ emissions from solid waste with respect to the base year is around 50 %.

**Costs**:

- EUR 6 million (including the costs of maintaining and constructing the system).

**Funding**:

- Ministry of Ecology, Sustainable Development and Development of the North, local governments / EU funds, other international donors and IFIs.

**Annual public budgetary impacts**:

- EUR 6 million spread over the period 2023-2030.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:

- The PaM is developed as an additional measure in order to reach national GHG target. All analyses are prepared basing on historical data and typical technology characteristics during modelling of the PaM as a part of WAM scenario.

#### *3.1.1.7 Land-use change and forestry*

***Exact name:*** *Reduction in the area annually affected by wildfires*

**Considered in which scenario**: WAM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
Due to their geographical position and the increasingly pronounced negative impact of climate change, Montenegrin forests are particularly endangered. During July and August 2017 alone, 115 forest fires were registered in state forests, while 39 fires were recorded in privately owned forests. The estimated burned wood mass was 96,309.13 $m^3$, and furthermore it was recorded that 267,500 pieces of seedlings afforested during 2015 and 2016 (young forest crops) were destroyed. Currently the most important threat to forests is climate change with increased risk of drought, fire and biotic pests, and the threat is expected to increase in future. The forest fires have significantly increased since 1990. In the decade of the 90s the average annual area of forest affected by fires was 888 ha, whilst in the 00s raised to 3,609 ha and from 2010-2018 the average further increase to 9,370 ha.

**Description of the PaM**:
In 2014, the National Forest Strategy 2014-2023 (Nacionalna Šumarska Strategija, NŠS) already identified the problem and provided actions to reduce the area of forest burnt. However, those measures were not effectively put in practice. So, this measure is based on NŠS vision.
The measure envisages:

- Preservation of open areas between the forests and support of meadow mowing
- Improving the organization of institutions involved in forest fire fighting
- Investments in equipment and preventive measures for fire fighting
- Inclusion of local population in prevention and fire fighting
- Development and testing of rehabilitation methods for fire burnt areas
- Exchange of experience and cooperation with the institutions from the region.

**Legal, technical, financial, informational, regulatory policy or measure**: Legal and financial measure.

**Problem the policy or measure is addressing**: GHG emissions from wildfires.

**Objective of the policy or measure**: Reduced large areas affected by fire and large amounts of wood subject to postfire salvage-logging, better biodiversity preservation, avoidance of economic damages due to the extension of forest fires to populated areas, reduction of the health effect due to the fire smokes and the number of casualties, better sustainable management of natural resources, upgrading the quality of forest, firefighting teams more motivated.

**Implementation process**:

- Coordination between all stakeholders.
- Educational and awareness raising activities.
- Public calls for equipment.
- Monitoring of implementation.

**Implementation period**:

- Expected starting date: 2022
- Expected end date: 2030
- The measures will have long-term effects, reducing emissions of $CO_2$, $CH_4$ and $N_2O$.

**Status of implementation**:

- The project is ongoing.

**Responsible for implementation**:

- Ministry of Agriculture, Forestry and Water Management (MAFWM), State Forest Management Company, population in rural areas, including forest owners and association of forest owners, Environmental Protection Agency, Forestry sector companies, Municipal services for protection and rescue, Entrepreneurial and volunteer fire fighting units, Scientific institutions.

**Actions taken**:

- Enhanced fire protection was defined as part of Objective 1 in the NŠS.

**Impact**:
- Energy Union Dimension(s) affected: Decarbonisation.
- Sectors affected: Agriculture sector (IPCC sector: 3B1 – Forest Land).
- GHG areas and greenhouse gases covered: Carbon dioxide ($CO_2$), Methane ($CH_4$) and Nitrous oxide ($N_2O$) emissions caused by wildfire. Total decrease of all emissions caused by wildfires with respect to the base year is about 40 %.

**Costs**:
- No information on costs available.

**Funding**:
- MAFWM / EU funds, other international donors and IFIs.

**Annual public budgetary impacts**:
- No information on costs available.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- National Forest Strategy 2014-2023.

***Exact name:*** *Further increases in the share of industrial round wood used for long-term products*

**Considered in which scenario**: WAM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
The sale of wood assortments in warehouses in the forest replaced the old model of giving forests for use with sales in the dumbing state. Thus, real market prices of wood were obtained and a timber exchange was formed, on which providers of wood assortments (state-owned Forest Management Company and private forest owners) and wood buyers, primarily domestic wood processors, provide their position. The private sector was introduced into the system of services, specifically contracting and performing the tasks of felling trees and making wood assortments, as well as their delivery to forest warehouses. Wood assortments, classified by quality classes, are offered on auction to wood processors who have a registered production of wood products.

**Description of the PaM**:
Historically, the production of wood commodities shows a prevalence of fuelwood, representing approximately 70 % of production, whilst industrial roundwood only represents the remaining 30 %. The objective of the PaM is to increase the amount of wood used for long-term products, reducing the share of energy use of the wood. However, this is not expected to result in high competition of large dimension trees harvest with other round wood uses (e.g. household heating) especially due to an improvement in the general efficiency of wood for energy use. This higher efficiency in wood use is envisaged to be achieved through:

- restricting high-quality round wood use to industrial use; and
- preventing and limiting the damage of wildfires (as long as some 24 % of the annual total harvest volume originates in salvage logging after wildfires).

It is planned to increase the share of industrial round wood by 10 % until 2030.

**Legal, technical, financial, informational, regulatory policy or measure**: Legal and financial measure.

**Problem the policy or measure is addressing**: Unsustainable forest management.

**Objective of the policy or measure**: Better sustainable management and resilient of natural resources.

**Implementation process**:
- Coordination between all stakeholders.
- Educational and awareness raising activities.
- Monitoring of implementation.

**Implementation period**:
- Expected starting date: 2022
- Expected end date: 2030
- The measures will have long-term effects, increasing $CO_2$ sinks.

**Status of implementation**:
- The project is ongoing.

**Responsible for implementation**:
- Ministry of Agriculture, Forestry and Water Management (MAFWM), State Forest Management Company, population in rural areas, including forest owners and association of forest owners, Environmental Protection Agency, Forestry sector companies, Municipal services for protection and rescue, Entrepreneurial and volunteer fire fighting units, Scientific institutions.

**Actions taken**:
- The Government has recently adopted Forest concession use reorganization programme.

**Impact**:
- Energy Union Dimension(s) affected: Decarbonisation.
- Sectors affected: Agriculture sector (IPCC sector: 3B1 – Forest Land).
- GHG areas and greenhouse gases covered: Carbon dioxide ($CO_2$) sinks increase caused by limiting wood harvest. The resulting effect is about 6 % increase of total $CO_2$ sinks.

**Costs**:
- No information on costs available.

**Funding**:
- MAFWM / EU funds, other international donors and IFIs.

**Annual public budgetary impacts**:

- No information on costs available.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:

- Forest concession use reorganization programme
- The PaM is developed as an additional measure in order to reach national GHG target. All analyses are prepared basing on historical data during modelling of the PaM as a part of WAM scenario.

#### *3.1.1.8 Other*

### 3.1.2 Renewable Energy

#### *3.1.2.1 Sector and technology specific measures: Electricity*

***Exact name:*** New renewable power plants

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
Montenegro is characterized by low electricity production diversification (high dependence on HPPs and TPP) which makes electricity supply vulnerable to meteorological circumstances, stochastic electricity market prices and availability of cross border capacity during dry part of the year. Also, Montenegro has a great and proven renewable energy potential (hydro, solar, wind). Therefore, an increase of wind and solar energy utilization, which are currently characterized by very small share in electricity production, will bring a necessary robustness to electricity production mix because of their complementary effect with respect to the operation of HPPs which are the most dominant power plants in country. However, it is important to take into account their variable production which is a great challenge for their integration in power system. There is a need for more balancing reserve, higher flexibility of power system which are strengthened by electricity storage power plants (HPPs with reservoir, pump storage power plants, battery electric storage systems etc.). However, this PaM does not include high installation powers of new RES power plants but only projects with high level of readiness, and due to this there are no expected problems with new RES integration and operation in the current power system.

**Description of the PaM**:
Although there is a great interest for development of new RES power plants in Montenegro by EPCG and private investors, this PaM only includes projects with the highest and soonest realization possibility basing on the current level of technical and legal documentation readiness:

- HPPs – additional capacity 58.5 MW (50 GWh) – existing HPP Perucica

- sHPPs – additional capacity 3,3 MW (11.4 GWh) – construction of a new sHPP Otilovici
- WPPs – new WPP Gvozd with 54.6 MW (150 GWh)
- SPPs (PV power plants) – 2 new plants (Krupac, Slano) with capacity 35+50 MW (52+73 GWh)

All of these power plants are planned and developed by EPCG (only WPP Gvozd project includes a private investor as a partner). EPCG is responsible for more than 85 % share of the total electricity production in Montenegro. Its portfolio includes HPPs capable for balancing new renewables and therefore their optimal utilization in the electricity market. This PaM does not envisage any PPA support by the Government.

**Legal, technical, financial, informational, regulatory policy or measure**: Technical measure.

**Problem the policy or measure is addressing**: Electricity production diversification, power system flexibility.

**Objective of the policy or measure**: Greater utilization of RES potential for electricity production, increasing energy security, improvement of position in electricity markets, higher integration of RES in power system.

**Implementation process**:
- Development of feasibility studies for new RES.
- Preparation of technical documentation.
- Preparations of grid connection studies.
- Obtaining permits.
- Obtaining financing.
- Selection of equipment and construction works providers.
- Commissioning of power plants.

**Implementation period**:
- Expected starting date: 2025
- Expected end date: 2027
- The measures will have long-term effects, significantly affecting RES share in the energy consumption as well as decrease of GHG emissions.

**Status of implementation**:
- The project is ongoing.

**Responsible for implementation**:
- EPCG (Electricity Power Utility of Montenegro).
- Private investor (in cooperation with EPCG on the development of WPP Gvozd I).

**Actions taken**:
- Montenegrin power company (EPCG) developed plans for increase of RES power sources in their portfolio.
- Part of technical documentation is prepared.

- Public procurement procedure initiated for the selection of the equipment supplier and installer for all power plants.
- Contract awarded for construction of WPP Gvozd I.

**Impact**:
- Energy Union Dimension(s) affected: Decarbonisation, Energy security.
- Sectors affected: Energy generation (IPCC sector: 1A Energy, subcategory: 1A1 Energy industries).
- GHG areas and greenhouse gases covered: This measure targets fuel switch to renewable electricity and therefore impacts decrease of all GHG emissions, however, its effect is greatly dependent on annual operation of TPP Pljevlja and penetration of e-mobility (since these two sectors impact the most GHG emissions level). It is expected that major effect of the PaM on national targets is evident after 2029.

**Costs**:
- The total budget for the project is EUR 181 million, spread over 4 years (2024-2027).

**Funding**:
- EPCG, IFIs, private investors.

**Annual public budgetary impacts**:
- None.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- All power plants have feasibility studies. Most of them have technical documentation prepared (inception design, main design).

***Exact name:*** Additional renewable power plants

**Considered in which scenario**: WAM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
Montenegro is characterized by low electricity production diversification (high dependence on HPPs and TPP) which makes electricity supply vulnerable to meteorological circumstances, stochastic electricity market prices and availability of cross border capacity during dry part of the year. Also, Montenegro has a great and proven renewable energy potential (hydro, solar, wind). Therefore, an increase of wind and solar energy utilization, which are currently characterized by very small share in electricity production, will bring a necessary robustness to electricity production mix because of their complementary effect with respect to the operation of HPPs which are the most dominant power plants in country. However, it is important to take into account their variable production which is a great challenge for their integration in power system. There is a need for more balancing reserve, higher flexibility of power system which are strengthened by electricity storage power plants (HPPs with reservoir,

pump storage power plants, battery electric storage systems etc.). As the main objective, this PaM targets high integration of new RES in order to substitute the electricity production of TPP Pljevlja as soon as possible in the most effective manner. This task is very challenging due to large amount of electricity production that corresponds to TPP Pljevlja, as well as due to a power system limitation when high integration of new RES power plants is in question, like balancing, system flexibility, necessary infrastructure for connection to the grid. Therefore a coordination between investors and the state administration is needed.

**Description of the PaM**:
Development of additional renewable power plants is necessary in order to reach the most challenging national targets regarding RES share and GHG emissions. Also, it impacts energy security and internal energy market development. This PaM includes planned power plants whose project readiness is at lower level of preparation, because all necessary technical documentation has not been prepared, financing is not confirmed, some aspects of environmental impact assessment are not elaborated in details. There are a lot of projects that are being developed by private investors, and EPCG. While EPCG does not need a support regarding financing, and therefore some PPA support from the Government, most of investors do. Therefore, it is expected that for a certain part of installed power of new renewable power plants there will be a need for PPA support as it is envisaged by the Law on renewable energy usage. It will be done through public auctions where all bidders would compete to get the PPA for the installed power defined by the call. PPA is based on electricity market premium that is determined using reference electricity market price. Maximum electricity price for auction is defined in the call. Participation is possible if the investor submitted a construction application or obtained a construction permit in accordance with the law governing the construction of buildings for the power plant type that is targeted by the auction. Companies awarded with PPA are not free of the balancing costs. Balancing cost calculation is defined by the Law. The level of installed power per year that will have PPA support will be decided basing on the plan that is prepared for three years period. There is a possibility that the first auction is organized prior to the preparation of the mentioned three year plan and after the decision of the Government.
The overview of renewable power plants structured per type of technology planned to be operational until 2030 with basic technical characteristics follows:

- WPPs – new WPPs 145 MW (380 GWh)
- SPPs – new WPPs 746 MW (1044 GWh)

There are plans for development of new HPPs (253.9 MW / 383 GWh) and SPPs with additional installed power of more than 1000 MW that are planned to be operational in period 2031-2035. The dynamics of realization of all new renewable power plants is mainly impacted by the grid infrastructure development because of the great number of new power plants and very significant challenges with construction of the new power lines in Montenegro (mainly due to land ownership issues). It is safe to point out that beside financial viability of a renewable energy project (which can be mitigated using PPAs), the main challenge for timely construction of a new plant is construction of the power lines needed for grid connection.
It is important to emphasize that in order to reach the national targets (RES share and GHG emission decrease) it is not necessary that all power plants planned until 2030 are operational, but only half of them (half of the planned installed power). However, their mix should be diversified in order to support and strengthen the flexibility of the power system. Therefore, all

types of renewable power plants should take part in the mix. Furthermore, if the realized dynamics of the development of the planned new renewable sources would threaten the security of the power system operation, additional measure for increase of system flexibility is needed, which can be done through including of a certain level of battery electric storage systems within the new plants (SPP and WPP). The capacity of BESS per new plant will be defined within bylaw that regulates grid operation.

**Legal, technical, financial, informational, regulatory policy or measure**: Technical and regulatory measure.

**Problem the policy or measure is addressing**: Electricity production diversification, power system flexibility.

**Objective of the policy or measure**: High integration of RES electricity production, increasing energy security, improvement of position in electricity markets.

**Implementation process**:

- Development of feasibility studies for new RES.
- Preparation of technical documentation.
- Preparations of grid connection studies.
- Obtaining permits.
- Preparation of Auction plan for three-year period.
- Auctions.
- Obtaining financing.
- Selection of equipment and construction works providers.
- Commissioning of power plants.

**Implementation period**:

- Expected starting date: 2025
- Expected end date: 2035
- The measures will have long-term effects, significantly affecting RES share in the energy consumption as well as decrease of GHG emissions.

**Status of implementation**:

- The project is ongoing.

**Responsible for implementation**:

- EPCG (Electricity Power Utility of Montenegro).
- Private investors.

**Actions taken**:

- Montenegrin power company (EPCG) developed plans for increase of RES power sources in their portfolio.
- Part of technical documentation is prepared.
- Basic permits obtained (the first step for construction permit).
- Connection studies prepared.
- Contracts for joint infrastructure development prepared.
- Several construction permits issued.

- Preparation of the first auction organizing.

**Impact**:
- Energy Union Dimension(s) affected: Decarbonisation, Energy security.
- Sectors affected: Energy generation (IPCC sector: 1A Energy, subcategory: 1A1 Energy industries).
- GHG areas and greenhouse gases covered: This measure targets fuel switch to renewable electricity and therefore impacts decrease of all GHG emissions, however, its effect is greatly dependent on annual operation of TPP Pljevlja and penetration of e-mobility (since these two sectors impact the most GHG emissions level). It is expected that major effect of the PaM on national targets is evident after 2032.

**Costs**:
- The total budget for the project is EUR 1.5 billion up to 2030 and taking into the account all power plants planed to be operational after 2030 additional EUR 1 billion, spread over 12 years (2024-2035).

**Funding**:
- EPCG, IFIs, private investors, public budget.

**Annual public budgetary impacts**:
- It depends on the prices achieved and PPAs awarded after auctions.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- All power plants have feasibility studies. Detailed technical documentation is under preparation, but most of them dispose of Inception design.

***Exact name:*** Refurbishment of small hydro power plants

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
The group of small hydropower plants covered by this measure has been in operation for many years without serious investments that would envisage technological innovations, so they are characterized by low energy efficiency in terms of using the available hydro potential in relation to today's solutions.

**Description of the PaM**:
The operating life of small hydro power plants owned by EPCG: Rijeka Crnojevića, Podgor, Šavnik, Mušovića rijeka and Lijeva Rijeka are over 50 years. Small hydro power plants have a total installed capacity of 2.8 MW. The modernization of the sHPP Glava Zete and sHPP Slap Zete has been completed in 2020. The goal is to renew equipment of all the rest sHPPs owned by EPCG in order to increase their reliability and efficiency. There will be a slight increase in

the total installed power to 3.38 MW. This PaM does not envisage any PPA support by the Government.

**Legal, technical, financial, informational, regulatory policy or measure**: Technical measure.

**Problem the policy or measure is addressing**: Increase of RES share.

**Objective of the policy or measure**: New technologies, better utilization of hydro potential.

**Implementation process**:
- Preparation of technical documentation.
- Obtaining permits.
- Selection of equipment and construction works providers.
- Commissioning of power plants.

**Implementation period**:
- Expected starting date: 2023
- Expected end date: 2024
- The measures will have long-term effects, affecting RES share in the energy consumption as well as decrease of GHG emissions.

**Status of implementation**:
- The project is ongoing.

**Responsible for implementation**:
- EPCG (Electricity Power Utility of Montenegro).

**Actions taken**:
- Public procurement procedure initiated for the technical documentation preparation, selection of the equipment supplier and installer for all power plants.
- All contracts are awarded.
- All necessary technical documentation is prepared.
- All equipment is installed.
- Commissioning is ongoing.

**Impact**:
- Energy Union Dimension(s) affected: Decarbonisation, Energy security.
- Sectors affected: Energy generation (IPCC sector: 1A Energy, subcategory: 1A1 Energy industries).
- GHG areas and greenhouse gases covered: The effect of this measure is small but it positively affects RES goals and GHG emission decrease. However, the effect on both goals is evident after 2029 and it depends on the annual operation of TPP Pljevlja.

**Costs**:
- The total budget for the project is EUR 0.8 million, spread over 2 years (2023-2024).

**Funding**:

- EPCG, IFIs, private investors.

**Annual public budgetary impacts**:
- None.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- Technical documentation is prepared for all sHPPs (inception design, main design).

***Exact name:*** Development of decentralized energy generation (distribution medium voltage connection)

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
It is confirmed that Montenegro has a great RES potential. High integration of new renewable power plants in a more dynamical manner is an important means to achieve the national targets. However, some barriers affecting the dynamics of realization of the mentioned potential are identified:
- Existing legal framework regulating construction of objects and spatial planning
- Grid connection.

Therefore some updates of laws and bylaws are prepared and done in order to enable more efficient realization of medium size RES potential. In the same time, medium sized renewable power plants can be connected to distribution grid where the challenges with infrastructure are significantly lower. Additionally, distributed generation is closer to load centers and it can be used to enable positive effects on the grid operation (lower energy losses, better voltage regulation). However there can be some negative effects so it is of great importance to prepare connection studies in order to mitigate potential problems.

**Description of the PaM**:
Making the procedures more efficient, including local municipalities in the process of realization of medium sized RES potential (up to 5 MW of installed power), as well as Distribution System Operator, great number of private investors recognized a chance to develop distributed generation projects in a reliable and efficient manner. Therefore, there is a following plan for increase of distributed generation by 2030:
- New SPPs – additional capacity up to 25 MW (33.75 GWh), numerous new distributed power plants in all parts of Montenegro, which will be operational starting from 2023 and gradually increasing the total installed power until 2030.

The plants included by the PaM are selected basing on the readiness of the projects, level and quality of preparation of technical documentation and accompanying permits issued. This PaM does not envisage any PPA support by the Government.

**Legal, technical, financial, informational, regulatory policy or measure**: Legal and technical measure.

**Problem the policy or measure is addressing**: Electricity production diversification, increasing RES share.

**Objective of the policy or measure**: Greater utilization of RES potential for electricity production, increasing energy security, higher integration of RES in power system.

**Implementation process**:
- Development of feasibility studies for new RES.
- Preparation of technical documentation.
- Preparations of grid connection studies.
- Obtaining permits.
- Obtaining financing.
- Selection of equipment and construction works providers.
- Commissioning of power plants.

**Implementation period**:
- Expected starting date: 2023
- Expected end date: 2030
- The measures will have long-term effects, significantly affecting RES share in the energy consumption as well as decrease of GHG emissions.

**Status of implementation**:
- The project is ongoing.

**Responsible for implementation**:
- Private investor (in cooperation with EPCG on the development of WPP Gvozd I)
- Local municipalities
- Distribution system operator.

**Actions taken**:
- Part of technical documentation is prepared.
- Local municipalities issued requirements necessary for further development of technical documentation.
- DSO is providing support through development of connection studies.
- Construction of certain number of power plants is ongoing.

**Impact**:
- Energy Union Dimension(s) affected: Decarbonisation, Energy security.
- Sectors affected: Energy generation (IPCC sector: 1A Energy, subcategory: 1A1 Energy industries).
- GHG areas and greenhouse gases covered: This measure targets fuel switch to renewable electricity and therefore impacts decrease of all GHG emissions, however, its effect is greatly dependent on annual operation of TPP Pljevlja and penetration of e-mobility (since these two sectors impact the most GHG emissions level). It is expected that major effect of the PaM on national targets is evident after 2029.

**Costs**:
- The total budget for the project is EUR 30 million, spread over 7 years (2024-2030).

**Funding**:
- IFIs, private investors.

**Annual public budgetary impacts**:
- None.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- All power plants have feasibility studies. Most of them have technical documentation prepared (inception design, main design).

***Exact name:*** *Additional* Development of decentralized energy generation (distribution medium voltage connection)

**Considered in which scenario**: WAM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
Although there are some positive effects of already planned measures on development of medium sized RES potential, national targets regarding RES share and GHG emission are set very high and there is a need for further support of distributed generation. The power plant investment costs are decreasing (especially in SPPs which are the focus of investors interest) but the grid connection may be an issue since the grid was primarily planned for electricity distribution to consumers and its development needs time. Therefore in a lot of cases grid connection is significantly increasing the investment and becomes a barrier for obtaining the funding.

**Description of the PaM**:
Introducing a separate auction for PPA for distributed generation (up to 5 MW of installed power per power plant) as it is envisaged by the Law on renewable energy usage will enable more investments and higher rate of new RES integration. It will be done through public auctions where all bidders would compete to get the PPA for the installed power defined by the call. PPA is based on electricity market premium that is determined using reference electricity market price. Maximum electricity price for auction is defined in the call. Participation is possible if the investor submitted a construction application or obtained a construction permit in accordance with the law governing the construction of buildings for the power plant type that is targeted by the auction. Companies awarded with PPA are not free of the balancing costs. Balancing cost calculation is defined by the Law. Therefore, there is a following plan for increase of distributed generation by 2030:
- New SPPs – additional capacity up to 25 MW (33.75 GWh), where a single power plant does not have installed power higher than 5 MW. New plants will be operational starting from 2023 and gradually increasing the total installed power until 2030.

**Legal, technical, financial, informational, regulatory policy or measure**: Financial and regulatory measure.

**Problem the policy or measure is addressing**: Electricity production diversification, increasing RES share.

**Objective of the policy or measure**: Greater utilization of RES potential for electricity production, increasing energy security, higher integration of RES in power system.

**Implementation process**:
- Development of feasibility studies for new RES.
- Preparation of technical documentation.
- Preparations of grid connection studies.
- Obtaining permits.
- Obtaining financing.
- Selection of equipment and construction works providers.
- Commissioning of power plants.

**Implementation period**:
- Expected starting date: 2025
- Expected end date: 2030
- The measures will have long-term effects, significantly affecting RES share in the energy consumption as well as decrease of GHG emissions.

**Status of implementation**:
- The project is ongoing.

**Responsible for implementation**:
- Private investor (in cooperation with EPCG on the development of WPP Gvozd I)
- Local municipalities
- Distribution system operator.

**Actions taken**:
- Part of technical documentation is prepared.
- Local municipalities issued requirements necessary for further development of technical documentation.
- DSO is providing support through development of connection studies.
- Organization of the first auction is under preparation.

**Impact**:
- Energy Union Dimension(s) affected: Decarbonisation, Energy security.
- Sectors affected: Energy generation (IPCC sector: 1A Energy, subcategory: 1A1 Energy industries).
- GHG areas and greenhouse gases covered: This measure targets fuel switch to renewable electricity and therefore impacts decrease of all GHG emissions, however, its effect is greatly dependent on annual operation of TPP Pljevlja and penetration of e-mobility (since these two sectors impact the most GHG emissions level). It is expected that major effect of the PaM on national targets is evident after 2029.

**Costs**:
- The total budget for the project is EUR 33 million, spread over 6 years (2025-2030).

**Funding**:

- IFIs, private investors, public budget.

**Annual public budgetary impacts**:

- It depends on the prices achieved and PPAs awarded after auctions. An estimate is EUR 0.6 million if all planned capacities are developed.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:

- All power plants have feasibility studies. Most of them have technical documentation prepared (inception design, main design).

#### *3.1.2.2 Sector and technology specific measures: Heating and cooling*

#### *3.1.2.3 Sector and technology specific measures: Transport*

PaMs targeting the Transport sector have decreasing of GHG emissions and increasing of energy efficiency as the main goals. These measures have also impact on the RES share because of the introduction of biofuels and greater share of electricity consumption in the sector.

#### *3.1.2.4 Measures on financial support*

#### *3.1.2.5 Specific measure: Streamlining administrative procedures and contact point*

Not applicable

#### *3.1.2.6 Specific measure: Information and training*

Not applicable

#### *3.1.2.7 Specific measure: Facilitating the uptake of power purchase agreements*

Not applicable

#### *3.1.2.8 New infrastructure for district heating and cooling produced from RES*

Not applicable

## 3.2 Dimension Energy Efficiency

### 3.2.1 Energy efficiency obligation schemes and alternative policy measures

Detailed information regarding EEO schemes and alternative measures is given in the 4th EEAP – Chapter 3.1.1 and Annex 1.

http://energetska-efikasnost.me/download/strateska_dokumenta/3.-Akcioni-plan-energetske-efikasnosti-Crne-Gore-za-period-2019-2021.-godina.pdf

### 3.2.2 Long-term renovation strategy and stimulating cost-effective deep renovation

***Exact name:*** *Development and implementation of energy efficiency regulatory framework in buildings*

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
This measure has a major impact on the new buildings and refurbishment of existing buildings, as all fully refurbished buildings and new buildings must meet the minimum requirements. The implementation of a regulatory framework for the building energy performance is a measure ensuring compliance with the standards relevant to the minimum requirements of buildings energy performance. Implementation mechanisms include control of the minimum energy efficiency requirements, control of the certification obligation of both new and reconstructed buildings prior to their use, control of the energy performance certificates correctness, as well as inspection controls. The main national goals that are impacted are final energy use, and consequently primary energy use, while there are some indirect effects on and RES share and GHG emissions. Residential and service sector are the main targets of this PaM because the share of these sectors in the total final energy demand is about 48 % in the base year (cca 36 + 12 %, respectively).

**Description of the PaM**:
Ministry of Energy has already transposed previous EPBD in the national legislation and by laws in 2014, when the implementation started. The amending Directive (EU) 2018/844 is partly transposed in the national legal framework by amendments of the Law on energy efficiency which are approved by Parliament of Montenegro in December 2022. Full transposition will be provided by the bylaws in 2023. The main improvement is the obligation to develop Building renovation strategy whose results should be included within the NECP. Also, there are changes in the obligations of local municipalities and large legal entities (more than 500 employees) which should prepare programs for improvement of energy efficiency, report regarding their realization each year and perform energy audits of their objects at least once every four years.

**Legal, technical, financial, informational, regulatory policy or measure**: Legal measure (compliance with EPBD and the amending Directive (EU) 2018/844).

**Problem the policy or measure is addressing**: Energy efficiency in building sector.

**Objective of the policy or measure**: PaM will contribute to EPBD implementation (with certification tool), and together with the development of Building Renovation Strategy achieve legal and strategic preconditions for effective "Renovation Wave" in Montenegro.

**Implementation process**:

- Adoption of the amendments of the Law on energy efficiency.
- Preparation of the necessary bylaws.

**Implementation period**:

- Expected starting date: 2022
- Expected end date: 2024
- The measures will have long-term effects, significantly improving energy efficiency.

**Status of implementation**:

- The project is ongoing. It is expected that phase I.2 of the project is finished in September 2025.

**Responsible for implementation**:

- State administration (State authority for properties, Ministry of Energy, local governments), citizen, private companies / owner of commercial buildings, investors in buildings for housing and commercial sector.

**Actions taken**:

- Amendments of the Law on energy efficiency which are approved by Parliament of Montenegro in December 2022.
- Bylaws necessary for full transposition of the Law are under preparation.
- Ministry of Energy has secured the funds for the preparation of buildings inventory as well as for determining energy classes and development and commissioning of national software for calculation of energy performance of buildings and their certification.
- Building renovation strategy is under preparation.
- National software for building certification is prepared and the basic trainings are organized.
- Education of energy auditors is ongoing.

**Impact**:

- Energy Union Dimension(s) affected: Energy efficiency, Decarbonisation.
- Sectors affected: Residential sector, Service sector (IPCC sector: 1A Energy, subcategory: 1A4 Other sectors).
- GHG areas and greenhouse gases covered: Carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) emissions are all produced during combustion of oil derivatives, coal and wood which are the main sources of GHG emissions in service and residential sectors. Although the residential sector is energy wise more intensive than the service sector, the situation with GHG emission intensity is opposite due to greater usage of oil derivatives in the service sector. This PaM has as an effect of more efficient energy usage which enables lower usage of more intensive fuels with respect to GHG emissions (oil derivatives, wood and in some extent of the coal (lower usage of coal is mainly affected by the introduction of district heating in Pljevlja where this fuel is mainly used)). The effect of PaM on GHG emissions in residential and service sectors is a decrease of GHG emissions in amount of 2 Gg $CO_{2eq}$. However there is a great synergy between this PaM and introduction of prosumer concept which directly impacts RES share in these sectors.

**Costs**:

- Total budget for bylaws amendments negligible (EUR 10k) and EUR 0.55 mil. for development of software for energy certification of buildings and buildings inventory in order to provide conditions for determining energy classes.

**Funding**:
- The state budget.

**Annual public budgetary impacts**:
- EUR 0.56 million.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- There is no specific Montenegrin study that is the base for this PaM. The development of energy efficiency regulations for buildings is closely linked to meeting the requirements of Directive 2012/27/EU on energy efficiency (EED) and Directive 2010/31/EU on the energy performance of buildings (EPBD), both transposed to the national Law on Efficient Use of Energy and activities based on the requirements of these directives will continue to be implemented in the coming period.

***Exact name:*** *District Heating in Pljevlja*

**Considered in which scenario**: WAM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
The district heating development in Pljevlja town will follow after TPP Pljevlja eco-refurbishment, while during the refurbishment, all the heating system connection related preparatory works are to be completed. The heating project shall solve the long-lasting air pollution problem and other urgent environmental and public health issues in Pljevlja and its surroundings. The citizens of Pljevlja for heating purposes fire around 80% of the total coal used in residential sector in the country. The air in Pljevlja during the winter season is heavily loaded primarily with air pollutants ($SO_2$, $NO_X$, $PM_{2.5}$, $PM_{10}$, ash and dust), which are mostly the by-products of lignite combustion in individual mostly inefficient furnaces in around 5,000 local households. It is assumed that the project will eliminate lignite as a fuel used for heating purpose in Pljevlja. The phasing out of lignite used in Pljevlja municipality residential sector will result in GHG emission reduction that follows the dynamics of lignite decrease throughout the observed period.

**Description of the PaM**:
The project includes the construction of a heat source, primary and secondary hot water networks. In the first phase, the construction of the primary heat pipe will create the conditions for supply of 6 of the largest boiler plants in the city center. This will be done with unregulated removal of steam from the turbine block of the Pljevlja Thermal Power Plant, with a capacity of 10 MW, immediately after the completion of the Environmental Reconstruction in 2025. In addition, the construction of 20 connections on the primary heat pipe of the appropriate

diameter for all consumption zones creates the conditions for the second phase and regulated removal of steam from the turbine block of the Pljevlja Thermal Power Plant and further development of the heating of the city with a heat consumption of 44 MW.

**Legal, technical, financial, informational, regulatory policy or measure**: Legal and technical measure (compliance with IED Law).

**Problem the policy or measure is addressing**: Air pollution and inefficient households lignite furnaces.

**Objective of the policy or measure**: New technologies, heat energy supply of Pljevlja town via modern centralized heat supply system, from central heat source, that will close down the households' coal furnaces.

**Implementation process**:

- Phase I.1: Construction of the primary heat pipe part 1 (2.281 km).
- Phase I.2: Construction of the primary heat pipe part 2 and 3 (4.451 km).
- Phase II: Creation of conditions for the development of heating of all consumption zones of the city of Pljevlja with capacities up to 2x22 MW on the same heat pipe already built in the first phase.

**Implementation period**:

- Expected starting date: 2023
- Expected end date: 2030
- The measures will have long-term effects, significantly reducing emissions and improving air quality and efficiency after installation.

**Status of implementation**:

- The project is ongoing. It is expected that phase I.2 of the project is finished in September 2025.

**Responsible for implementation**:

- Local government, EPCG.

**Actions taken**:

- EPCG has granted EUR 2.5 mil.
- Phase I.1 finished.
- Phase I.2 is ongoing – revision of technical design is under preparation, after which a public call for construction will be announced.

**Impact**:

- Energy Union Dimension(s) affected: Decarbonisation, Energy efficiency.
- Sectors affected: Residential sector, Energy generation (thermal power plants).
- GHG areas and greenhouse gases covered: Carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) emissions are all produced during lignite combustion. Total removal of coal usage in residential sector leads to decrease of GHG emissions in amount of 12.4 Gg $CO_{2eq}$ .

**Costs**:

- The total budget for the project is EUR 23 million. EPCG has granted EUR 2.5 million. 8.3 million is already allocated for phases I.1 and I.2. Local government will cover expropriation costs.

**Funding**:

- The entire funds for implementation are provided by the capital budget of the state of Montenegro.

**Annual public budgetary impacts**:

- It depends on the realization. 8.3 million is already allocated (period 2023-2025), the rest of funds will be spread over the remaining 5 years (period 2026-2030).

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:

- Project "Heating of Pljevlja, for clean and warm Pljevlja" – project of public significance.

### 3.2.3 Uptake of energy performance contracting and other EE service models

No PaMs

### 3.2.4 Exemplary role of public buildings and energy-efficient public procurement

***Exact name:*** *Increased energy efficiency in public buildings*

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
Public buildings have a share of 9 % in total energy demand of service sector. Electricity is the dominantly used fuel (64 % share) but there are also extralight fuel oil (15 %), charcoal (15 %), wood (6 %) and negligible usage of LPG. Buildings are characterized by low energy efficiency and in some cases very low comfort conditions. There is a need for significant improvement of building envelope, HVAC systems, water heating, lighting, but also it is necessary to introduce energy management systems, renewable energy integration and behavioral and operational changes. Since public buildings are part of public administration energy efficiency measures are significantly easier to implement than in residential sector due to lower financial and organizational challenges.

**Description of the PaM**:
Several years of investments in increasing energy efficiency in public (healthcare, education, cultural and administrative buildings) buildings has occurred through two programmes: Energy Efficiency in Montenegro (MEEP) and Energy Efficiency Program in Public Buildings (EEPPB), implemented since 2010 and 2012, respectively. These programmes have already

effected big savings and emission reductions. The two programmes have covered 48 public buildings so far.

**Legal, technical, financial, informational, regulatory policy or measure**: Technical measure.

**Problem the policy or measure is addressing**: Energy efficiency in public buildings.

**Objective of the policy or measure**: Improve energy efficiency and comfort conditions in selected public buildings.

**Implementation process**:
- Energy audits preparation.
- Selection of public buildings.
- Obtaining funding.
- Public call for equipment and construction works.
- Implementation and monitoring.

**Implementation period**:
- Expected starting date: 2022
- Expected end date: 2025
- The measures will have long-term effects, significantly improving energy efficiency.

**Status of implementation**:
- Implementation of EE measures is ongoing.

**Responsible for implementation**:
- State administration (State authority for properties, Ministry of Energy, local governments).

**Actions taken**:
- The Govt. has prepared the Reconstruction plan of state-owned official buildings for period 2020-2022.
- Ministry of Energy is currently implementing two programs for public buildings EE refurbishment, in the period 2019 – 2023 for the health sector, and in the period 2021-2025 for public buildings.

**Impact**:
- Energy Union Dimension(s) affected: Energy efficiency, Decarbonisation.
- Sectors affected: Service sector (IPCC sector: 1A Energy, subcategory: 1A4 Other sectors).
- GHG areas and greenhouse gases covered: Carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) emissions are all produced during combustion of oil derivatives, coal and wood which are the main sources of GHG emissions in service sector. Public administration has a share of 12 % in the total GHG emissions. Main source of GHG emissions is usage of extra light fuel oil (86 %). It is expected that this PaM enables decrease of GHG emissions in amount of 2 Gg $CO_{2eq}$.

**Costs**:

- Total budget amounts EUR 56 million.

**Funding**:

- The state budget, EBRD and KfW loans.

**Annual public budgetary impacts**:

- It depends on the dynamics of realization (total budget is to be divided into 2019-2025).

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:

- There is no specific Montenegrin study that is the base for this PaM. However, there are energy audits performed for all public buildings which include analysis of the current situation and potential measures for energy efficiency improvement.

***Exact name:*** *Implementation of energy efficiency measures in public municipal companies*

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:

There is no statistical data regarding the share that public municipal companies have in the total sectorial energy consumption, but it is certain that their energy consumption can be reliably monitored and analysed with respect to energy efficiency. Therefore, the optimal measures targeting improvement of energy efficiency can be effectively selected. Based on adopted local EE programmes, several municipalities have already implemented various EE measures. So far, public lighting has already been replaced in some municipalities. All local energy-efficiency programmes envisage this action, since it is easy to implement and cost-effective.

**Description of the PaM**:

In accordance with the Law on Efficient Energy Use, local governments are obliged to prepare a programme for improving local government energy efficiency for a period of three years. The programme shall contain proposal of energy efficiency measures in the area of the local government, which includes plan for adaptation and maintenance of buildings used by local government bodies to perform activities and public services founded by local government, with the aim of improving energy efficiency; plans for the improvement of the communal services system (public lighting, water supply, waste management, etc.) and transport to improve energy efficiency; specific energy efficiency measures in buildings protected as cultural property, etc.; other energy efficiency measures to be implemented in the area of local self-government. Within the EU support, through IPA 2019, the funds amounting EUR 2.4 mil. are planned for the establishment of financial support schemes for energy efficiency improvement in facilities under the jurisdiction of local governments.

**Legal, technical, financial, informational, regulatory policy or measure**: Technical, regulatory measure.

**Problem the policy or measure is addressing**: Energy efficiency in public municipal companies.

**Objective of the policy or measure**: This measure accounts for the improvement of condition, monitoring and maintenance, as well as investments in order to improve energy efficiency related to public lighting, water supply and sewerage and other utilities.

**Implementation process**:
- Energy audits preparation.
- Obtaining funding.
- Public call for equipment and construction works.
- Implementation and monitoring.

**Implementation period**:
- Expected starting date: 2019
- Expected end date: 2030
- The measure will have long-term effects, significantly improving energy efficiency.

**Status of implementation**:
- Implementation is ongoing.

**Responsible for implementation**:
- Local governments.

**Actions taken**:
- Several local municipalities implemented projects targeting improvement of public lighting.

**Impact**:
- Energy Union Dimension(s) affected: Energy efficiency, Decarbonisation.
- Sectors affected: Service sector (IPCC sector: 1A Energy, subcategory: 1A4 Other sectors).
- GHG areas and greenhouse gases covered: It is difficult to differentiate with respect to the GHG emissions decrease achieved by total public sector.

**Costs**:
- EUR 2.51 mil. in period 2019-2021 and EUR 5.12 mil. in period 2019-2030 (budget calculated based on the PaM description in the NEEAP).

**Funding**:
- Govt. of Montenegro and international donors.

**Annual public budgetary impacts**:
- It depends on the dynamics of realization (total budget is to be divided into 2019-2030).

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:

- National energy efficiency action plan (NEEAP).

***Exact name:*** *Establishment and implementation of EE criteria in public tendering*

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
Public administration participates with share of 9 % in total energy demand of service sector. Numerous energy audits have shown that there is a great potential for improvement of energy efficiency. Also, energy efficiency measures are significantly easier to implement in public sector than in residential sector due to lower financial and organizational challenges. Considering that the public sector is a very important contracting authority for goods and services relevant to the energy consumption aspect, successful implementation of this measure can significantly transform the market towards more energy efficient solutions, reducing the price of new technologies and promoting their wider use.

**Description of the PaM**:
In 2018 and 2022, amendments were made to the relevant provisions of the Law on Efficient Use of Energy, and the new legal solution envisages the possibility of introducing energy efficiency not only as a criterion for the most economically advantageous offer, but also as a mandatory technical requirement. For the full application of the amended provision of the Law, it is necessary to make amendments to the Ordinance on the methodology for determining the energy efficiency degree in the public procurement procedure.

**Legal, technical, financial, informational, regulatory policy or measure**: Technical measure.

**Problem the policy or measure is addressing**: Energy efficiency in public buildings.

**Objective of the policy or measure**: Establish systematic mechanisms for introducing energy efficiency criteria into the public procurement process, in order to achieve significant energy savings as well as financial and other benefits.

**Implementation process**:

- Preparation of the first draft.
- Consultations with stakeholders.
- Finalization of the draft.
- Adoption procedure.

**Implementation period**:

- Expected starting date: 2023
- Expected end date: -

- The measures will have long-term effects, significantly improving energy efficiency.

**Status of implementation**:
- Regulation came into effect on December 12, 2022.

**Responsible for implementation**:
- Ministry of Energy, Public Procurement Authority and public institutions.

**Actions taken**:
- Amending of the Law on Efficient Use of Energy in 2022.

**Impact**:
- Energy Union Dimension(s) affected: Energy efficiency.
- Sectors affected: Service sector (IPCC sector: 1A Energy, subcategory: 1A4 Other sectors).
- GHG areas and greenhouse gases covered: Carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) emissions are all produced during combustion of oil derivatives, coal and wood which are the main sources of GHG emissions in service sector. Public administration has a share of 12 % in the total GHG emissions. Main source of GHG emissions is usage of extra light fuel oil (86 %). This PaM will gradually affect the lowering of the growth rate of energy consumption in the sector and therefore limit the growth rate of GHG emissions. However, its impact on GHG emissions decrease is not great (below 1 Gg $CO_{2eq}$).

**Costs**:
- Cost is negligible (EUR 10k).

**Funding**:
- Govt. of Montenegro.

**Annual public budgetary impacts**:
- The cost for developing corresponding procurement rules is negligible, while actual compliance will pose additional cost to public budgets.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- There is no specific Montenegrin study that is the base for this PaM. However, there were no obligations for public tendering regarding energy efficiency. The only priority of public tendering was to achieve the lowest price for the equipment that fulfills basic technical requirements.

***Exact name:*** *Energy labeling and ecodesign requirements for energy related products*

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
The energy labeling legal provisions require that economic operators provide customers with information about the energy consumption of the devices. The ecodesign requirements set minimum energy efficiency standards (and in some cases pollution standards) for a number of products, meaning that if they do not meet these standards they cannot be put on the market. In order to provide conditions and practices for the labeling and ecodesign requirements of devices, an appropriate legal framework is already in place obliging market players (suppliers and distributors) to comply with a number of legal requirements for products.

**Description of the PaM**:
Rulebooks for energy labeling are adopted and cover the following energy-related products: washing machines, TV sets, dishwashers, air-conditioning, refrigerators, electric light bulbs and lamps and car tires, while the adopted 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.

**Legal, technical, financial, informational, regulatory policy or measure**: Legal measure (compliance with EPBD and the amending Directive (EU) 2018/844).

**Problem the policy or measure is addressing**: Energy consumption reduction.

**Objective of the policy or measure**: Energy efficiency improvement of energy related products.

**Implementation process**:
- Adoption of the amendments of the Law on energy efficiency.
- Preparation of the necessary bylaws.

**Implementation period**:
- Expected starting date: 2018
- Expected end date: 2033
- The measures will have long-term effects, significantly improving energy efficiency.

**Status of implementation**:
- All regulation came into effect from 2018.

**Responsible for implementation**:
- Ministry of Energy, market players (suppliers and distributors).

**Actions taken**:
- Energy labeling regulations are in effect starting from 2015 and eco design regulations from 2018.

**Impact**:

- Energy Union Dimension(s) affected: Energy efficiency.
- Sectors affected: All demand sectors, (IPCC sector: 1A Energy, subcategory: 1A4 Other sectors).
- GHG areas and greenhouse gases covered: Carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) emissions are all produced during combustion of oil derivatives, coal and wood which are the main sources of GHG emissions in service and residential sectors. Although the residential sector is energy wise more intensive than the service sector, the situation with GHG emission intensity is opposite due to greater usage of oil derivatives in the service sector. This PaM has as an effect of more efficient energy usage which enables lower usage of more intensive fuels with respect to GHG emissions (oil derivatives, wood and in some extent of the coal (lower usage of coal is mainly affected by the introduction of district heating in Pljevlja where this fuel is mainly used)). The effect of PaM on GHG emissions in residential and service sectors is a decrease of GHG emissions in amount of 2 Gg $CO_{2eq}$. However there is a great synergy between this PaM and introduction of prosumer concept which directly impacts RES share in these sectors.

**Costs**:

- Total budget amounts EUR 139 mil. in 2021-2030 (expenditure for products purchase)
- The policy transposition costs only EUR 10k.

**Funding**:

- Govt. of Montenegro and international donors.

**Annual public budgetary impacts**:

- EUR 10k.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:

- Market Readiness Study prepared in 2018 through REEP+ project, financed by EBRD. The study has assumed that all energy related products covered by new labeling and eco-design legislation, which was that time in phase of transposition from EU ordinances, will be replaced in all MNE households with high-efficient ones in period 2018-2033. Also, the calculated energy savings within the study were also used in NEEAP 2019-2021.

### 3.2.5 Promoting energy audits and energy management systems

***Exact name:*** *Establishment and development of energy management in public sector*

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
Public buildings have a share of 9 % in total energy demand of service sector. Electricity is the dominantly used fuel (64 % share) but there are also extralight fuel oil (15 %), charcoal (15 %), wood (6 %) and negligible usage of LPG. Monitoring of energy consumption is at very low level and there is no energy management system application in public sector. Reliable monitoring of energy consumption is an important pillar for development of various policies and measures that enable improvement of energy efficiency. There are various very affordable technological solutions for establishing an energy management system and to tailor it in an optimal manner for government-owned and managed facilities, infrastructure, and operations. It is significantly simpler to introduce energy management in public sector due to lower financial and organizational challenges. By implementing structured energy management practices, the public sector can achieve significant energy savings, contribute to environmental sustainability, and set a benchmark for energy efficiency across all sectors.

**Description of the PaM**:
This measure aims at reducing energy consumption in public buildings. The measure is based on the establishment of an organizational structure for energy management, employee education and the application of IT tools for continuous monitoring and analysis of energy and water consumption in public sector facilities. The establishment of energy management (energy management system) is the first step towards a designed, systematic and gradual action to improve energy efficiency. However, there are several requirements in order to establish an effective energy management in public sector:

- Establishing an obligation for it through legislation;
- Set clear standards for energy use, renewable energy adoption, and operational efficiency;
- Use digital tools to track energy performance and for monitoring and reporting;
- Conducting energy audits;
- Selecting and implementing energy efficiency measures;
- Renewable energy integration;
- Development of financial strategies to implement selected measures (grants, green loans, public-private partnerships, energy service companies).

Ministry of Energy has prescribed the obligation of energy management to state administration bodies, local self-government units, public services founded by the state, i.e. local government, as well as large consumers. The law also prescribes sanctions in case of non-compliance with this obligation. Regulations are being drafted which will further regulate the manner of establishing the energy management system, organizational structure, the manner of calculation and collection of achieved energy savings and other issues of importance for energy management in public sector facilities, which will legally regulate this area. Support has been provided for the development of a system for energy efficiency information, maintenance planning, monitoring and verification (MVP), and capacity building measures have been carried out.

**Legal, technical, financial, informational, regulatory policy or measure**: Technical and legal measure.

**Problem the policy or measure is addressing**: Energy efficiency in public buildings.

**Objective of the policy or measure**: Improve energy efficiency and energy management in public sector.

**Implementation process**:
- Preparation of the first draft.
- Consultations with stakeholders.
- Finalization of the draft.
- Adoption procedure.
- Implementation and monitoring (providing support).

**Implementation period**:
- Expected starting date: 2019
- Expected end date: 2025
- The measure will have long-term effects, improving energy efficiency.

**Status of implementation**:
- Providing support to all those obliged to conduct energy management through the elements named above.

**Responsible for implementation**:
- State administration (State authority for properties, Ministry of Energy, local governments).

**Actions taken**:
- Legal basis is established.
- Energy management systems are developing with support of the ministry.

**Impact**:
- Energy Union Dimension(s) affected: Energy efficiency.
- Sectors affected: Service sector (IPCC sector: 1A Energy, subcategory: 1A4 Other sectors).
- GHG areas and greenhouse gases covered: Carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) emissions are all produced during combustion of oil derivatives, charcoal and wood which are the main sources of GHG emissions in public sector. Public administration has a share of 12 % in the total GHG emissions. Main source of GHG emissions is usage of extra light fuel oil (86 %). It is expected that this PaM enables decrease of energy intensity of the sector an as a consequence, GHG emissions decrease. This sector is not significant source of GHG emissions so the amount of GHG decrease caused by this PaM is negligible (lower than 1 Gg $CO_{2eq}$).

**Costs**:
- Total budget amounts EUR 1.345 million.

**Funding**:
- GIZ and KfW.

**Annual public budgetary impacts**:
- It depends on the dynamics of realization (to be divided into 2019-2025).

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:

- There is no specific Montenegrin study that is the base for this PaM. However, there are energy audits performed for all public buildings which include analysis of the current situation and potential measures for energy efficiency improvement.

### 3.2.6 Consumer information and training measures

No PaMs

### 3.2.7 Measures to utilise energy efficiency potentials of gas and electricity infrastructure

***Exact name:*** Reduction of losses in the electricity transmission power network

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
According to the Energy Law of Montenegro, the electricity transmission system operator is obligated to perform the transmission of electricity under the conditions specified by the license, adhering to the principles of objectivity, transparency, and non-discrimination. To fulfill this key role and meet the operational requirements placed upon it, the electricity transmission system operator is required, under Article 112 of the Energy Law of Montenegro, to prepare a ten-year transmission system development plan. This plan must align as much as possible with Montenegro's planning documents and with the development plans of neighboring transmission systems. In line with this, the transmission system operator also submits annual investment plans tailored to the needs of system users. These plans are consistent with the ten-year transmission system development plan and spatial planning documents.
An important part of this plan are measures and projects targeting the electricity losses. A separate study on electricity losses estimation is also prepared. The development of transmission system is impacted by numerous factors:

- System security
- Increase of electricity consumption
- New power plants
- Development of better interconnections with neighboring power systems
- Better integration in the regional electricity market.

Al mentioned factors impact the internal grid operation and development and may lead to increase of electricity losses. Therefore, it is needed to design measures that target electricity losses in order to limit their increase or decrease them.

**Description of the PaM**:
Although each upgrade of transmission system grid that targets capacity increase have positive effects on electricity losses decrease, many of those projects are selected in order to increase

secure operation of the system, new users connection or to improve the regional connectivity of the system. Therefore, these projects from the plan are not primarily selected to enable decrease of losses. This PaM includes only measures that are directly targeting electricity losses:

- Use of high-efficiency conductors (reconstruction of power lines)
- Improve grid management and operation
    - Use real-time monitoring systems to adjust transmission capacity based on weather conditions and demand, optimizing usage
    - Optimization of grid configuration (control of power flow)
    - Reactive power management – better voltage profile
    - Employ modern substation equipment with lower internal losses and better efficiency
    - Smart grids
    - Demand response programs: shift energy consumption patterns to off-peak times, reducing the load on transmission systems.

The importance of implementing Smart Grid technologies is reflected in the fact that CGES has consolidated all projects based on these technologies into a unified Smart Grid program. This program aims to ensure the necessary coordination in the planning and implementation of these projects. The program includes ongoing or already completed projects, such as:

- SCADA for the new dispatch center with the EMS system (including real-time assessment of the N-1 security factor in the power system);
- Expansion and improvement of the Automated Meter Reading (AMR) system;
- Implementation of a system for remote access to process networks and integration of new facilities into the SCADA system of the National Dispatch Center (NDC);
- Application of software for creating and analyzing models in CGMES format;
- Procurement of servers and equipment for EES software at the Regional Dispatch Center (RDC);
- Procurement of software for network analysis for the needs of development plans;
- Procurement of inverters for substations.

Better connectivity of the system leads to increase of power flows through the grid and higher electricity losses, but this will be compensated by Inter TSOs Compensation Mechanism.
After implementation of this PaM, although there is an expected increase of power flows until 2030 (new RES, new interconnections), the share of electricity losses will not increase (it will rest at 2 %).

**Legal, technical, financial, informational, regulatory policy or measure**: Technical and financial measure.

**Problem the policy or measure is addressing**: Energy efficiency.

**Objective of the policy or measure**: Introduction of new technologies, energy management, energy efficiency increase.

**Implementation process**:

- Development of necessary studies.

- Preparation of technical documentation.
- Preparations of grid connection studies.
- Obtaining permits.
- Obtaining financing.
- Selection of equipment and construction works providers.
- Commissioning of new infrastructure.

**Implementation period**:
- Expected starting date: 2023
- Expected end date: 2032
- The measure will have long-term effects, affecting energy efficiency of the transmission grid.

**Status of implementation**:
- The project is ongoing.

**Responsible for implementation**:
- CGES (Montenegrin transmission system operator).

**Actions taken**:
- Ten year development plan is adopted.
- Electricity losses study is adopted.
- Part of technical documentation is prepared.
- Public procurement procedure initiated for some of the selected projects.

**Impact**:
- Energy Union Dimension(s) affected: Energy efficiency.
- Sectors affected: Energy generation (IPCC sector: 1A Energy, subcategory: 1A1 Energy industries).
- GHG areas and greenhouse gases covered: The main target is decrease of electricity losses. Indirect effect is a slight decrease of GHG emissions. It is not estimated since it depends on the share of RES in the national electricity production mix.

**Costs**:
- (CGES) has adopted the Investment Plan for the period 2024–2028, which envisions an investment of 198 million euros in the development and modernization of the transmission network. Not all of these funds are planned for decrease of electricity losses. There is no specific information how much of these funds will be used for decrease of electricity losses

**Funding**:
- CGES, IFIs, private investors.

**Annual public budgetary impacts**:
- None.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:

- Ten year development plan of the transmission network until 2032.
- Study on electricity losses.

***Exact name:*** Reduction of losses in the electricity distribution power network

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:

The importance of loss analysis arises from the need to reduce losses both during the design phase and in the operation of power networks and systems (PES) and their components. High losses, particularly in electricity distribution (ED) networks, are a clear indicator of mismatched network development with the growing demands of consumers. The first step in the process of reducing losses in the ED network is to calculate losses based on available information about the network infrastructure, customers, and their consumption. Therefore, a study (Study of reduction of power and energy losses in electrical distribution networks of Montenegro) is prepared in order to enable identification of hot spots as well as measures to decrease electricity losses. In EU countries, there are significant differences in the average level of losses, ranging from 1% to 13.5%. The percentage of total (technical and commercial) losses in Montenegro's electricity distribution networks has consistently remained above 12% of the energy received at the distribution threshold over the past half-century. In 2005 and 2006, losses reached a very high level of 29%, but since 2006, they have been steadily decreasing, reaching 12.39% or 354.5 GWh in 2021. However, in certain electricity distribution regions, losses remain significantly above the average.
Article 116 (Point 5) of the Energy Law establishes the obligation of the Distribution System Operator (DSO) to develop a ten-year distribution system development plan, based on the condition and level of system utilization, which is updated every five years. In the document Rules for the Operation of the Electricity Distribution System, provides a detailed specification of the content, methodology, objectives, types, general conditions for designing the distribution system, operational safety, quality, reliability, data, documentation, and technical criteria required for planning during the preparation of the ten-year and three-year development plans. One of the goals of the plan that is directly affecting energy efficiency of the existing grid operation is to ensure the safe, efficient, and high-quality operation of the distribution system. Also, projects that target reconstruction of the existing elements (increased capacity) and construction of new grid elements (substations, lines) also positively affect the level of electricity losses.

**Description of the PaM**:
Controlling technical and commercial losses involves implementing measures to minimize energy losses in the electricity distribution system, ensuring efficiency, reliability, and financial sustainability. Key aspects include:

- Reduction of technical losses through network optimization, upgrading infrastructure, and improving system design.

- Mitigation of commercial losses by addressing unauthorized usage, improving metering accuracy, and enhancing billing systems.
- Integration of advanced technologies, such as smart meters and real-time monitoring systems, to identify and rectify inefficiencies.
- Regular system audits to identify loss hotspots and implement targeted interventions.
- Awareness campaigns and customer engagement to reduce non-technical losses and promote responsible energy consumption.

By focusing on these strategies, the distribution system operator can effectively reduce losses, improving overall system performance and profitability. Ten year development plan includes the following projects types in order to improve grid efficiency:

- Projects for the Construction, Reconstruction, and Revitalization of the Network (35 kV, 10 kV, and LV)
    - Construction of underground cables
    - Construction of overhead lines
    - Replacement of cable lines
- Projects for the Construction, Reconstruction, and Revitalization of Substations (TS 35/X kV, TS 10/0.4 kV, and TS 110/X kV)
    - Construction of substations (TS)
    - Complete reconstruction of substations
    - Replacement of transformers
    - Replacement of transformers and MV switchgear
    - Replacement of transformers and LV switchgear
- Other Projects Related to Enhancing the Operations of the DSO
    - Reconstruction of connections for the relocation of metering points
    - Installation of measurement equipment
    - Monitoring and management of the electricity distribution network.

Considering the current state of the metering system and the experience gained from its operation, as well as its positive impact on grid efficiency, further investment in the development and modernization of the metering system is planned. This includes the replacement of the remaining "traditional" meters with a new advanced metering system. The connection of new users will also be carried out within the existing advanced metering system. One of the key objectives of further development of the advanced metering system is to enable the collection of load profiles from all metering devices.

The primary goal of the plan for developing the advanced electricity metering system, as defined by the Energy Law (Article 247), is to fulfill the obligation of the Electricity Distribution System Operator to establish an advanced metering system (smart meters) by January 1, 2025, while conducting an economic assessment of all long-term costs and benefits for the market and consumers. It is planned that by the end of 2025, the advanced AMM metering system will be implemented at over 85% of all metering points. Based on the benefits of the advanced metering system already in use by CEDIS, further implementation will be carried out in the coming period, focusing on replacing the "traditional" metering system. This will aim to achieve a coverage level of 95% of all metering points. As one of the main results, it will be enabled better monitoring and allocation of technical and commercial losses which is the first step in their decrease.

**Legal, technical, financial, informational, regulatory policy or measure**: Technical and financial measure.

**Problem the policy or measure is addressing**: electricity supply quality, energy efficiency.

**Objective of the policy or measure**: Introduction of new technologies, energy management, energy efficiency, electricity supply security.

**Implementation process**:

- Development of necessary studies.
- Preparation of technical documentation.
- Preparations of grid connection studies (hosting capacity).
- Obtaining permits.
- Obtaining financing.
- Selection of equipment and construction works providers.
- Commissioning of new infrastructure.

**Implementation period**:

- Expected starting date: 2023
- Expected end date: 2032
- The measure will have long-term effects, affecting energy security, energy efficiency and GHG emissions.

**Status of implementation**:

- The project is ongoing.

**Responsible for implementation**:

- CEDIS (Montenegrin power distribution system operator).

**Actions taken**:

- Ten year development plan is adopted.
- Study of reduction of power and energy losses is prepared.
- Part of technical documentation is prepared.
- Public procurement procedure initiated for some of the selected projects.

**Impact**:

- Energy Union Dimension(s) affected: Energy efficiency.
- Sectors affected: Energy generation (IPCC sector: 1A Energy, subcategory: 1A1 Energy industries).
- GHG areas and greenhouse gases covered: The main target is energy efficiency improvement. Indirect effect is a decrease of GHG emissions. It is not estimated since it depends on the share of RES in the national electricity production mix.

**Costs**:

- Total budget for all the planning period is EUR 331 million. Investments in advanced metering systems alone are EUR 49.2 million. Other investments in new grid elements also impact electricity losses.

**Funding**:
- CEDIS, IFIs, private investors.

**Annual public budgetary impacts**:
- None.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- Ten year development plan of the power distribution network until 2032.
- Study of reduction of power and energy losses in electrical distribution networks of Montenegro.

### 3.2.8 Regional cooperation

### 3.2.9 Energy efficiency in transport

***Exact name:*** Ban on import of old vehicles (Euro 4 or lower standard)

**Considered in which scenario**: WAM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
Transport sector is the second most important source of GHG emissions with share of 23 % in the total GHG emissions. Although the main reason for this is the fuel mix used in the sector, an important reason is also average age of vehicles. Passenger transport is dominant with 96 % share and almost all corresponds to usage of passenger cars. Average age of vehicles is close to 18 years which significantly affects fuel economy of the total vehicle stock. Banning the import of vehicles older than 15 will improve fuel consumption in the sector. Younger vehicles are generally more efficient than those older than 15 years for several reasons:
- Fuel Consumption: Newer vehicles typically utilize advanced technologies that reduce fuel consumption. Furthermore, emission laws are continually becoming stricter, pushing manufacturers to produce more efficient vehicles.
- Emissions: Newer vehicles must meet stricter emission standards. As a result, cars younger than 10 years emit fewer harmful gases into the atmosphere compared to older models.
- Maintenance: Older vehicles often require more maintenance and repairs, which can further decrease their overall efficiency and increase costs.
- Engine Technology and Drive Systems: Modern engines are optimized for better performance with lower fuel consumption and are often equipped with systems like start-stop technology, which further reduces fuel usage in urban settings.

Overall, vehicles younger than 15 years are more efficient and economical to operate, and they are also more environmentally friendly.

**Description of the PaM**:
In Montenegro, a regulation banning the import of vehicles older than 15 years was introduced in late March 2024, as part of amendments to the Rulebook on Technical Requirements for Vehicles. This regulation came into effect on July 1, 2024. It set a minimum standard of "Euro 5" for imported vehicles, which includes vehicles manufactured between 2009 and 2013. Previously, Montenegro required new vehicles to meet the "Euro 6" standard, while used vehicles needed to comply with the "Euro 4" standard. The purpose of this regulation is to modernize the vehicle fleet and reduce the environmental and safety risks associated with older vehicles. It is important to note that this ban applies only to the import of vehicles. Older vehicles already on the roads in Montenegro can continue to operate as long as they pass the required registration inspections. It is expected that this PaM will enable about 10 % improvement of fuel economy of the total vehicle stock by 2030.

**Legal, technical, financial, informational, regulatory policy or measure**: Regulatory policy.

**Problem the policy or measure is addressing**: Energy efficiency of the vehicle stock, GHG emissions in transport sector.

**Objective of the policy or measure**: Decrease of GHG emissions.

**Implementation process**:
- Preparation of the first draft.
- Consultations with stakeholders.
- Finalization of the draft.
- Adoption procedure.

**Implementation period**:
- Expected starting date: 2024
- Expected end date: -
- The measures will have long-term effects, decrease of energy consumption as well as decrease of GHG emissions.

**Status of implementation**:
- Regulation came into effect on July 1, 2024.

**Responsible for implementation**:
- Ministry of transport.

**Actions taken**:
- Amending of the Rulebook on Technical Requirements for Vehicles.

**Impact**:
- Energy Union Dimension(s) affected: Decarbonisation, Energy efficiency.
- Sectors affected: Energy demand (IPCC sector: 1A Energy, subcategory: 1A3 Transport).
- GHG areas and greenhouse gases covered: This measure targets all GHG and it enables decrease of 30 Gg $CO_{2eq}$.

**Costs**:

- There is no cost estimation.

**Funding**:
- None.

**Annual public budgetary impacts**:
- None.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- None.

***Exact name:*** Passenger transport modal shift to public bus transport

**Considered in which scenario**: WAM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
Transport sector is the second most important source of GHG emissions. Passenger transport is dominant with 96 % share. Public transport has a negligible 1 % share in the total passenger transport. The main reason for that are old vehicles, availability of lines, timing. In order to increase the share of public transport in the total passenger transport it is necessary to target the mentioned challenges. Local municipalities are the main partner to the ministry.

**Description of the PaM**:
There is a need for financial subsidizes for bus fleet renewal, a study regarding optimization of city lines and accompanying IT solutions for tracking of buses, ticket management. The goal is to increase share of bus public transport in the total passenger transport up to EU average 7 % by 2030. Increasing the share of public bus transport in total passenger kilometers involves implementing strategies that enhance accessibility, reliability, affordability, and appeal to a broader segment of the population. Below are some key approaches:

- Improve service quality and coverage
- Invest in modern, comfortable fleet
- Implement Incentives for public transport use (introduce competitive pricing strategies like flat-rate monthly passes or discounts for regular users)
- Public awareness campaigns
- Enable passengers to buy and validate tickets via apps
- Simplify payment across multiple transport modes.

There is a good example implemented in Podgorica where 45 new buses completely renewed bus fleet used for local public transport. Therefore, PaM targets to create a financial basis for purchase of 100 new buses for public transport in other municipalities. A study should be prepared in order to address mentioned approaches for improvement of public bus transport.

**Legal, technical, financial, informational, regulatory policy or measure**: Financial measure.

**Problem the policy or measure is addressing**: Low usage of public transport, GHG emissions.

**Objective of the policy or measure**: New technologies, financial incentives for cleaner traffic and the use of alternative fuels in traffic, decrease of GHG emissions.

**Implementation process**:
- Preparation of studies targeting local public transport optimization.
- Obtaining funding.
- Preparation of the calls.
- Monitoring and reporting on implementation.

**Implementation period**:
- Expected starting date: 2026
- Expected end date: 2030
- The measure will have long-term effects, affecting decrease in the energy consumption as well as decrease of GHG emissions.

**Status of implementation**:
- Preparatory phase.

**Responsible for implementation**:
- Local municipalities, Ministry of transport, Eco Fund.

**Actions taken**:
- Renewed bus fleet in Podgorica (2 phases, 16+29 of new buses).

**Impact**:
- Energy Union Dimension(s) affected: Decarbonisation, Energy efficiency.
- Sectors affected: Energy demand (IPCC sector: 1A Energy, subcategory: 1A3 Transport).
- GHG areas and greenhouse gases covered: This measure targets all GHG and it enables decrease of 25 Gg $CO_{2eq}$.

**Costs**:
- The total budget for the project is EUR 10 million.

**Funding**:
- Grants or loans focused on sustainable urban mobility from IFIs.

**Annual public budgetary impacts**:
- None.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- Good practice of Podgorica where 45 new buses completely renewed bus fleet used for local public transport. In the same time, city lines are optimized in order to correspond to the detected needs of citizens. There are new lines, the lines with more coverage, marking of designated lanes for local buses.

***Exact name:*** Passenger and freight transport modal shift to rail

**Considered in which scenario**: WAM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
Since there is only a negligible number of electric vehicles in the total vehicle stock, railway is the main reason electricity is a part of energy demand of the sector. Electricity usage is becoming more and more clean because of increasing RES share in electricity production, therefore, obtaining greater usage of electricity in the transport sector will help reaching of the all national goals (GHG emissions, RES share and energy usage). Usage of railway decreased significantly in the last 15 years. The main reasons are reliability of vehicles, infrastructure, low connectivity with neighboring countries, control systems. Current shares of railway in the transport of passengers and freight are below 1 % and 60 %, respectively.

**Description of the PaM**:
There is a significant grant (112 million EUR) which will be used for solving of the issues with infrastructure and vehicles. This will lead to increased reliability and increasing of the share of railway in the passenger and freight transport. The goal is to reach the share which was the case before untill 2030 and further increase it after:

- 5 % share in the total passenger transport in 2030
- 70 % share in the total freight transport in 2030.

These shares were the case when the vehicles and infrastructure were in much better state (before 2010). These share should improve after 2030.

**Legal, technical, financial, informational, regulatory policy or measure**: Financial and technical measure.

**Problem the policy or measure is addressing**: Diesel fuel substitution, low RES share in transport sector.

**Objective of the policy or measure**: Decrease of GHG emissions, diversification of energy mix.

**Implementation process**:

- Preparation of the technical documentation for infrastructure and vehicle stock improvement.
- Preparation of the calls.
- Monitoring and reporting on implementation.

**Implementation period**:

- Expected starting date: 2025
- Expected end date: 2030
- The measure will have long-term effects, significantly affecting RES share in the energy consumption as well as decrease of GHG emissions.

**Status of implementation**:

- Preparatory phase.

**Responsible for implementation**:
- Ministry of transport.

**Actions taken**:
- Documentation needed for application for grant is prepared.
- Grant obtained.

**Impact**:
- Energy Union Dimension(s) affected: Decarbonisation, Energy efficiency.
- Sectors affected: Energy demand (IPCC sector: 1A Energy, subcategory: 1A3 Transport).
- GHG areas and greenhouse gases covered: This measure targets all GHG and it enables decrease of 25 Gg $CO_{2eq}$.

**Costs**:
- The total budget for the project is EUR 112 million.

**Funding**:
- EU grant.

**Annual public budgetary impacts**:
- None.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- The PaM is developed as an additional measure in order to reach national GHG target. All analyses are prepared basing on historical data and typical technology characteristics during modelling of the PaM as a part of WAM scenario.

### 3.2.10 Financing measures

***Exact name:*** *Financial incentives for citizens/private households (for energy efficiency investments)*

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
Residential sector is responsible for over 36 % share in the total energy demand and it is the most energy intensive sector with the transport sector in the country. The average energy intensity of residential sector is 169 kWh/$m^2$ per year. There are 3 climate zones and the energy intensity varies across them. In order to reach energy efficiency goals, it is important to target the most energy intensive sectors with measures. Space heating is represented by the most dominant share of energy consumed in the residential sector (60 %). Electricity and wood are almost the only fuels used in the sector (99 % share). Although the share of wood consumption

is greater (55 %) it is gradually decreasing in the last years. Wood is dominantly used for space heating (77 %) and the rest is used for cooking needs. Energy efficiency of these technologies is very low. Also, almost 70 % of residential buildings is built before 2000, i.e. prior to establishing of any of the modern standards targeting energy efficiency.
There are some significant challenges for implementing energy efficiency measures in residential sector:

- Energy-efficient technologies, such as high-performance insulation, energy-efficient appliances, or renewable energy systems, often have higher upfront costs compared to standard options. They offer long-term savings on energy bills, but the initial investment can deter homeowners;
- Low-income families may lack the resources to invest in energy-efficient upgrades, even if they result in long-term savings;
- Low awareness of the benefits that can be achieved after implementation of energy efficiency measures;
- Market penetration of energy-efficient products.

By addressing financial and behavioral barriers, financial incentives play a critical role in transforming the residential sector into a more energy-efficient and sustainable contributor to energy systems and environmental goals.

**Description of the PaM**:
The aim of this measure is to provide financial support mechanisms available to individuals for investing in energy efficiency and RES. It includes an introduction of dedicated state and local government subsidizing programmes for energy savings in private households and RES use. Measures that contribute to reducing energy needs, as well as use of solar energy and modern forms of biomass (pellets, briquettes, wood chips) should be primarily encouraged. Some of the programmes include:

- Interest free loans:
    - interest free loans for the installation of modern biomass heating systems
    - interest-free loans for improving the energy performance of the building envelope
- Subsidy programme for the installation of solar systems in new buildings, through the reduction of local communal taxes
- Direct financial support for energy energy efficiency measures up to 60 % (depending on the development level of region):
    - Installation of thermal insulation on facades
    - Replacement of facade windows and doors
    - Installation of heating systems using modern biomass forms
    - Installation of split and multi-split systems for heating and cooling
    - Installation of high-efficiency heat pumps
    - Installation of solar systems for domestic hot water preparation
    - Installation of photovoltaic systems for electricity production for self-consumption.

Which of the mentioned financial mechanism is applied depends on the available funds. Lower funds often leed to mechanisms like interest free loans, and in the case of greater funds availability direct financial support (grants) is the main financial mechanism.

Ministry of Energy has recently launched the Energy Efficient Home programme, which aims to reduce heating costs and increase comfort in households, achieve a significant reduction in $CO_2$ emissions in the household sector and develop the market for biomass heating systems in Montenegro.
The programme implies an attractive and sustainable financial mechanism in order to implement energy efficiency measures in households. For the purposes of this Programme, Ministry of Energy has provided EUR 100,000 to subsidise interest and loan processing fees for: purchase and installation of heating systems on modern forms of biomass (pellets, briquettes), which include boilers / furnaces, piping and / or radiators; installation of thermal insulation on the façade of a residential building and installation of energy efficient façade joinery.
Citizens have the opportunity to apply for interest-free loans up to a maximum of EUR 10,000, with a repayment period of up to six (6) years, to implement the aforementioned energy efficiency measures in their households, while Ministry of Energy will subsidize loan processing and interest for the entire loan repayment period.
As part of EU support, certain funds have been allocated to the Western Balkans countries to support the household sector in energy efficiency measures implementation through the EBRD Western Balkans Residential Green Economy Financing Facility (GEFF-Residential) project. In order to implement the project, EBRD in cooperation with commercial banks in Montenegro has established dedicated loan lines for energy efficiency. Using these credit lines funds for energy efficiency improvement in households, 15-30% of the investment costs are subsidies from EU funds.
Additionally, Montenegro has launched a comprehensive subsidy program for households aimed at improving energy efficiency. The total budget for the program is €8.8 million, with €2.8 million allocated to the municipality of Pljevlja and the remaining €6 million for other municipalities across the country. The maximum amount of non-refundable funds per beneficiary is €10,000, with amounts for individual measures ranging from €2,000 to €6,000. The program is implemented in collaboration with the Eco Fund, which acts as the implementing body, with technical support from the United Nations Development Program (UNDP).

**Legal, technical, financial, informational, regulatory policy or measure**: Financial measure.

**Problem the policy or measure is addressing**: Energy efficiency in building sector.

**Objective of the policy or measure**: PaM will contribute to EPBD implementation.

**Implementation process**:
- Preparation of public call for equipment and construction work providers.
- Preparation of public call for financial service providers (banks).
- Organizing calls.
- Creation of the list of providers of all services (technical and financial).

**Implementation period**:
- Expected starting date: 2022
- Expected end date: 2025

- The measures will have long-term effects, significantly improving energy efficiency.

**Status of implementation**:
- The project is ongoing.

**Responsible for implementation**:
- Ministry of Energy, Eco Fund, local qualified EE equipment distributors and installers as well as local commercial banks.

**Actions taken**:
- Programmes implemented: MONTESOL, Energy Wood I, II and III.
- Programme Energy Efficient Home is ongoing.

**Impact**:
- Energy Union Dimension(s) affected: Energy efficiency, Decarbonisation.
- Sectors affected: Residential sector, Service sector (IPCC sector: 1A Energy, subcategory: 1A4 Other sectors).
- GHG areas and greenhouse gases covered: Carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) emissions are all produced during combustion of oil derivatives, coal and wood which are the main sources of GHG emissions in service and residential sectors. The effects of the PaM on GHG emissions are directly influenced by the number of residential units that have applied for this mechanism. Currently this is a small part of consumption of the whole sector and therefore the impact on GHG emissions decrease is below 1 Gg $CO_{2eq}$.

**Costs**:
- Total budget for bylaws amendments negligible (EUR 10k) and EUR 0.55 mil. for development of software for energy certification of buildings and buildings inventory in order to provide conditions for determining energy classes.

**Funding**:
- Govt. of Montenegro and international donors.

**Annual public budgetary impacts**:
- EUR 1.3 million and additional EUR 8.8 million.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- There is no specific Montenegrin study that is the base for this PaM. However, there are numerous energy audits, and programmes previously organised that confirmed the effectiveness of this PaM.

## 3.3 Dimension Energy Security

### 3.3.1 Power sector

***Exact name:*** Development of electricity transmission power network

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
According to the Energy Law of Montenegro, the electricity transmission system operator is obligated to perform the transmission of electricity under the conditions specified by the license, adhering to the principles of objectivity, transparency, and non-discrimination. To fulfill this key role and meet the operational requirements placed upon it, the electricity transmission system operator is required, under Article 112 of the Energy Law of Montenegro, to prepare a ten-year transmission system development plan. This plan must align as much as possible with Montenegro's planning documents and with the development plans of neighboring transmission systems. In line with this, the transmission system operator also submits annual investment plans tailored to the needs of system users. These plans are consistent with the ten-year transmission system development plan and spatial planning documents.
The development plans for the transmission system must be robust and adequate enough to accommodate a wide range of potential future system states. For this reason, it is no longer merely desirable but essential to conduct market analyses prior to network analyses. These market analyses optimize the operation of the generation portfolio, generate plans for the dispatch of generation units, and identify specific (non-standard) hours that require a detailed system state analysis. This practice of combining market and network analyses in the preparation of development plans is also applied in the pan-European transmission system development planning process by the ENTSO-E association.

**Description of the PaM**:
The main goal of the measure is increase of power system security, connecting new consumption areas and enabling integration of RES. All projects can be divided in two groups:

- Projects that already started and will be finished until 2027:
    - Reconstruction of 110kV Line Lastva - Budva: 2013–2024
    - Reconstruction of 110kV Line Lastva - Tivat: 2013–2022
    - Reconstruction of 110kV Line Podgorica - Danilovgrad - Perućica: 2020–2023
    - Reconstruction and Expansion of Substation 110/35kV Pljevlja 1: 2019–2023
    - Reconstruction of a Section of 110kV Line Nikšić - Bileća (Vilusi): 2020–2022
    - Replacement of High-Voltage Equipment in Substations: 2016–2023
    - Reconstruction of Protection Systems: 2016–2023
    - New reconstruction of 110kV Line Bar - Budva: 2017–2022
    - Revitalization of 110kV Line Herceg Novi - Tivat: 2021–2022
    - Revitalization of 110kV Line Bar - Možura - Ulcinj: 2023–2024
    - Construction of 400kV Line Čevo - Pljevlja: 2013–2023
    - Substation 400/110/35 kV Brezna: 2016–2026
    - Construction of 400kV Line Pljevlja2 - Bajina Bašta - Višegrad: 2012–2026

- Construction of 110kV Line Virpazar - Briska Gora - Ulcinj: 2018–Post-2026
- Installation of 250MVAr Variable Shunt Reactor in Substation Lastva: 2020–2023
- Construction of Substation 110/35kV Luštica with Connection to the 110kV Network: 2015–2024
- Construction of Substation 110/35kV Žabljak: 2012–2024
- Construction of Substation 110/10kV Podgorica 7 with Connection to the 110kV Network: 2021–2026
- Construction of Substation 110/35kV Buljarica with Connection to the 110kV Network: 2021–2026
- Construction of 110kV Line Lastva - Kotor: 2013–2024
- Construction of 110kV Line Vilusi - Herceg Novi: 2013–Post-2026
- Construction of Substation 110/10kV Bečići: 2023–2027

- Project that will start after 2025:
  - Construction of 400kV Line Brezna - Sarajevo
  - Construction of 110kV Line Ulcinj - Briska Gora - Kosmač
  - Construction of Substation 110/35kV Kolašin
  - Construction of Substation 110/35kV Velika Plaža with Connection to the Transmission Network
  - Construction of Substation 110/10kV Igalo
  - Construction of Substation 110/10kV Podgorica 6
  - Construction of Substation 110/10kV Podgorica 8
  - Construction of Substation 110/35kV Bijela
  - Reconstruction of the 110kV Line Podgorica 1 - EVP Trebješica - Andrijevica
  - Reconstruction of the 110kV Line Bar - Možura - Ulcinj to Increase Capacity
  - Reconstruction of the 110kV Line Bar - Budva to Increase Capacity
  - Reconstruction of the 110kV Line Podgorica 2 - Virpazar to Increase Capacity
  - Installation of a Synchronous Compensator.

The transition to new technologies is of great importance for CGES, considering that the following projects are either planned or already being implemented:

- Transition to a new SCADA system and remote management of the power system
- Video surveillance of substations and protection of CGES facilities
- Disaster Recovery Data Center
- Remote access to process networks and integration of new facilities into the SCADA system
- Expansion and improvement of the Automated Meter Reading (AMR) system
- Implementation of the pan-European PCN ENTSO-E IP/MPLS network
- Regional connection of TSO operators through the implementation of the Balkans Digital Highway project.

The main features of this system include a modern IT infrastructure with a high level of reliability and cybersecurity, complete observability of the high-voltage power system, and the integration of advanced functions such as:

- Wide Area Monitoring System (WAMS),
- Forecasting of renewable energy production,
- Dispatch log,

- Imbalance Netting mechanism, and more, into the SCADA system.

Additionally, the establishment of a backup dispatch center (RDC) has fulfilled one of the most important tasks of the new SCADA system, providing a fully redundant system configuration at an alternative location.

**Legal, technical, financial, informational, regulatory policy or measure**: Technical and financial measure.

**Problem the policy or measure is addressing**: power system security, RES integration.

**Objective of the policy or measure**: energy security, internal energy market and GHG emissions.

**Implementation process**:

- Development of necessary studies.
- Preparation of technical documentation.
- Preparations of grid connection studies.
- Obtaining permits.
- Obtaining financing.
- Selection of equipment and construction works providers.
- Commissioning of new infrastructure.

**Implementation period**:

- Expected starting date: 2023 (some of the projects started earlier)
- Expected end date: 2032
- The measures will have long-term effects, affecting energy security, internal energy market and GHG emissions.

**Status of implementation**:

- The project is ongoing.

**Responsible for implementation**:

- CGES (Montenegrin transmission system operator).

**Actions taken**:

- Ten year development plan is adopted.
- Part of technical documentation is prepared.
- Public procurement procedure initiated for some of the selected projects.

**Impact**:

- Energy Union Dimension(s) affected: Energy security.
- Sectors affected: Energy generation (IPCC sector: 1A Energy, subcategory: 1A1 Energy industries).
- GHG areas and greenhouse gases covered: The main targets are energy security and higher integration of RES. Indirect effect is a significant decrease of GHG emissions. It is not estimated since it depends on the share of RES in the national electricity production mix.

**Costs**:

- CGES has adopted the Investment Plan for the period 2024–2028, which envisions an investment of 198 million euros in the development and modernization of the transmission network. However, the cost for projects that will be implemented after 2025 was not defined since studies and inception designs are under preparation.

**Funding**:

- CGES, IFIs, private investors.

**Annual public budgetary impacts**:

- None.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:

- Ten year development plan of the transmission network until 2032.

***Exact name:*** Development of electricity distribution power network

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:

Article 116 (Point 5) of the Energy Law establishes the obligation of the Distribution System Operator (DSO) to develop a ten-year distribution system development plan, based on the condition and level of system utilization, which is updated every five years. In the document Rules for the Operation of the Electricity Distribution System, provides a detailed specification of the content, methodology, objectives, types, general conditions for designing the distribution system, operational safety, quality, reliability, data, documentation, and technical criteria required for planning during the preparation of the ten-year and three-year development plans. Main goals of the plan are:

- Ensure the safe, efficient, and high-quality operation of the distribution system;
- Timely provide sufficient network capacity to meet the realistic needs of existing distribution system users for increased power and electricity consumption;
- Ensure sufficient capacity of the distribution system to meet the realistic needs for connecting new users to the distribution system;
- Ensure the dynamic construction and reconstruction of the distribution system in a way that satisfies users' electricity needs, align the development of the distribution system with urban planning, and ensure the normal operation of the distribution system.

In general, main focus of the plan is on the reliable operation of the distribution grid and to enable secure supply of the existing and new consumers as well as to enable high integration of distributed RES and prosumers.

**Description of the PaM**:

Power distribution grid includes numerous grid elements and therefore, in order to monitor implementation of all projects, they have to be grouped in following manner:

- Projects for the Construction, Reconstruction, and Revitalization of the Network (35 kV, 10 kV, and LV)
    - Construction of underground cables
    - Construction of overhead lines
    - Relocation of the network
    - Replacement of cable lines
    - Replacement of poles, suspension equipment, and conductors
    - Installation of reclosers
    - Installation of line disconnectors
- Projects for the Construction, Reconstruction, and Revitalization of Substations (TS 35/X kV, TS 10/0.4 kV, and TS 110/X kV)
    - Construction of substations (TS)
    - Complete reconstruction of substations
    - Installation of grounding resistors for the neutral point
    - Replacement of MV switchgear
    - Replacement of LV switchgear
    - Replacement of MV and LV switchgear
    - Replacement of transformers
    - Replacement of transformers and MV switchgear
    - Replacement of transformers and LV switchgear
    - Reconstruction of relay protection and control systems in substations
    - Procurement of industrial computers with software
    - Replacement of circuit breakers and reconstruction of relay protection and control systems
    - Equipping MV cells
    - Installation of circuit breakers
    - Repair/reconstruction of the civil works in substations
- Other Projects Related to Enhancing the Operations of the DSO
    - Reconstruction of connections for the relocation of metering points
    - Installation of measurement equipment
    - Procurement of personal computers
    - Procurement and installation of server computing and communication equipment
    - Procurement of instruments, auxiliary tools, equipment, and software
    - Procurement of vehicles
    - Repair/reconstruction of the structural parts of workspaces
    - Equipping workspaces
    - Work safety and environmental protection
    - Monitoring and management of the electricity distribution network
    - Improvement of business processes.

An overview of number and structure of the planned projects is given in the table.

| Type of grid element | 2023 | 2024 | 2025 | After 2025 | Total |
|---|---|---|---|---|---|
| Substation 110/X kV | | 1 | 3 | 13 | 17 |

| | | | | | |
|---|---|---|---|---|---|
| 35 kV grid | 10 | 4 | | 43 | 57 |
| Substation 35/X kV | 8 | 14 | 11 | 72 | 105 |
| 10 kV grid | 37 | 35 | 19 | 142 | 233 |
| Substation 10/0.4 kV | 104 | 118 | 64 | 211 | 497 |
| LV grid | 4 | 3 | 1 | 33 | 41 |
| Other | 31 | 30 | 27 | 24 | 112 |
| Total | 194 | 205 | 125 | 538 | 1062 |

It is evident that the largest number of projects per year is related to the 10 kV network and 10/0.4 kV transformation, particularly during the first three years of the planning period. In the second half of the plan, the focus shifts more toward the 35 kV network. Regarding financial investments in projects, the most significant investments are allocated to the revitalization of the 10 kV and low-voltage (LV) network, including the secondary network (10 kV lines, 10/0.4 kV substations, and the low-voltage network), as well as AMR systems and metering points. Investments in these projects, combined with investments in the primary network (35 kV lines, 110/x kV substations, and 35/x kV substations), account for approximately 87% of all investments in the ten-year development plan.

**Legal, technical, financial, informational, regulatory policy or measure**: Technical and financial measure.

**Problem the policy or measure is addressing**: electricity supply quality, RES integration.

**Objective of the policy or measure**: energy security, distributed RES integration, prosumers expansion, GHG emissions.

**Implementation process**:

- Development of necessary studies.
- Preparation of technical documentation.
- Preparations of grid connection studies (hosting capacity).
- Obtaining permits.
- Obtaining financing.
- Selection of equipment and construction works providers.
- Commissioning of new infrastructure.

**Implementation period**:

- Expected starting date: 2023
- Expected end date: 2032
- The measures will have long-term effects, affecting energy security, internal energy market and GHG emissions.

**Status of implementation**:

- The project is ongoing.

**Responsible for implementation**:

- CEDIS (Montenegrin power distribution system operator).

**Actions taken**:

- Ten year development plan is adopted.
- Part of technical documentation is prepared.
- Public procurement procedure initiated for some of the selected projects.

**Impact**:
- Energy Union Dimension(s) affected: Energy security.
- Sectors affected: Energy generation (IPCC sector: 1A Energy, subcategory: 1A1 Energy industries).
- GHG areas and greenhouse gases covered: The main targets are energy security and higher integration of RES. Indirect effect is a significant decrease of GHG emissions. It is not estimated since it depends on the share of RES in the national electricity production mix.

**Costs**:
- Total budget for all the planning period is EUR 331 million.

**Funding**:
- CEDIS, IFIs, private investors.

**Annual public budgetary impacts**:
- None.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- Ten year development plan of the power distribution network until 2032.

***Exact name:*** Developing battery electric storage systems (BESS)

**Considered in which scenario**: WAM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
Increasing the share of renewable energy sources in total final energy consumption has been a strategic commitment of the state for many years, with EPCG (Montenegrin power company) as the most dominant domestic supplier of renewable energy. Achieving high integration of renewable energy sources is a highly challenging task, as new sources, such as those based on solar or wind energy, significantly complicate (and increase the cost of) managing the power system. The solution lies in enhancing the flexibility of the power system, and Battery Energy Storage Systems (BESS) are one of the ways to achieve this. EPCG has been providing balancing services for Montenegro's power system for many years, and with the construction of BESS, it will further strengthen its balancing capacities. Additionally, it will create opportunities for better utilization of its own electricity production and secure a stronger position in the market. The fundamental characteristic of electricity is that it must be produced precisely when there is a demand for it and in exactly the required amount (production and consumption must always be balanced). Therefore, it cannot be easily stored. Energy storage systems aim to

overcome this significant limitation. Battery systems perform electrochemical energy conversion. This feature is utilized both for storing and generating electricity.

**Description of the PaM**:
BESS (Battery Energy Storage Systems) have been considered a solution for the high integration of renewable energy sources (RES) for the past decade. However, large-scale implementation has been slow due to high investment costs. In recent years, this situation has been changing as competition among manufacturers has grown, making BESS more affordable. The benefits of BESS primarily stem from their high controllability (charging/discharging), which allows them to provide system balancing services with the same quality as the hydropower plants managed by EPCG. On the other hand, considering significant fluctuations in electricity prices (with multiple differences in hourly prices) throughout the day—particularly during the summer months due to the variability in electricity availability and demand—BESS can be used to transfer electricity from hours with low prices to those with high prices. BESS also has applications in:

- Households (energy consumption optimization, integration with photovoltaic systems, electric vehicle charging);
- Service sectors;
- Industry (peak demand optimization, improving supply security, electric vehicle charging).

This PaM primarily includes development of large-scale BESS on selected locations where there is an existing grid infrastructure for connection (owned by EPCG). Several locations are recognized by the availability of transformers connected to the transmission grid (voltage level 110 kV and 220 kV):

- HPP Perucica – available transformer with 63 MVA of installed power (3 winding transformer)
- Steel factory Niksic – 2 available transformers with installed power 63 MVA each.
- Future location of WPP Gvozd.
- Other locations are still under analysis.

Therefore, it is planned to install BESS at these locations with the following characteristics: 60 MW/60 MWh. In total, there will be 240 MW/240 MWh of BESS connected to transmission power grid.
Also, there is a plan of developing medium sized BESS which would be distributed by substations 10/0.4 kV in order to enable more efficient integration of prosumers. Their installed power per location would be in range 0.2 MW – 1 MW, but this is still under analysis and there are no selected locations for installation.

**Legal, technical, financial, informational, regulatory policy or measure**: Technical measure.

**Problem the policy or measure is addressing**: Power system flexibility.

**Objective of the policy or measure**: New technologies, increasing energy security, improvement of position in electricity markets, higher integration of RES in power system.

**Implementation process**:

- Development of feasibility study.

- Preparation of technical documentation.
- Preparations of grid connection studies.
- Obtaining permits.
- Obtaining financing.
- Selection of equipment and construction works providers.
- Commissioning of BESS.

**Implementation period**:
- Expected starting date: 2025
- Expected end date: 2027
- The measures will have long-term effects, enabling large scale RES integration.

**Status of implementation**:
- The project is ongoing.

**Responsible for implementation**:
- EPCG (Electricity Power Utility of Montenegro).

**Actions taken**:
- Montenegrin power company (EPCG) collected the information necessary for feasibility study and inception technical design preparation.

**Impact**:
- Energy Union Dimension(s) affected: Energy security.
- Sectors affected: Energy generation (IPCC sector: 1A Energy, subcategory: 1A1 Energy industries).
- GHG areas and greenhouse gases covered: There are no direct impacts on GHG emission.

**Costs**:
- The total budget for the project is EUR 100 million, spread over 5 years (2025-2029).

**Funding**:
- EPCG, IFIs, private investors.

**Annual public budgetary impacts**:
- None.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- Preliminary analysis is done. Feasibility study and inception technical design are under preparation.

### 3.3.2 Oil & Gas sector

Not applicable

### 3.3.3 Waste sector (Waste to Energy)

Not applicable

### 3.3.4 Regional cooperation

Regional security coordination between Montenegrin TSO and its neighbours in accordance with the EU regulations started back in 2015. when regional security coordination initiative was formalised by 3-TSOs through the joint venture SCC. Today this initiative is a platform for cooperation between 7 regional TSOs that provides coordinated validation and merging of Individual Grid Models, Common Grid Model (CGM) creation, Coordinated Security Analysis (CSA), Outage Planning Coordination (OPC) and Short-Term Adequacy (STA) forecast. At the moment, participating TSOs are jointly developing Regional Operational Security Coordination Methodology

Coordinated capacity calculation process will be initiated once proper the EU regulations are transposed in the WB6 region, having in mind complexity of Capacity Calculation Region definition in mixed regulatory environment. From technical perspective no open issues are left open.

Cross-border capacity allocation procedure is performed on each ME border where Montenegrin TSO- CGES and Serbian TSO - EMS are responsible for the capacity allocation on ME-RS border, while the renting of the capacity on other borders (XK, IT, AL, BA) falls under the jurisdiction of regional allocation office SEE CAO. Cross-border capacity is auctioned through short term and long term allocation procedures, where operators are remunerated only when congestion occurs. Daily, monthly and yearly allocation procedures are conducted applying the pricing method where congestion price is a marginal price, but on the other hand, the capacity reservation during the intraday is based on the "First come first served" principle and it is free of charge.

The following associations, committees, groups and subgroups, which CGES representatives participate in, are dealing with the aforesaid matters:

1. European association for the cooperation of transmission system operators (TSOs) for electricity (ENTSO-E);

1.1 Assembly of ENTSO-E

1.2 System Development Committee

1.2.1 Asset Implementation Management within System development Committee

1.2.2 Subgroup Data and Models

1.2.3 Southeast Europe Cooperation Initiative Transmission System Planning Project

1.3 Research, Development and Innovation Committee

1.4 System Operation Committee - SOC) and Regional Group of the Continental Europe (RG CE)

1.4.1 Network Models and Forecast Tools -NMFT

1.4.2 FSkar implementation

1.4.3 Sub Group Coordinated System Operation –SG CSO

1.4.4 Technical user group „ Electronic Highway"

1.4.5 International Grid Control Cooperation Expert Group -IGCC

1.5 Market Committee

1.5.1 Congestion Management and Market Integration-CMMI
1.6 Legal and Regulatory Group-LRG
1.7 Resource Planning Project
2. Association of the Mediterranean Transmission System Operators for electricity (MedTSO)
2.1 Assembly Med-TSO
2.2 Technical committee „Regulations and Institutions“
2.3 Technical committee „Planning“
2.4 Technical committee „Operation“
2.5 Working group „Economic Studies and Scenarios“
2.6 Technical committee „Knowledge sharing“
3. Energy Community
3.1 Security of Supply Coordination Group - Subgroup for electricity
3.1.1 Working group for cybersecurity
3.2 Central and South-Eastern European Gas Connectivity – CESEC
3.3 PECI/PMI Electricity Working Group
3.4 DSO2TSO Working Group for Smart Grid Concept
4. Other activities
4.1 Electricity Market Initiative-EMI
4.2 Know-how Exchange Programme-KEP
4.3 Working group AIMS – coupling of markets (Albania, Italy, Montenegro and Serbia)
4.5 Working group for SMM
4.6 Utility Cyber Security Initiative (UCSI) for Balkan and United States Energy Association - USEA
4.7 Horizon Projekat Trinity (increasing regional border capacity of transmission system by means of intelligent market technology)
4.8 Projekat Balkans Digital Highway
4.9 Horizon Projekat CROSSBOW – CROSS Border management of variable renewable energies and storage units enabling a transnational Wholesale market

## 3.4 Dimension Internal Energy Market

### 3.4.1 Electricity infrastructure

No PaMs

### 3.4.2 Energy transmission infrastructure

HVDC cable MONITA (the first phase – 600 MW capacity) is in commercial operation since January 2020 and it proved itself as an important energy corridor with regional impact. It enabled better distribution of renewable energy surplus i.e. better utilization of renewable power plants located in Balkans region as well as in Italy. The next phase (full capacity) will be finished in the following years when the necessary prerequisites are met.

Even better utilization of HVDC cable MONITA will be possible if the capacity of Montenegrin interconnections with Bosnia and Herzegovina and Serbia would increase. This would help better usage of the existing and future renewable power plants. Therefore, 400 kV OHL Bajina Basta – Pljevlja – Visegrad project is expected to remove present congestions and enable reliable electricity transit between Balkans and Italy. This project will support electricity transits through Montenegrin transmission grid and enable secure operation of the power system nevertheless the load, i.e. the amount of transits.

In order to support the realization of the mentioned projects, several regulation and strategic documents are prepared:

- Law on confirmation of agreement between Montenegro and Italy regarding construction of submarine power interconnection between Montenegrin and Italian transmission grid with realization of strategic partnership of TSOs ("National Gazette – International contracts", No 8/10)
- Energy – WB5-REG-ENE-02 Feasibility Study: 400kV Interconnection Serbia – Montenegro – BiH, February 2015
- Detailed spatial plan for 400 kV OHL Bajina Basta – Pljevlja – Visegrad – in procedure, to be adopted by Parliament
- WB13-REG-ENE-01, 400 kV OHL Bajina Basta-Pljevlja-Visegrad, Technical documentation preparation and TSO support, Financial and Economic Assessment Report, September 2020
- Inception design of 400 kV OHL Bajina Basta – Pljevlja – Visegrad, under revision.

All mentioned projects are of great interest for Montenegro, Italy, Serbia, and Bosnia and Herzegovina as direct participants, but both projects will generate multiplicative positive effect on energy security of the region and enable more efficient integration of renewable energy as one of the main means to achieve decarbonization goals. Currently, all the studies related to the projects implementation are prepared with direct participation of Montenegro, Italy, Serbia and Bosnia and Herzegovina and with the assistance of the European Union.

Montenegro and CGES (national transmission company) received a grant for project implementation (400 kV OHL Bajina Basta – Pljevlja – Visegrad) financing by WBIF, which envisages implementation according to requirements of the Special Contract, signed by KfW bank and CGES. The technical documentation that is prepared in order to develop the best approach to realize the project is financed by European Investment Bank.

### 3.4.3 Market integration

***Exact name:*** Market coupling

**Considered in which scenario**: WAM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
After the adoption of the Electricity Market Integration Package by the Ministerial Council of the Energy Community (December 2022), a legal framework was established for integrating the electricity markets of the contracting parties of the Energy Community into the single

European market. One of the key steps to initiate activities for integration was defining the "direction" of integration.
At its session held on March 7, 2024, the Government of Montenegro adopted conclusions based on the information provided by the Ministry of Energy and Mining, approving that the integration of Montenegro's day-ahead electricity market with the single European market proceeds in the direction of Montenegro–Italy.
Market coupling contributes to jointly overcoming challenges regarding energy supply security, increasing market competition, expanding the use of renewable energy, and thereby improving the environmental situation. Through the integration of electricity markets:

- A larger and more liquid market is created, where prices are formed based on the supply and demand of all connected markets;
- Competition is encouraged;
- Cross-border electricity trading is enabled in accordance with harmonized regulations;
- The efficient use of production resources across Europe is facilitated.
- Ensures more efficient use of cross-border transmission capacities through the application of implicit auctions, which enable maximum utilization of available capacities.
- Facilitates electricity trading and reduces risks for market participants, as separate trading of transmission capacities is not performed. Instead, implicit auctions combine electricity trading and cross-border transmission capacity trading in a single step.
- Increases energy security and reduces dependence on dominant market participants, as connected markets can rely on each other during shortages or unexpected supply disruptions.
- Facilitates the integration of renewable energy sources by balancing intermittent electricity production from renewables with supply and demand across a larger market, reducing the need for backup generation through pooling production resources and increasing cross-border trade.

**Description of the PaM**:
The single day-ahead and intraday market coupling (SDAC and SIDC) is based on intensive cooperation and activities carried out by nominated electricity market operators (NEMO) and transmission system operators (TSO) through three distinct dimensions:

- Pan-European dimension: (pan-European rules and methodologies (TCM), Market Coupling Steering Committee, All NEMO Committee, ENTSO-E, agreements on mutual cooperation and procedures, etc.);
- Regional dimension: (capacity calculation regions and local implementation projects, regional TCMs, agreements, and procedures);
- National dimension: (local agreements and procedures implemented by NEMOs and TSOs, national TCMs).

Regulatory authorities play a significant role in this process through:

- Approving regional and national TCMs,
- Supervising the fulfillment of obligations by NEMOs and TSOs, etc.

Montenegrin Electric Transmission System AD Podgorica (CGES) and Electricity Exchange LLC Podgorica (BELEN) have already obtained observer status in the Market Coupling Steering Committee (MCSC), whose main role is to ensure continuous cooperation between NEMOs and TSOs in the implementation of SDAC and SIDC. The observer status will allow BELEN and CGES to familiarize themselves with the functioning of the MCSC, which is crucial for preparing and

implementing the market coupling process. Additionally, BELEN has obtained observer status in the All NEMO Committee, which was established to enable mutual cooperation between NEMOs in fulfilling their prescribed obligations. This status will allow BELEN to monitor the processes conducted by the All NEMO Committee prior to obtaining full membership status.
Terna and CGES have established working and management bodies through which they cooperate on the preparation of regional TCMs. ARERA and REGAGEN signed a Memorandum of Cooperation in May 2024, which regulates the mode of collaboration aimed at approving regional TCMs. The IT-ME Implementation Group was also established to enable discussions and consultations between regulatory authorities and TSOs.
The first draft of the capacity calculation methodology has been prepared.

**Legal, technical, financial, informational, regulatory policy or measure**: Regulatory policy.

**Problem the policy or measure is addressing**: Integration of electricity market

**Objective of the policy or measure**: Energy security increase.

**Implementation process**:
- Preparation of the first draft.
- Consultations with stakeholders.
- Finalization of the draft.
- Adoption procedure.

**Implementation period**:
- Expected starting date: 2026
- Expected end date: -
- The measures will have long-term effects regarding energy security.

**Status of implementation**:
- A letter was sent requesting the inclusion of the Montenegro–Italy border in the IBWT (Italy North Borders Working Table) regulators and the IBWT Steering Committee, accompanied by a letter of support from the Agency.

**Responsible for implementation**:
- Ministry of Energy, CGES, Energy and Water Regulatory Agency of Montenegro.

**Actions taken**:
- Obtained observer status in the Market Coupling Steering Committee (MCSC).
- BELEN has obtained observer status in the All NEMO Committee.
- Established working and management bodies.
- ARERA and REGAGEN signed a Memorandum of Cooperation.

**Impact**:
- Energy Union Dimension(s) affected: Internal energy market, Energy security.
- Sectors affected: Energy generation (IPCC sector: 1A Energy, subcategory: 1A1 Energy industries).
- GHG areas and greenhouse gases covered: This measure targets all GHG since it enables greater integration of RES.

**Costs**:
- There is no cost estimation.

**Funding**:
- None.

**Annual public budgetary impacts**:
- None.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- None.

***Exact name:*** Imbalance netting

**Considered in which scenario**: WAM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
Secure operation of power system is mandatory obligation of transmission system operator according to the Energy Law. High integration of RES is recognized as a means to reach all the national targets. However, that task is very challenging due to volatile electricity generation from wind and solar power plants. This is mitigated in a certain level by more reliable forecast of their productions but still there is a need for more reserves in controllable electricity generation and more activation of the existing power plants. This creates higher costs for power system balancing.
The International Grid Control Cooperation (IGCC) was first established in 2011 to avoid counter-acting activations of aFRR balancing energy through the process known as imbalance netting. The establishment of a common European platform for operating the imbalance netting process has been officially achieved by the legal deadline of 24th June 2021, following the successful completion of all requirements as defined in the guideline on electricity balancing (EB Regulation Art. 22). The cooperation has grown and currently counts twenty-seven members, of which twenty-one TSOs already performing the imbalance netting process in a coordinated manner. The operational TSOs are: 50Hertz (DE), ADMIE (GR), Amprion (DE), APG (AT), CEPS (CZ), Eles (SI), Elia (BE), Energinet (DK), HOPS (HR), Mavir (HU), PSE (PL), REE (ES), REN (PT), RTE (FR), SEPS (SK), Swissgrid (CH), TenneT (DE), TenneT (NL), Terna (IT), Transelectrica (RO) and TransnetBW (DE).
TSO from Serbia (EMS) started its technical participation in IGCC in 2022. Montenegrin TSO (CGES) and EMS are part of the same control block (SMM) with TSO of North Macedonia.

**Description of the PaM**:
Imbalance netting is a critical tool for modernizing power systems, particularly as grids integrate more variable renewable energy sources like wind and solar. It aligns well with the broader goals of efficiency, sustainability, and cost-effectiveness in energy markets. It is a

mechanism used to manage and minimize energy imbalances across interconnected electricity markets or regions. Main benefits of imbalance netting are:

- Reduces balancing energy costs for TSOs.
- Enhances grid stability and security.
- Supports the European Union's target of creating a single electricity market.
- Enables a more sustainable and efficient use of renewable energy.

Process of Imbalance Netting:

- Detection of imbalances – Each TSO identifies imbalances in its control area based on real-time data.
- Exchange of information – TSOs share imbalance data with a central platform or directly with neighboring TSOs.
- Netting opposite imbalances – Surpluses in one area are matched with deficits in another area, effectively reducing the net imbalance across the interconnected system.
- Remaining balancing – Needs After netting, any remaining imbalances are corrected using local balancing resources or through coordinated balancing markets.

With the implementation of the SCADA project for the new dispatch center with an EMS system, CGES has acquired a modern SCADA system with Energy Management functions. The main features of this system include a modern IT infrastructure with a high level of reliability and cybersecurity, complete observability of the high-voltage power system, and the integration of advanced functions such as:

- Wide Area Monitoring System (WAMS),
- Renewable energy production forecasting,
- Dispatch log,
- Imbalance Netting mechanism.

The SMM Control Block (Serbia, Montenegro, and North Macedonia Control Block) is a power system control block that includes the power systems of Serbia, Montenegro, and North Macedonia. This block is defined within the broader European power system and represents an entity for managing balancing and energy exchange among these countries. The control block employs Imbalance Netting to optimize balancing between the countries within the block.

**Legal, technical, financial, informational, regulatory policy or measure**: Technical and regulatory measure.

**Problem the policy or measure is addressing**: Secure and efficient operation of power system

**Objective of the policy or measure**: Energy security increase, high integration of RES.

**Implementation process**:

- Preparation of the technical specification (enabling high-quality, real-time data exchange and communication between TSOs).
- Cross-border coordination regarding regulatory alignment.

**Implementation period**:

- Expected starting date: 2022
- Expected end date: -

- The measure will have long-term effects regarding energy security.

**Status of implementation**:
- Implemented on the level of SMM control block.

**Responsible for implementation**:
- CGES, Energy and Water Regulatory Agency of Montenegro.

**Actions taken**:
- Technical requirements fulfilled.
- Imbalance netting mechanism is operational.

**Impact**:
- Energy Union Dimension(s) affected: Internal energy market, Energy security.
- Sectors affected: Energy generation (IPCC sector: 1A Energy, subcategory: 1A1 Energy industries).
- GHG areas and greenhouse gases covered: This measure targets all GHG since it enables greater integration of RES.

**Costs**:
- There is no cost estimation for this specific PaM since it is a part of greater project (the project for the procurement and implementation of the new SCADA/EMS system, including the equipping of facilities for remote monitoring and control, had a total value of approximately EUR 4.5 million).

**Funding**:
- CGES.

**Annual public budgetary impacts**:
- None.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- Ten year development plan of the transmission network until 2032.

### 3.4.4 Energy poverty

## 3.5 Dimension Research, Innovation and Competitiveness

***Exact name:*** Smart Specialisation Strategy of Montenegro 2019-2024

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
In June 2019, Montenegro was the first country in the region to adopt a smart specialisation strategy (S3), covering the period 2019-2024. Strategic priorities are energy and sustainable environment, sustainable agriculture and food value chain, sustainable and health tourism, ICT (information and communication technologies). This is a National Innovation Strategy that sets development priorities, aimed at building competitive advantage through networking own forces in research and innovation with the needs of the economy, responding coherently to growing opportunities and market development, thus avoiding overlapping and fragmenting policies. The S3 has high political backing and, with careful management and monitoring, has the potential to generate economic growth by developing the country's competitive advantages through an innovative approach. Montenegro should follow up on the technical recommendations resulting from a conditional positive assessment by the European Commission (December 2019) and ensure sustained and close collaboration between all relevant stakeholders in a continuous Entrepreneurial Discovery Process.

**Description of the PaM**:
The Innovation and Smart Specialisation Council was established in August 2019 while its secretariat started operations in March 2020. Current funding instruments as specific PaMs encompassed by this strategy do not have specific targets and allocations for energy and climate protection field since the policy measures are implemented on a broad competitive, bottom up basis, except for one specific measure for energy efficiency in common with the Industrial Policy described below. With the creation of an Operational Programme of the S3 strategy in 2021 it is planned to define specific R&I measures for S3 priority areas, therefore for Energy and Sustainable Environment as well. The planned S3 implementation institution, The Innovation Fund of Montenegro, will have established results-oriented programming with clear indicators and monitoring mechanisms.
Montenegro was the first candidate country for EU membership to adopt the Smart Specialisation Strategy (S3) (2019-2024) in June 2019. This reaffirmed strong commitment of the state to building and fostering sustainable research and innovation system, which entails encouraging synergies between science and economy in clearly defined priority sectors of development, thus stimulating economic growth and development of the country. S3 became a key link bringing together several sectoral policies, which will serve as the basis for further national investments. Information and communication technologies are deemed to be the key technologies that should impact the increase in competitiveness of the priority sectors: agriculture, energy, and tourism.
The main goal of the S3 is to modernise and increase the competitiveness of the Montenegrin economy by concentrating available research, natural and economic resources on a limited number of priority areas. S3 should enable further intensive development of the subject priority areas, as well as the development of new sub-areas within them and development of new industries with strategic potential based on the synergistic interaction of the priority areas. The achievement of the main goal of the S3, i.e. modernised and competitive Montenegro, relies on three key strategic directions that represent the general long-term vision of the country's development:

1. Healthy Montenegro
2. Sustainable Montenegro
3. Digitalised Montenegro

These directions constitute a general vision of development of Montenegro and are in line with the spirit of the Smart Specialisation Strategy, representing a logical continuation of the efforts to meet the goals of the Europe 2020 Strategy. The strategic directions confirm the country's orientation to development based on knowledge, environmental protection, high employment level, productivity and social cohesion, with a focus on three interrelated development goals: smart growth, sustainable growth and inclusive growth.
The S3 Strategy identifies the main common objectives of policy mix, determined by the interests related to research and innovation activity, and these are:

1. Improving excellence and relevance in scientific research activities;
2. Strengthening human resources in the field of research and innovation;
3. Enhancing collaboration within the innovation system;
4. Supporting innovative activities in the business sector;
5. Enhancing framework conditions for innovation ecosystem.

Priority domain specific goals, i.e. sectoral goals will be achieved by implementation of a combination of policy instruments and measures distributed throughout S3.me common policy mix goals. The attainment of these goals shall particularly be supported by exclusively sector oriented policy instruments. However, since the accomplishment of sectoral goals is primarily expressed through sectoral key indicators, these will be predominantly achieved through synergistic effects of different policy instruments.

**Legal, technical, financial, informational, regulatory policy or measure**: Regulatory policy.

**Problem the policy or measure is addressing**: Lack of specialisation of Montenegrin economy based on knowledge; poor connection between research – business – government and society and therefore lack of mutually enforcing actions that could increase competitiveness of the economy and ensure sustainable development.
**Objective of the policy or measure**: Modernisation and improved competitiveness of the country based on specialisation in the following priority areas: Sustainable agriculture and food value chains; Energy and sustainable environment; Sustainable and health tourism; Information and communication technologies. Indicators: Number of enterprises in the field of renewable energy sources 2019: 50 / 2024: 80. The output and outcome indicators, specifically for R&I in the energy area are not defined in the strategic document, which is an area indicated for improvement by the European Commission.

**Implementation process**:

- Preparation of the first draft.
- Consultations with stakeholders.
- Finalization of the draft.
- Adoption procedure.

**Implementation period**:

- Expected starting date: 2019
- Expected end date: 2024
- The measure will have long-term effects on improving implementation of specific expert knowledge in practice on sustainable development of all sectors.

**Status of implementation**:

- Implementation phase of all defined policies and measures defined by the strategy.

**Responsible for implementation**:
- Ministry of Economic Development (Setting the regulation(s); Planning); Council for Innovation and Smart Specialisation (Planning; Providing the funding; Evaluation); Innovation Fund of Montenegro (to be established in 2021) (Implementation; Monitoring).

**Actions taken**:
- Smart specialisation strategy (S3), covering the period 2019-2024 is adopted.
- The new Operation Programme 2021 – 2024 for realization of the S3 is under preparation.

**Impact**:
- Energy Union Dimension(s) affected: Research, innovation and competitiveness.
- Sectors affected: all sectors.
- GHG areas and greenhouse gases covered: This measure targets all GHGs but the effect is not estimated.

**Costs**:
- Total budget is EUR 112.9 million.

**Funding**:
- Public budget.

**Annual public budgetary impacts**:
- Total budget spread over 6 years.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- Smart specialisation strategy (S3), covering the period 2019-2024.

***Exact name:*** Law on incentives for research and innovation development

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
The main challenges for further improvement of innovation activity in Montenegro are related to:
- Limited access to funding;
- High costs of innovation;
- Low public and private R&D spending;
- Inadequate policy frameworks;

- Small domestic markets;
- Lack of competitive pressure;
- Dependence on imported technology;
- Dependence on primary industries.

Therefore, support of innovation activities in a more decisive manner in Montenegro is needed.

**Description of the PaM**:
In July 2020, in order to support the growth of knowledge-based economy and implementation of Smart Specialisation Strategy, Montenegro has adopted two laws: Law on Innovation Activities and the Law on Incentives for Research and Innovation Development. The latter law provides incentives for the development of innovative economy and start-up companies, namely tax. The Law on Innovation Activities foresees the establishment of the Innovation Fund with a set of innovation funding schemes.

**Legal, technical, financial, informational, regulatory policy or measure**: Regulatory policy.

**Problem the policy or measure is addressing**: Low level of R&I expenditure and intensity in general in the country, undeveloped innovation market.
**Objective of the policy or measure**: Increased R&I spending; increased employment in high tech and knowledge based services; estimated 10% for energy and climate, of total (ca. EUR 250,000 annually in conservative scenario).

**Implementation process**:
- Preparation of the first draft.
- Consultations with stakeholders.
- Finalization of the draft.
- Adoption procedure.

**Implementation period**:
- Expected starting date: 2022
- Expected end date: -
- The measure will have long-term effects on improving implementation of specific expert knowledge in practice on sustainable development of all sectors.

**Status of implementation**:
- Regulation came into effect.

**Responsible for implementation**:
- Ministry of Economic Development (Setting the regulation(s); Planning); Council for Innovation and Smart Specialisation (Planning; Providing the funding; Evaluation); Innovation Fund of Montenegro (to be established in 2021) (Implementation; Monitoring).

**Actions taken**:
- Law and bylaws adopted.

**Impact**:
- Energy Union Dimension(s) affected: Research, innovation and competitiveness.

- Sectors affected: all sectors.
- GHG areas and greenhouse gases covered: This measure targets all GHGs but the effect is not estimated.

**Costs**:
- Total budget is EUR 2.6 million.

**Funding**:
- Public budget.

**Annual public budgetary impacts**:
- EUR 250k.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- Smart specialisation strategy (S3), covering the period 2019-2024.

***Exact name:*** Programme for improvement of competitiveness of Montenegrin economy and Industrial Policy of Montenegro – Programme line for incentivising circular economy

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
Pollution of the environment from industrial waste and incompatibility of industrial processes in Montenegrin companies with the EU standards is recognized as the problem that needs to be solved. There are impacts on water, soil, air and health. Waste management is not organised according to EU standards.

**Description of the PaM**:
Financial support is provided to companies, for co-financing of the related wastewater facility costs. Ministry of Economic Development started to implement measures in favour of circular economy within Montenegrin SMEs since 2020, as part of the Programme for the improvement of competitiveness of Montenegrin economy. The measure was worth EUR 150,000 with support to individual company of maximum EUR 10,000 and with a mandatory co-financing.

**Legal, technical, financial, informational, regulatory policy or measure**: Financial measure.

**Problem the policy or measure is addressing**: Pollution of the environment from industrial waste and incompatibility of industrial processes in Montenegrin companies with the EU standards defined in the regulations: 91/271/EEC, 98/83/EC i 2000/60/EC, related to the wastewater management and the use of water resources.

**Objective of the policy or measure**: Reduction of industrial waste, in particular treatment of residual wastewater in agro-food facilities, industry and hospitality sector. Indicator: Percentage of internal waste removed from industrial waste, 2018: 3.4% >> 2023: 3.8%.

**Implementation process**:
- Obtaining funding.
- Consultations with stakeholders.
- Preparation of the call for Programme.
- Implementation and monitoring.

**Implementation period**:
- Expected starting date: 2020
- Expected end date: 2023
- The measure will have long-term effects on reduction of industrial waste.

**Status of implementation**:
- Programme is ongoing.

**Responsible for implementation**:
- Ministry of Ecology, Sustainable Development and Development of the North, Providing the funding: Ministry of Economic Development, Planning: Ministry of Economic Development, Monitoring: Ministry of Economic Development, Evaluation: Ministry of Economic Development – externally commissioned.

**Actions taken**:
- The call is open.

**Impact**:
- Energy Union Dimension(s) affected: Research, innovation and competitiveness.
- Sectors affected: Industry.
- GHG areas and greenhouse gases covered: This measure targets all GHGs but the effect is not estimated.

**Costs**:
- Total budget is EUR 0.6 million.

**Funding**:
- Public budget.

**Annual public budgetary impacts**:
- EUR 150k.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- Smart specialisation strategy (S3), covering the period 2019-2024.

***Exact name:*** Continuation of Programme for improvement of competitiveness of Montenegrin economy and Industrial Policy of Montenegro – Programme line for energy efficiency in industry

**Considered in which scenario**: WEM scenario

**Single PaM or part of a group of PaMs**: Single PaM

**General context**:
The instrument related to energy efficiency in industry has been piloted through a EU – IPA project "Enhancement of business environment and competitiveness of private sector of Montenegro - BESME" during 2020 – mid-2021. Pilot Programme for Energy Monitoring consisted of the implementation of the Smart Energy Monitoring System - Smart EMoS within four pilot companies in Montenegro. Energy efficiency action plans for the companies are developed based on each monitoring report.

**Description of the PaM**:
In order to create a more favorable business environment for creating new, improving, and developing existing economic entities, all with the objective to support continuously development of entrepreneurship and businesses in Montenegro, the Ministry of Economic Development has created the Programme for Improvement of Competitiveness of the Economy. Observing growing trends both in terms of expressed interest and in number of supported beneficiaries, it is expected that growth trend of number of enterprises will continue the upward trend, with programme lines supporting their project activities.
The Programme consists of 7 programme lines and includes activities and measures for realization of financial and non-financial support to potential and existing entrepreneurs, micro, small, medium and large enterprises. The goal is to increase their competitiveness on the national and international market, to encourage the development of existing processes, products and services, in order to strengthen the competitiveness and export potential of micro, small and medium enterprises by improving productivity and profitability while maintaining existing and creating new jobs.
The total budget allocated for the implementation of the Programme is EUR 3 million, while the individual amounts, as well as the manner and dynamics of granting support are defined by individual programme lines.
In order to enabling support to those SMEs which are willing to apply biological processes for wastewater treatment Ministry of Economic Development has designed the Programme line for Fostering Circular Economy.
Support is intended to co-finance the costs of the following activities:

- Component I – Wastewater treatment in industry, intended for entrepreneurs and micro-enterprises, and
- Component II – Industrial wastewater treatment, intended for small and medium-sized enterprises and hotels.

The Ministry of Economic Development approves reimbursement of up to 70% of eligible costs (excl. VAT) for entrepreneurs, micro and small enterprises, i.e. up to 60% of eligible costs (excl. VAT) for medium-sized enterprises, with the maximum amount set at EUR 10,000 (excl. VAT).
The total budget implemented the Programme for Fostering Circular Economy was EUR 200,000.

The Programme aimed to introduce and use modern biological processes for wastewater treatment in Montenegrin business sector. The application of Upflow Sludge Blanket Filtration (USBF) biological wastewater treatment process was in the focus of the Programme.
Until 2023, the Ministry of Economic Development have a plan to develop financing mechanisms that will be offered to those SMEs which are willing to transform their existing businesses into green ones or establish a green business from the very beginning. Moreover, it is a plan to encourage the introduction of the circular economy principle which integrates the economy and the waste management system.
The pilot demonstrator provided stimulus for new technology and knowledge creation of local service providers. The results of the analysis of the energy monitoring system are reviewed by experts, and in accordance with the obtained results, recommendations to companies are given on how to use electricity/energy more rationally. Furthermore, recommendations are provided to Ministry of Economic Development in their future industrial modernisation supporting programmes. Pilot scheme was created and implemented during 2020 – mid-2021.

**Legal, technical, financial, informational, regulatory policy or measure**: Financial measure.

**Problem the policy or measure is addressing**: High level of energy consumption and electricity costs in industrial facilities in Montenegro.
**Objective of the policy or measure**: Improved energy efficiency in Montenegrin industry.

**Implementation process**:
- Obtaining funding.
- Consultations with stakeholders.
- Preparation of the call for Programme.
- Implementation and monitoring.

**Implementation period**:
- Expected starting date: 2021
- Expected end date: -
- The measure will have long-term effects on energy efficiency in industry.

**Status of implementation**:
- Programme is ongoing.

**Responsible for implementation**:
- Ministry of Economic Development, Providing the funding: Ministry of Economic Development, Planning: Ministry of Economic Development, Monitoring: Ministry of Economic Development, Evaluation: Ministry of Economic Development – externally commissioned.

**Actions taken**:
- Programme for Improvement of Competitiveness of the Economy is developed.
- Programme line for Fostering Circular Economy is created.

**Impact**:
- Energy Union Dimension(s) affected: Research, innovation and competitiveness.

- Sectors affected: Industry.
- GHG areas and greenhouse gases covered: This measure targets all GHGs but the effect is not estimated.

**Costs**:
- Total budget is not yet defined.

**Funding**:
- Public budget.

**Annual public budgetary impacts**:
- Public budgetary impacts not yet defined.

**References to the underlying analysis performed or other technical reports used to underpin the selection and design of the policy or measure**:
- Study on enhancement of business environment and competitiveness of private sector of Montenegro - BESME.

# SECTION B: ANALYTICAL BASIS

The analytical part of the NECP has been developed with LEAP (Low Emissions Analysis Platform). LEAP[19] is a software tool for energy policy analysis and climate change mitigation assessment. Figures without explicit sources in the caption are taken from the LEAP Model.

# 4 CURRENT SITUATION AND PROJECTIONS WITH EXISTING POLICIES AND MEASURES

## 4.1 Projected evolution of main exogenous factors influencing energy system and GHG emission developments

*Macroeconomic forecasts (GDP and population growth)*

The macroeconomic drivers underlying this analysis are based on the most up-to-date available projections. GDP projection is based on calculations of the International Monetary Fund (IMF 2021) including impacts of the COVID-19 pandemic impacting economic development starting in 2020 with a decrease of 12% in GDP. The recovery starting in 2021 with 5.5% of GDP growth, which then gradually decreases to 3% p.a. in 2024 decreasing further to 1.8% 2040. Figure 16 shows the real GDP development (monetary value of 2015).
The population development uses MONSTAT Population Estimations for the 1st of January of each year (MONSTAT 2021). From 2022, the projection uses 5-year average annual growth rates from the UN World Population Prospects 2019 in the medium fertility scenario. According to this projection, population will decrease from 622 Thousand in 2018 to 617 Thousand in 2030 and 603 Thousand in 2040. Figure 17 shows the population development.

[19] https://www.sei.org/tools/leap-long-range-energy-alternatives-planning-system/

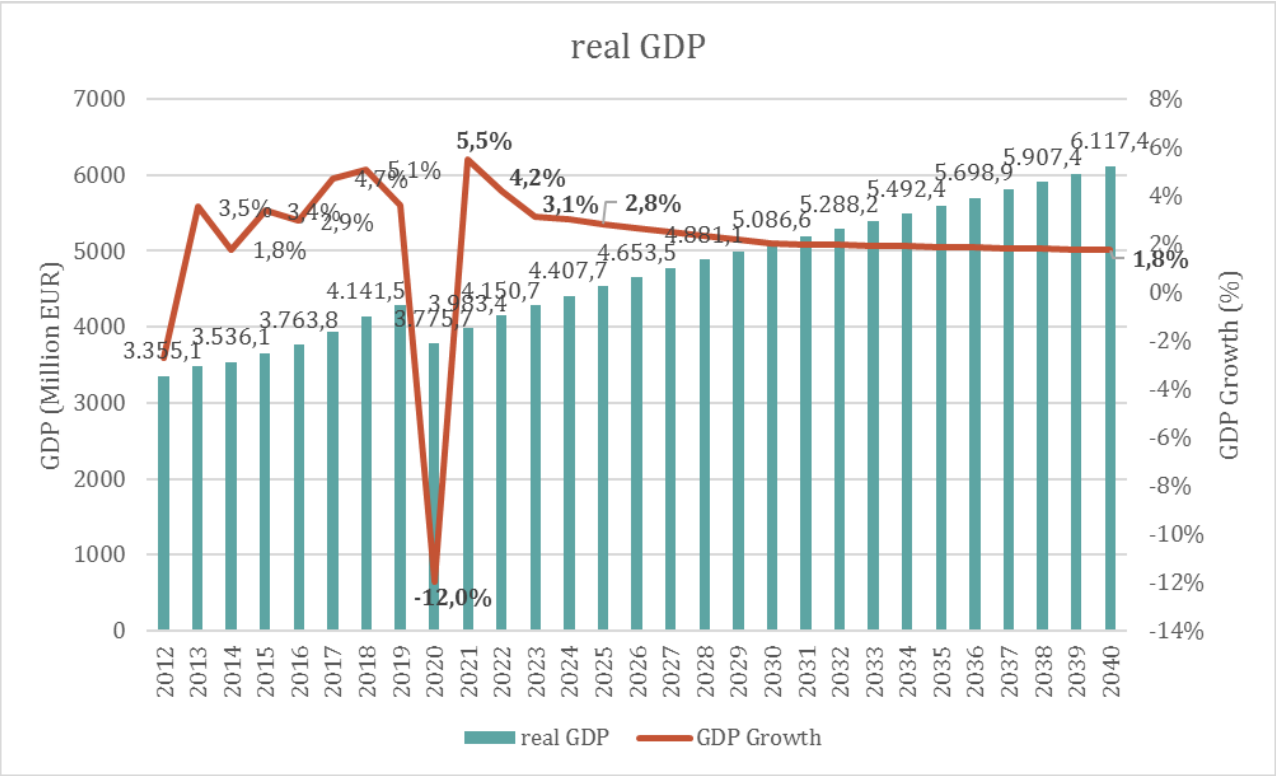



*Figure 16: Real GDP (monetary value of 2015) development 2012 - 2040 Source: IMF 2021*

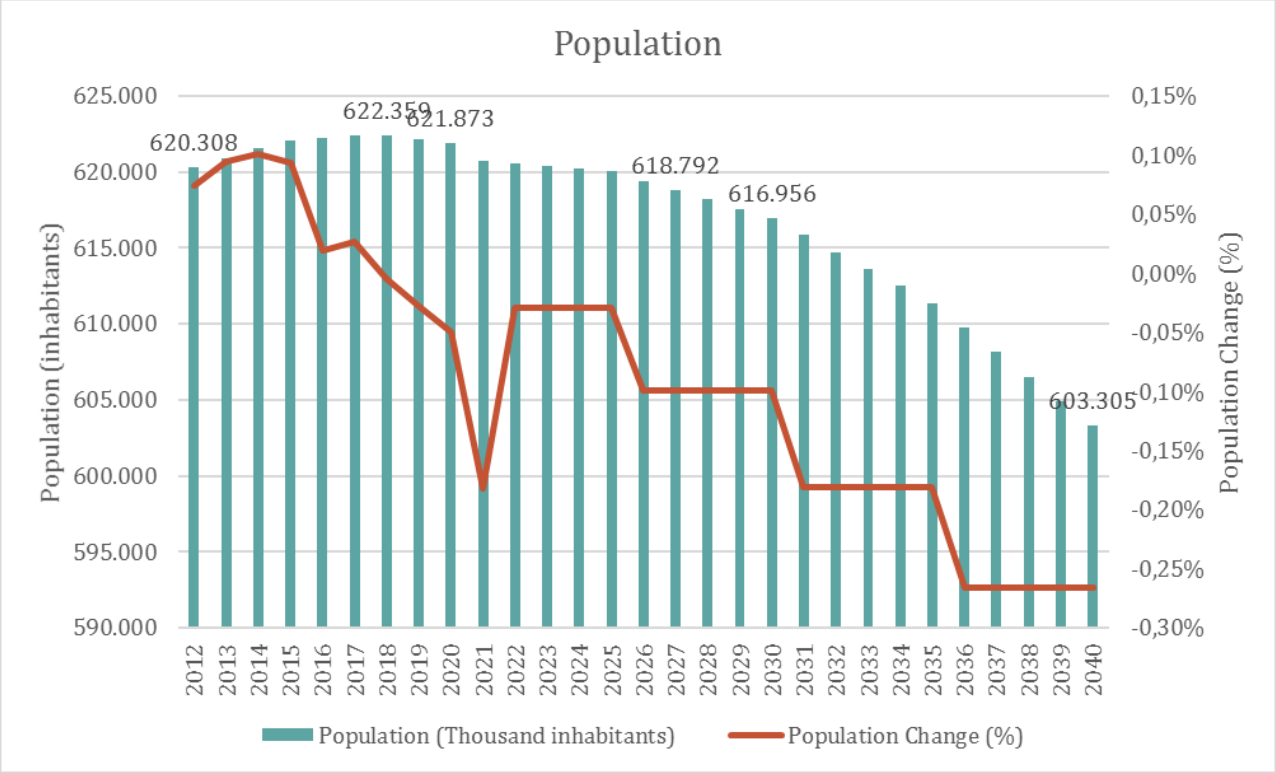



*Figure 17: Population development 2012-2040. Source: MONSTAT 2021, United Nations 2019*

### *Sectoral changes expected to impact the energy system and GHG emissions*

Apart from GDP and Population, the distribution of value added among energy demand sectors plays an important role in energy consumption. Figure 18 shows the growth development of the industrial, services and agricultural sector between 2000 and 2018. The strong growth in the services sector is projected to continue.

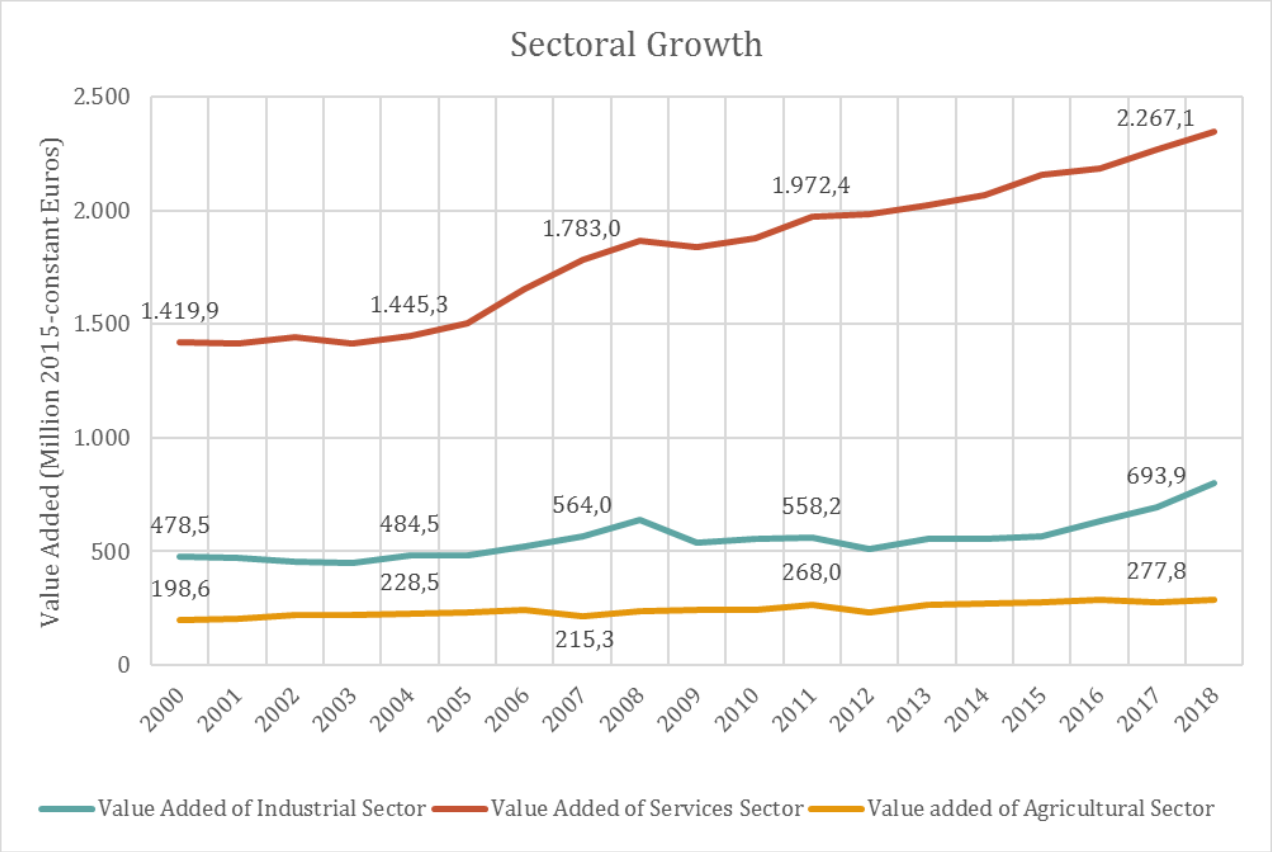



*Figure 18: Sectoral growth of energy demand sectors explicitly analysed in the model from 2000 to 2018*

Apart from macroeconomic impacts, different structural changes affect energy consumption on sectoral level. The most important effects are presented subsequently ordered by sector.

#### *Residential sector*

The household size is decreasing from on average 3.2 persons per household in 2011 to 2.8 persons per household in 2030 and then decreasing further to 2.6 in 2040 (MONSTAT 2021). The floor area per person is considered to increase from 27.1m$^2$ in 2012 to 29.5 m$^2$ in 2018 and 33.5 m$^3$ in 2030. It further increases to 37.7m$^2$ in 2040. Overall, total floor area increases from 16.8 Million m$^2$ in 2012 to 20.6 Million m$^2$ in 2030 and further to 22.8 Million m$^2$ in 2040 despite the decrease in population. Figure 19 shows the development of building age classes based on SLED 2015, which is assumed as projection here. The reconstruction rate is rather high, leading to a share of 32% of floor area by 2040 that is built or refurbished after 2015. The strongest deconstruction is seen in buildings built between 1971 and 1990.

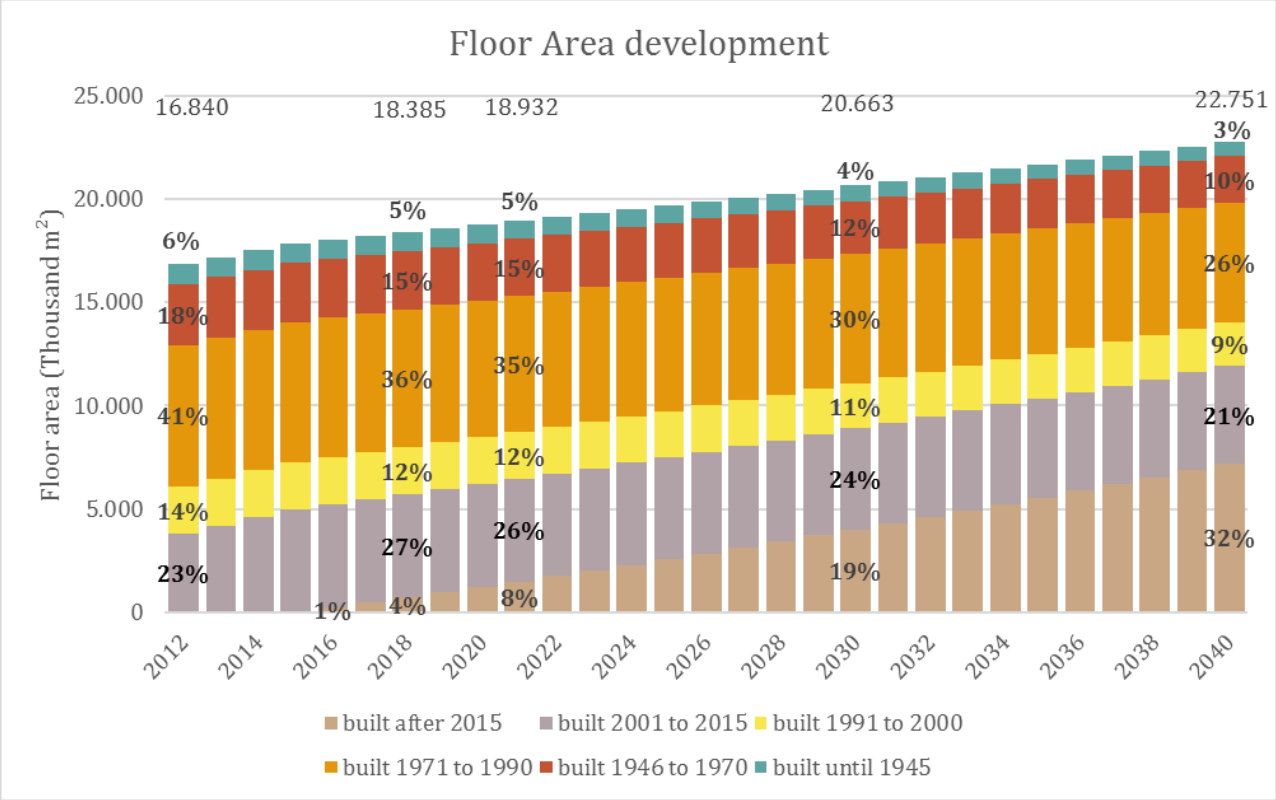



*Figure 19: Floor area development by year of construction. Source: SLED 2015, own representation*

Notable as well is the change in distribution of floor area over different building types. Table 4.1 defines these building classes.

| Building type | Number of dwellings per building |
|---|---|
| Small houses | 1 to 2 |
| Medium houses | 3 to 9 |
| Large houses | More than 9 |

*Table 4.1: Definition of building types*

With the share of medium houses remaining constant at 14% in terms of floor area and at 13% in terms of number of dwellings, small houses see the highest change in share, dropping from 67% in 2012 to 63% in 2040 in terms of floor area and from to 61% to 55% in terms of floor area. The strongest increase is seen in large buildings, rising from 20% of floor area in 2012 to 24% in 2040 and 25% in terms of the number of dwellings to 30%.

The impact of the change in housing composition decreases energy intensity due to lower energy consumption per floor area in large apartment buildings than in smaller building types. Figure 20 shows the development of floor area by building type. Figure 21 the development by number of dwellings. Furthermore, newer and larger buildings tend to use a lower share of fuel wood for space heating and water heating, giving way for electric heating and increasingly heat pumps. The reconstruction rate of buildings therefore has the largest share in decreasing energy intensity and a changing fuel split in the residential sector. Wood usage in space heating decreases from 71% in 2012 to 66.3% in 2030 and 61.2% in 2040 when not accounting for any

policies and measures. In the same timeframe the use of electricity rises from 29% to 37%. The rest is covered by lignite coal in the Pljevlja region.
Energy Intensity for space heating and space cooling is determined by heating degree days (HDD) and cooling degree days (CDD). Values are taken for three climate zones. Zone A being the warmest region along the coast and including the capital Podgorica, Zone B the central area with intermediate climate and Zone C being the mountainous north of the country with the coolest climate.

| Degree Days | Zone A | Zone B | Zone C |
|---|---|---|---|
| HDD (19°C) | 1209 | 3050 | 4015 |
| CDD (26°C) | 224 | 128 | 53 |

*Table 4.2: Heating and Cooling degree days (HDD base temperature: 19°C, CDD base temperature 26°C)*

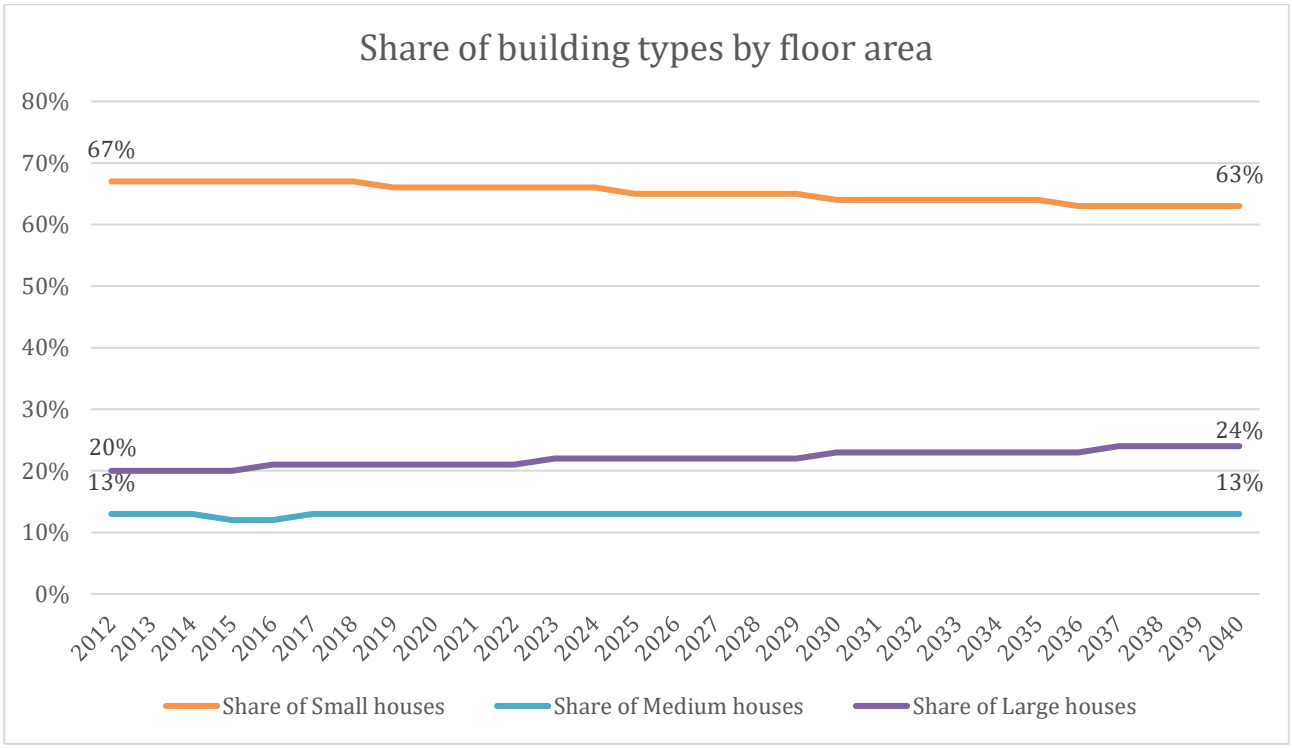



*Figure 20: Share of building types by floor area. Source: SLED 2015, own representation*

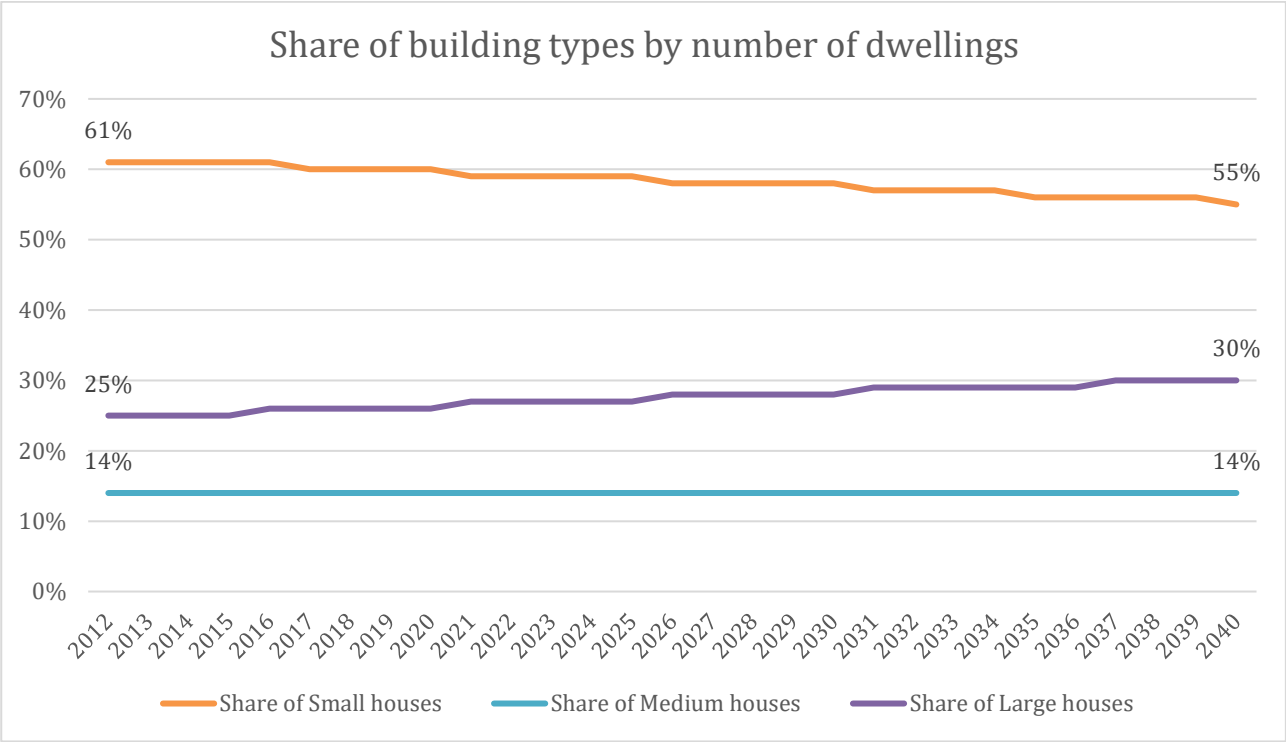
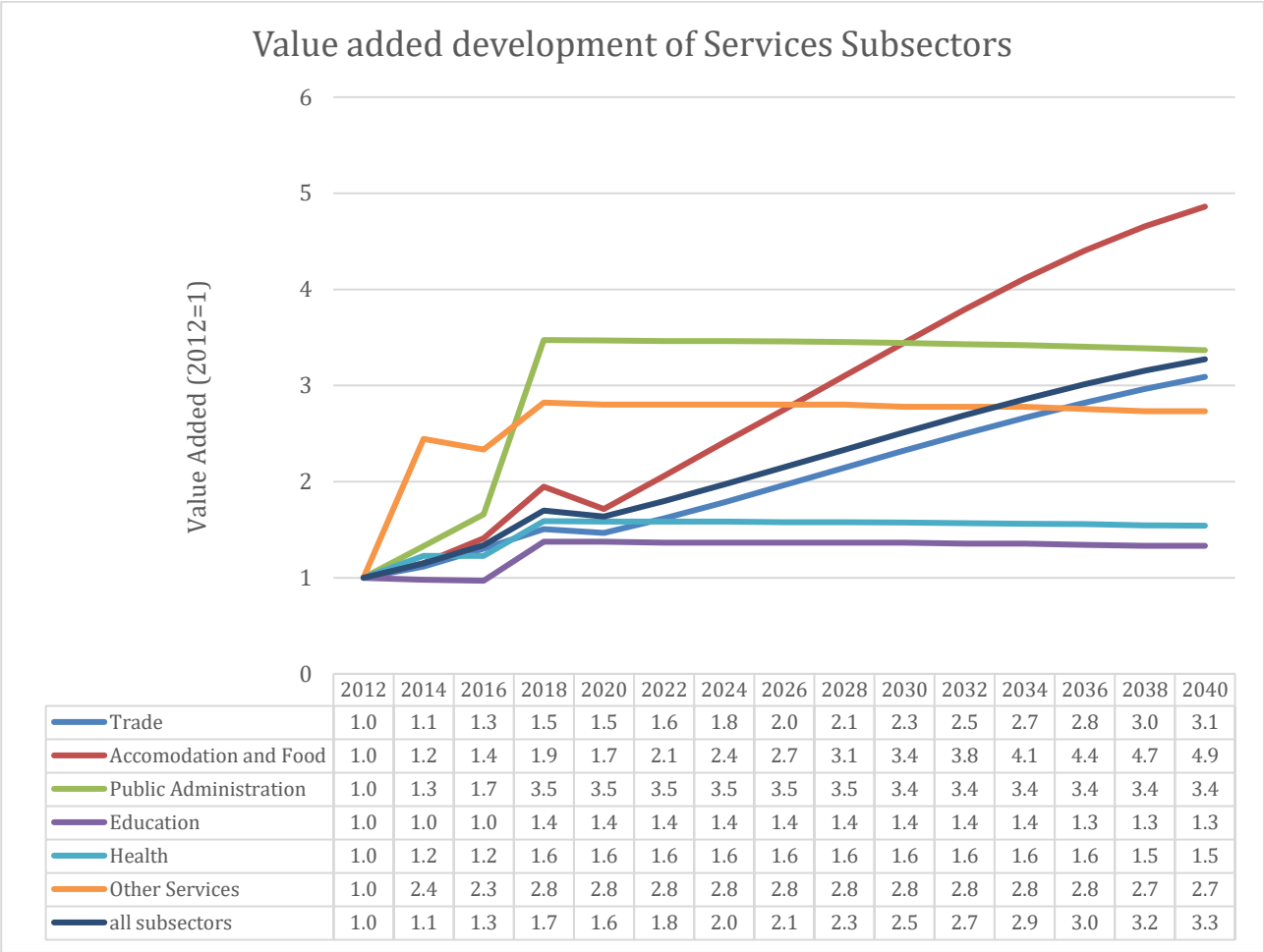



*Figure 21: Share of building types by number of dwellings. Source: SLED 2015, own representation*

### *Services Sector*

In the services sector, the most important driver is the strong growth performance in value added as was shown in the sectoral development of the economy in Figure 18. In 2040, the sector reaches a value added of 3.3 times that of the 2012-base value (in constant Euros). The strongest growth performance originates from the accommodation and food subsector, increasing 4.9-fold between 2012 and 2040 (Figure 22).




| | 2012 | 2014 | 2016 | 2018 | 2020 | 2022 | 2024 | 2026 | 2028 | 2030 | 2032 | 2034 | 2036 | 2038 | 2040 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trade | 1.0 | 1.1 | 1.3 | 1.5 | 1.5 | 1.6 | 1.8 | 2.0 | 2.1 | 2.3 | 2.5 | 2.7 | 2.8 | 3.0 | 3.1 |
| Accomodation and Food | 1.0 | 1.2 | 1.4 | 1.9 | 1.7 | 2.1 | 2.4 | 2.7 | 3.1 | 3.4 | 3.8 | 4.1 | 4.4 | 4.7 | 4.9 |
| Public Administration | 1.0 | 1.3 | 1.7 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.5 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 | 3.4 |
| Education | 1.0 | 1.0 | 1.0 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.4 | 1.3 | 1.3 | 1.3 |
| Health | 1.0 | 1.2 | 1.2 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.5 | 1.5 |
| Other Services | 1.0 | 2.4 | 2.3 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.8 | 2.7 | 2.7 |
| all subsectors | 1.0 | 1.1 | 1.3 | 1.7 | 1.6 | 1.8 | 2.0 | 2.1 | 2.3 | 2.5 | 2.7 | 2.9 | 3.0 | 3.2 | 3.3 |

*Figure 22: Value added development of Services subsectors representation*

### *Industry*

In industry, the energy demand is determined by production volumes. The most important sector in terms of energy demand is the nonferrous metals sector, i.e., the production of aluminium. There is also some production of steel (in electric arc furnaces), as well as industrial gases. The bauxite required for aluminium is also mined in the country, as is lignite for power generation. Marble is also produced in Montenegro (represented under the sector 'Other' in the following). Processing of food, drink and tobacco plays only a minor role in terms of energy consumption. The demand for energy increases in all sectors with production volumes, which are projected to grow according to GDP growth projections. The aluminium production is an exception to this rule, projected to increase from 40 kt in 2018 to 65 kt in 2024 and 90 kt in 2032. This also drives bauxite extraction. The increasing energy demand in industry is in part compensated by an efficiency gain of 0.1% p.a.

### *Transport*

The main driver of the transport sector is the demand for mobility, seen in a rising annual demand for person km, as given in Figure 23. This variable has been growing in the past and is projected to continue to grow with historic growth rate. Transport of freight is projected to undergo growth with GDP.

In addition to total demand for transport, the share between transport modes is an important factor to consider, see Figure 24 for numbers on passenger transport. The largest share of passenger transport happens by passenger cars, with bus and rail transport taking small shares of 2.3% and 1.3%, respectively, in 2018. Rail transport has seen a slight decrease over the past years. Without additional measures, these low shares are expected to continue in the future. Next to overall demand and public transport, an important factor to regulate energy demand in passenger transport is the load of vehicles, but this is not projected to change with existing measures. Freight transport is delivered by trucks and to a small share by rail. The shares between these modes do not see a change until 2040.

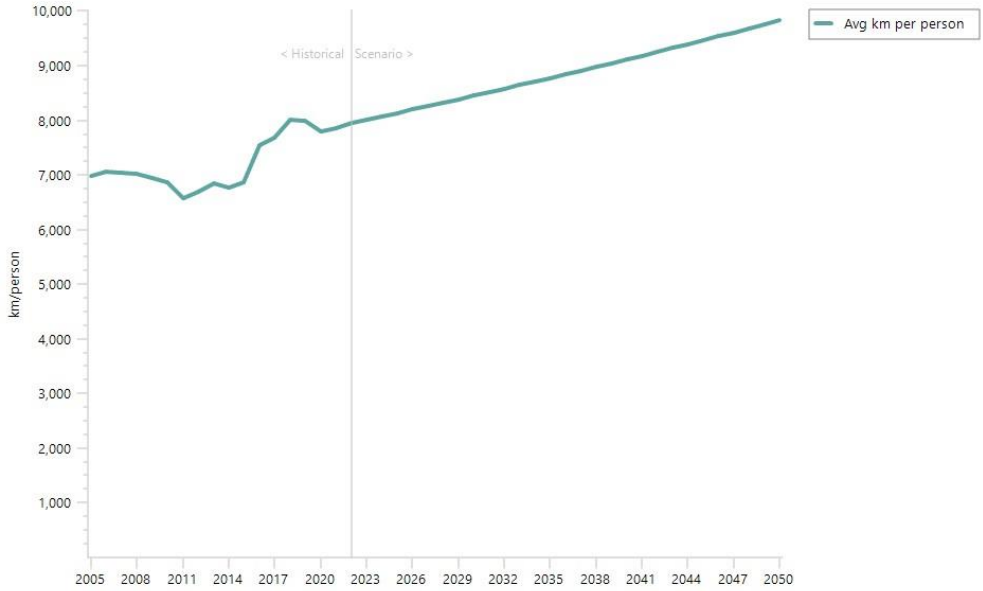



*Figure 23: Annual demand for passenger transport in Montenegro, giving historic values and the future growth.*

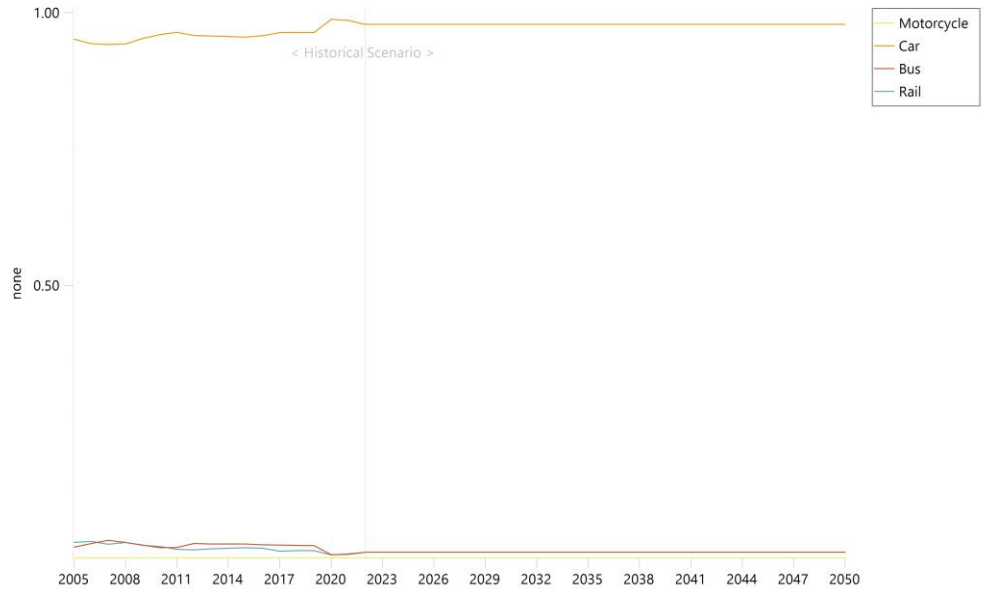



*Figure 24: Shares of transport modes in passenger transport in Montenegro projected without additional measures until the year 2050.*

The energy demand in the transport sector is also determined by the technology used for propulsion and respective fuels. As has been discussed above, passenger transport and notably by car is the main driver of energy demand. Figure 25 shows how electric vehicles are projected to penetrate the vehicle stock of passenger cars in Montenegro. Other modes do not see a change in transport technologies away from fossil fuels.

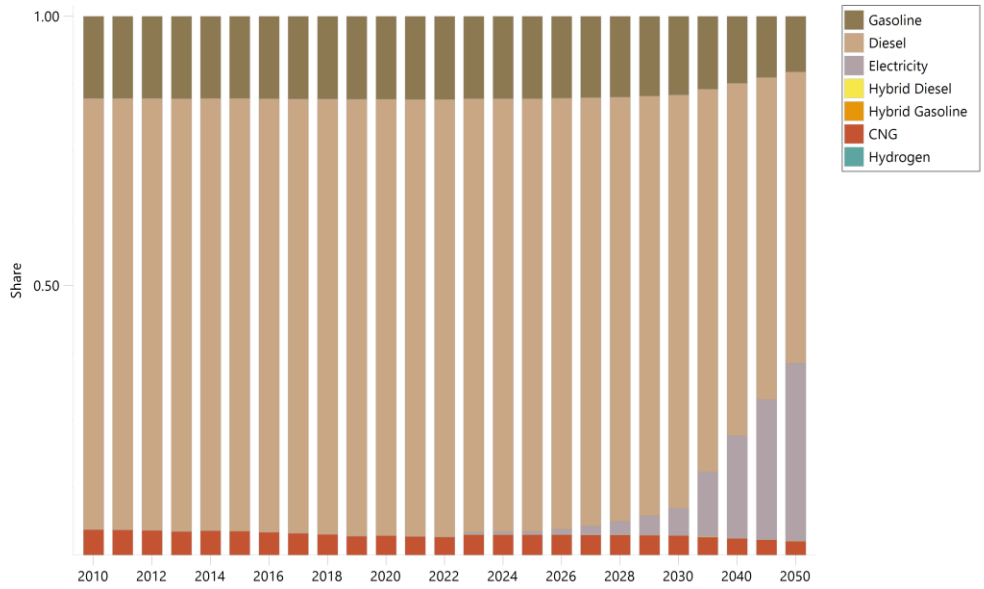



*Figure 25: Technology shares in passenger transport by cars as given for historic vehicle statistics and as projected under consideration of existing measures until the year 2030 and for 2035 to 2050 in five year steps*

### *Other energy demand*

Other energy demand sectors are distinguished as in the energy balance of Montenegro. Energy demand in the agriculture and forestry sector is driven by the production volume, which has been stable over the past years and is continued to remain constant.

Non-energy use of energy carriers is associated with production in the chemical sector (growing with GDP, roughly two thirds of non-energy demand) and with the total demand for transport.

### *Energy transformation*

The energy transformation sector includes Coal extraction, electricity production and transmission and distribution.

Montenegro has one principal lignite coal mining zone in the area of Pljevlja in the north of the country. The coal is directly used to fire the coal-fired thermal power plant of Pljevlja being the only on in the country. Pljevlja power plant delivers between 40 and 50% of the overall power generation. Most of the rest is delivered from both reservoir and run-of-river hydroelectric plants.

Aspects of energy security play an increasing role with changing climate conditions and diminishing rainfall. Dry years with low hydroelectric output can currently only be compensated by output from the Pljevlja lignite power plant. That power plant accounts for about 60% of Montenegrin GHG emissions and its future critically determines the overall performance in terms of GHG emissions reduction.

Finally, while transmission networks incur losses of about 3.8%, distribution networks account for the larger share of losses at roughly 14%. These losses are continually decreasing by existing measures in the coming years reaching only 2.5% by 2029.

### *Industrial processes and product use*

The largest share of IPPU emissions (8.6% of total emissions in terms of CO2eq without LULUCF) stem from the use HFCs used as refrigerants in place of ozone depleting substances. These are projected to continue to rise until the year 2024 with historic trends. After 2024, emissions of these substances see no further increase in line with the Kigali amendment of the Montreal protocol. Emissions of polyfluorinated carbons in aluminium production have seen a decline over the last decade with decreasing aluminium production, but also a decreasing trend in specific emissions. Steel production contributes with a very low share to IPPU emissions.

### *Agriculture*

The development of non-energy emissions in the agricultural sector (8.1% of total emissions in terms of CO2eq without LULUCF) is determined by the livestock population and agricultural practices. The population of all livestock species has been relatively constant over the past years, except for poultry and pigs. The number of the respective species is therefore seen to continue in this increasing trend. Manure management practices are not projected to change.

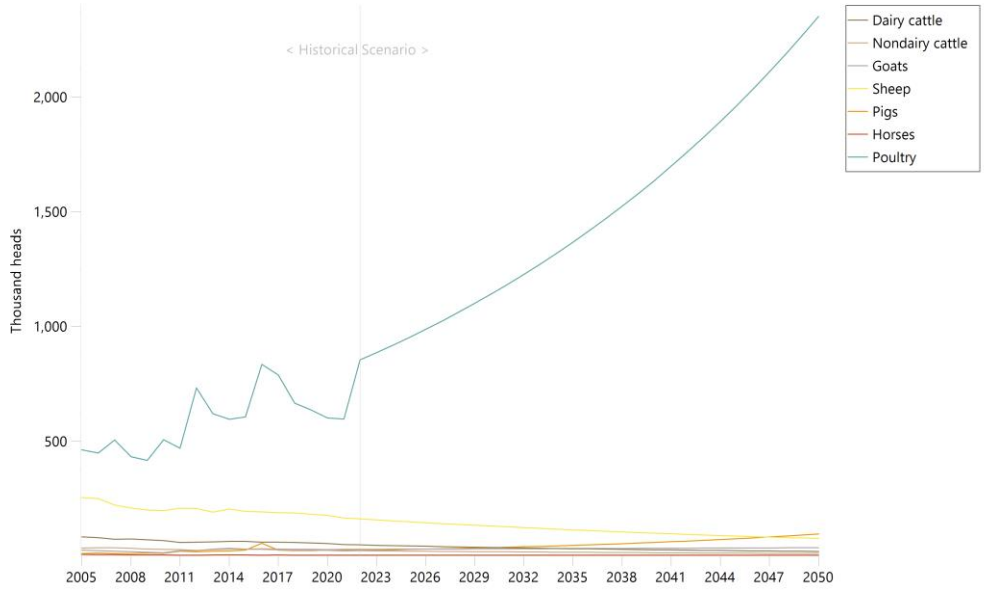



*Figure 26: Livestock historically and until the year 2050*

In addition to livestock, agricultural emissions stem from field management practices. The share of organic farming is projected to remain constant at 20% without additional measures. The application of urea and lime is also projected to remain constant.

### *LULUCF*

According to recent statistics, the LULUCF sector is a major sink of emissions (compensating 63% of the emissions attributed to other sectors in 2018). The sink capacity is projected to continue in the future in absolute numbers. Other land conversions contribute to a small part to emissions, with the conversion of land to settlements taking the highest of the minor shares.

Forest fires have been a major source of emissions and can potentially become a dominant factor in the overall GHG balance. Improved forest management can help to reduce the impact and spread of forest fires, but an increase to median fire area (2.1kha) is still projected (increase of 50% until 2050), with no large fire episodes considered.

### *Waste*

Emissions from the waste sector (8.8% of total emissions in terms of CO2eq without LULUCF, considering solid waste and wastewater treatment) are projected to see a decline with the policies currently in place.

The emissions of solid waste management are driven by the overall generation of waste per capita, which is projected to increase from 518 kg/cap in 2018 with an annual growth rate to 566 kg/cap in 2030 and 628 kg/cap in 2050, continuing historic trends. Waste management then determines the amount of emissions generated. Waste is deposited in managed landfills with a small share or methane recovery. With existing policies, the recycled share of biogenic waste increases, which reduces the emissions.

Likewise, the share of wastewater treated in managed sites rises from 58% today to 93% in 2035 with the measures currently in place.

### *Policies reflected in the model*

The following table provides an overview of those policies listed as relevant for the existing measures scenario. It shows how the policies have been reflected in the modelling activity underlying this document. Main effects have been described in the previous paragraphs.

| Abbr. | Policies and measures | Effect on Variable |
|---|---|---|
| EI01 | Environmental refurbishment of Thermal Power Plant (TPP) Pljevlja | Change in environmental loadings for sulfur dioxide and nitrogen oxides to 15% of the non-filtered values from 2023 onwards, reduced generation in 2025. Slightly higher energy efficiency from 2026 (34.5 %). |
| EI02 | New renewable power plants | 58.5 MW of additional capacity of HPP Perucica from 2024.<br>54.6 MW of additional capacity of WPP from 2025.<br>85 MW of additional capacity of PV power plants from 2027.<br>Gradual increase to 4 MW of additional capacity of sHPPs from 2027. |
| EI04 | Refurbishment of small hydro power plants (increased EE) | Gradual additional capacity of 30% over the existing 2.8 MW from 2019 to 2024. |
| EI05 | Development of decentralized energy generation (distribution medium voltage connection) | Gradual increase to 25 MW of installed power in 2030. |
| IP01 | Uniprom KAP: electrolysis cells replacement and overhauling | Anode effect minutes fall to 10% of 2018 in 2024. |
| IP03 | Reduction of HFCs in line with the Law Acknowledging Amendments to the Montreal Protocol on Substances that Deplete the Ozone Layer | Emissions of<br>HFC 32 and others decrease as given in PaM description. |
| E01 | Development of decentralized energy generation by producer - customers (prosumer) | Gradual increase to 248.4 MW of installed power in 2030. |
| W1 | Reduction of bio-waste in municipal waste | MSW composition:<br>Food, Paper, Garden shares change to 75% in 2025, 50% in 2029 33% in 2035. |
| W2 | Increase of connection rate to sewage system (target 93% by 2035) | Sceptic wastewater treatment; linear decrease from 2018 to 2035, reaching 7%. |
| EI08 | Reduction of losses in the electricity transmission power network | Gradual reduction from 17% transmission and distribution losses until 2021 to 4,83% in 2029. |
| EI08 | Reduction of losses in the electricity transmission power network | Gradual reduction from 17% transmission and distribution losses until 2021 to 4,83% in 2029 |
| EO3 | Development and implementation of energy efficiency regulatory framework in buildings | Gradual reduction in final energy intensity for different building categories (by climate zone, building age, building size) according to the SLED "Ambitious" scenario. |

| Abbr. | Policies and measures | Effect on Variable |
|---|---|---|
| EO4 | Increased energy efficiency in public buildings | Final Energy intensity in Public administration, education and health by reconstruction and refurbishment. |
| EO5 | Energy labeling and ecodesign requirements for energy related products | Reduction in energy intensity of refrigerators, freezers, dishwashers and washing machines by 42,4% until 2040 and 50% until 2050. |
| EO6 | Establishment and implementation of EE criteria in public tendering | Final Energy intensity in Public administration, education and health: reduction in energy intensity of 10.6% until 2040 and 12.5% until 2050. |
| EO7 | Implementation of energy efficiency measures in public municipal companies | Final Energy intensity in Public administration: reduction by 30% in energy intensity until 2024 and by 45% until 2050 |
| EO8 | Establishment and development of energy management in public sector | Not explicitly modelled as these are indirect effects and not clearly quantifiable. |
| EO9 | Financial incentives for citizens/private households (for energy efficiency investments) | Gradual reduction in final energy intensity for different building categories (by climate zone, building age, building size) according to the SLED "Ambitious" scenario. |
| EI10 | Market coupling | Not explicitly modelled but necessary for enabling higher accessibility of electricity from other markets, as well as for enabling export of the surplus of electricity production which is increasing over years as more renewable energy sources are part of the system. |
| EI11 | Imbalance netting | Not explicitly modelled but necessary for enabling more efficient balancing of power system with high penetration of new renewable sources and more secure operation of the system. |
| EI12 | Development of electricity transmission power network | Not explicitly modelled but necessary for enabling secure operation of power system, high integration of renewable energy sources and better connectivity with neighboring systems. |
| EI13 | Development of electricity distribution power network | Not explicitly modelled but necessary for higher integration of distributed renewable energy sources and prosumers. |
| RIC01 | Smart Specialisation Strategy of Montenegro 2019-2024 | Not explicitly modelled. |
| RIC02 | Law on incentives for research and innovation development | Not explicitly modelled. |
| RIC03 | Programme for improvement of competitiveness of Montenegrin economy and Industrial Policy of Montenegro – Programme line for incentivising circular economy (link to PaM Transition to circular economy) | Not explicitly modelled. |
| RIC04 | Continuation of Programme for improvement of competitiveness of Montenegrin economy and Industrial Policy of Montenegro – Programme line for energy efficiency in industry | Not explicitly modelled. |

*Table 4.3: The implementation in modelling of policies and measures listed in Chapter 3 as relevant to the scenario with existing measures*

### *Global energy trends, international fossil fuel prices, EU ETS carbon price*

The oil price in the model is assumed to incur a drop in 2020 due to the COVID-19 pandemic. Figure 27 displays the development. This plays into the final energy consumption in the residential sector.

EU ETS Carbon prices are not considered in the existing measures scenario up to 2040. An introduction of carbon pricing is considered as part of an additional policy, the effect of which is described in Section 5.

Finally, the progression of climate change leads to changes in availability of renewable energy. With Montenegro producing a large share of electric energy from hydroelectric sources, related changes in the water cycle are of crucial impact. According to a study by the World Bank (World Bank ESMAP 2009), output from reservoir hydroelectric plants is expected to decrease by 15%

until 2050. Run-of-river hydroelectric plants are expected to see a 20% drop in output. Photovoltaics output is expected to increase by 5% until 2050.

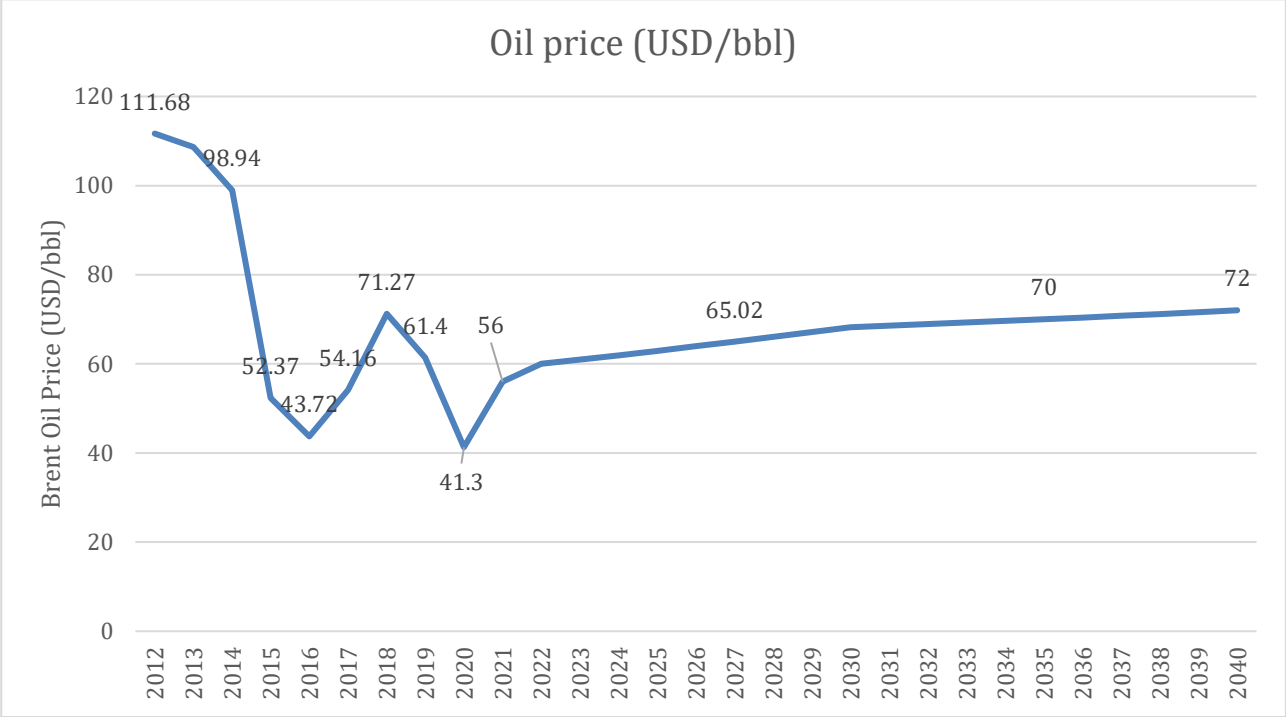



*Figure 27: Oil Price (USD/bbl). Historical data Brent Source: Enerdata Projection data world average. Source: World Bank 2021*

### *Technology cost developments*

In electricity production, the most important technologies used are reservoir hydroelectric plants, followed by run-of-river hydroelectric plants and some wind and solar PV power generation.

Cost assumptions are given in Table 4.4. The table gives those costs relevant for dispatch. In addition, the total system costs are also determined by the capital costs of investments. While conventional power systems are not expected to see a decrease in investment costs, wind and solar power plants will continue to be subject to a substantial decrease in investment costs.

| **Electricity Production Technology** | 2019 | 2040 |
|---|---|---|
| Hydroelectric Fixed OM Cost (USD/$MW_{el}$ Capacity) | 60 000 | 60 000 |
| Photovoltaic power Variable OM Cost (USD/$MWh_{el}$ Output) | 10 | 10 |
| Wind power Onshore Variable OM Cost (USD/$MWh_{el}$ Output) | 15 | 15 |
| Thermal power Lignite Variable OM Cost (USD/$MWh_{el}$ Output)* | 70 | 90 |

*Table 4.4: Electricity Production Costs by technology. Source: IEA 2020*

## 4.2 Dimension Decarbonisation

### 4.2.1 GHG emissions and removals

*Trends in current GHG emissions and removals in the EU ETS, effort sharing and LULUCF sectors and different energy sectors*

Long time trends in GHG emissions can be assessed for Montenegro since the year 2010, due to limited statistics available prior to this date. Several data sources have been assessed and compiled to best of knowledge, mostly building on the data provided by the statistical office MONSTAT (MONSTAT 2021), data supplied by experts in the country and the National Inventory Report (NEPA 2020). The main difficulties currently lie in assessing the energy balance prior to 2009 and transport statistics prior to 2010.
For these reasons, historic trends are only shown here starting from the year 2010. Current trends are given until and including the year 2018. The modelling activity underlying this document starts the projection in 2019. For a better overview of historic developments and future projections considering existing measures, figures and tables are given here only once, in the following section.
Main trends in the period of time up to 2018 include increasing emissions from the energy sectors, in particular (in terms of relative increase) the industrial sector (+38% relative to 2010), the services sector (+34% relative to 2010) and the transport sector (+14%). In absolute numbers, the transport sector dominates (increase of close to 100 ktCO2eq). As explained above, IPPU emissions have seen a decline over this period due to the changes in aluminium production, which is in part compensated by an increase in the use ODS replacement substances. Agriculture and LULUCF emissions have remained largely unchanged, apart from large forest fire events recorded in 2010 and 2016. Emissions from waste treatment have increased by 7% since 2010.

*Projections of sectoral developments with existing national and Union policies and measures at least until 2040 (including for the year 2030)*

Considering the measures classified as existing measures in Chapter 3 and summarized in section 3, the following figures and table show GHG emissions for different sectors. Where appropriate, the emissions are broken down to subsectors, showing an increasing level of sectoral detail.
For better readability, these figures show values for historic trends from the year 2010 to 2018, followed by projections for the years up to 2030, as well as projected values for 2035 to 2050 in five year time steps. Table 4.5 lists historic values for 2010, 2017-2018 as well as projections for 2020 to 2050 in five-year time steps.

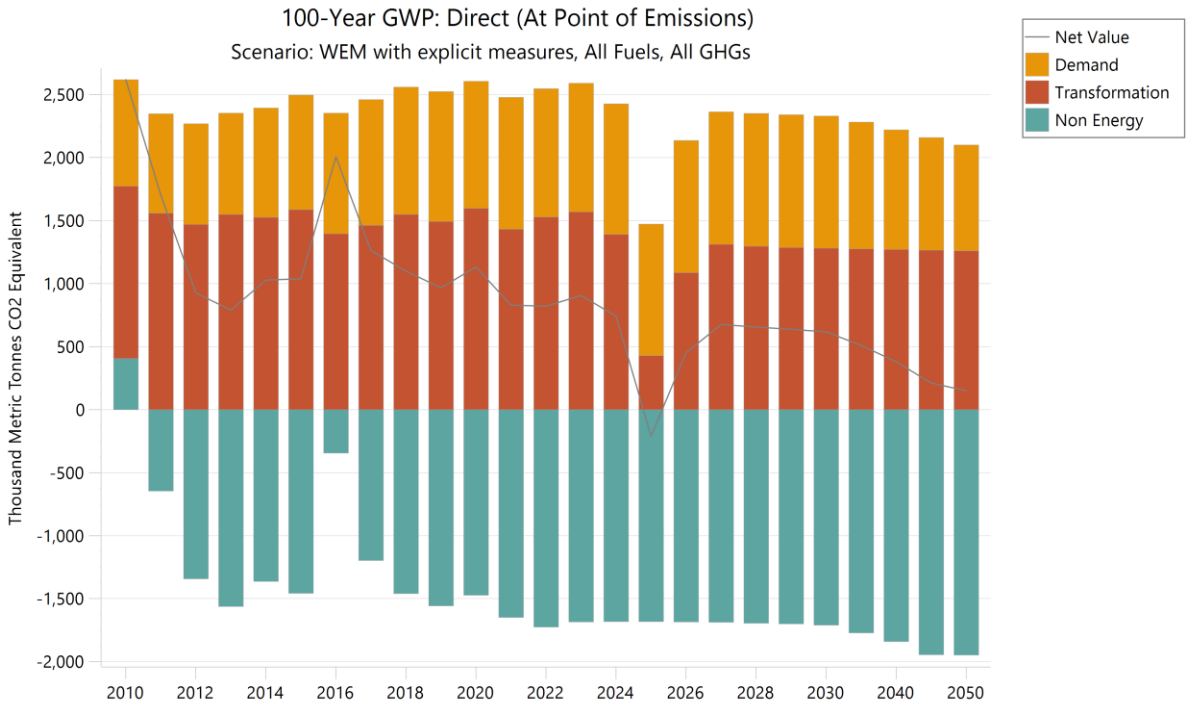



*Figure 28: GHG emissions (CO2eq) for the whole economy for the historic years 2010-2022 and as projected for 2023-2030, 2035 and 2040, 2045 and 2050 with existing measures*

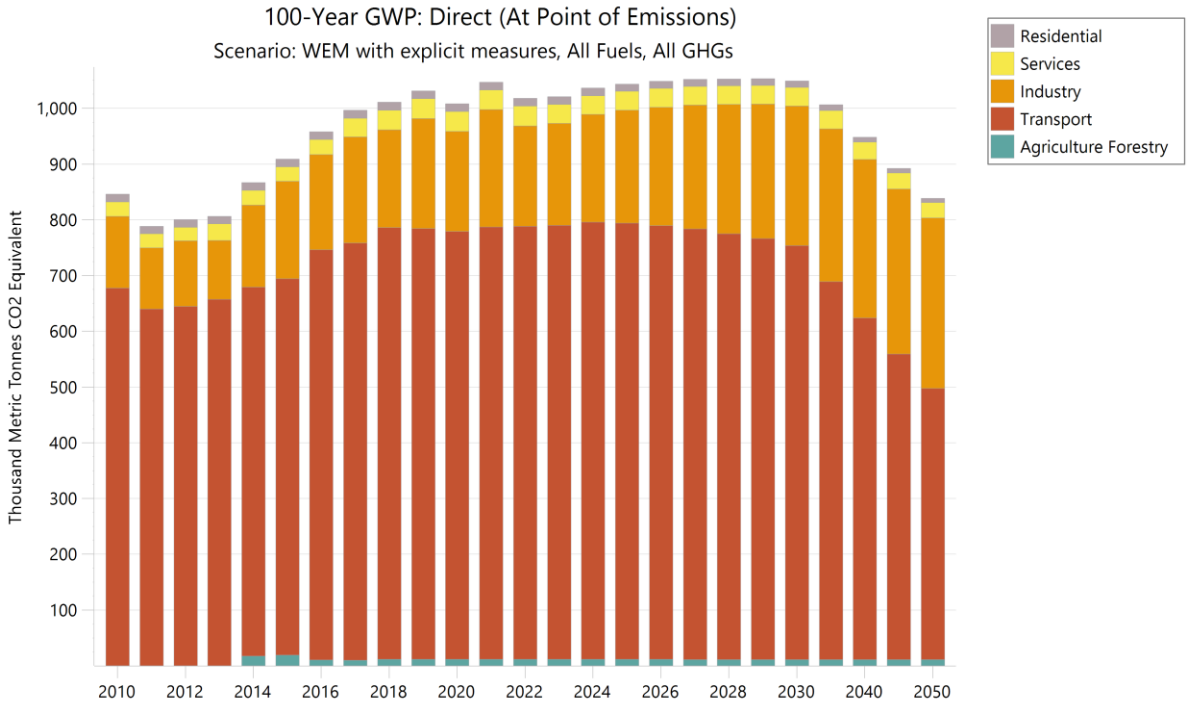



*Figure 29: GHG emissions (CO2eq) for direct emissions of the energy demand sectors for the historic years 2010-2012 and as projected for 2023-2030, 2035 and 2040, 2045 and 2050 with existing measures*

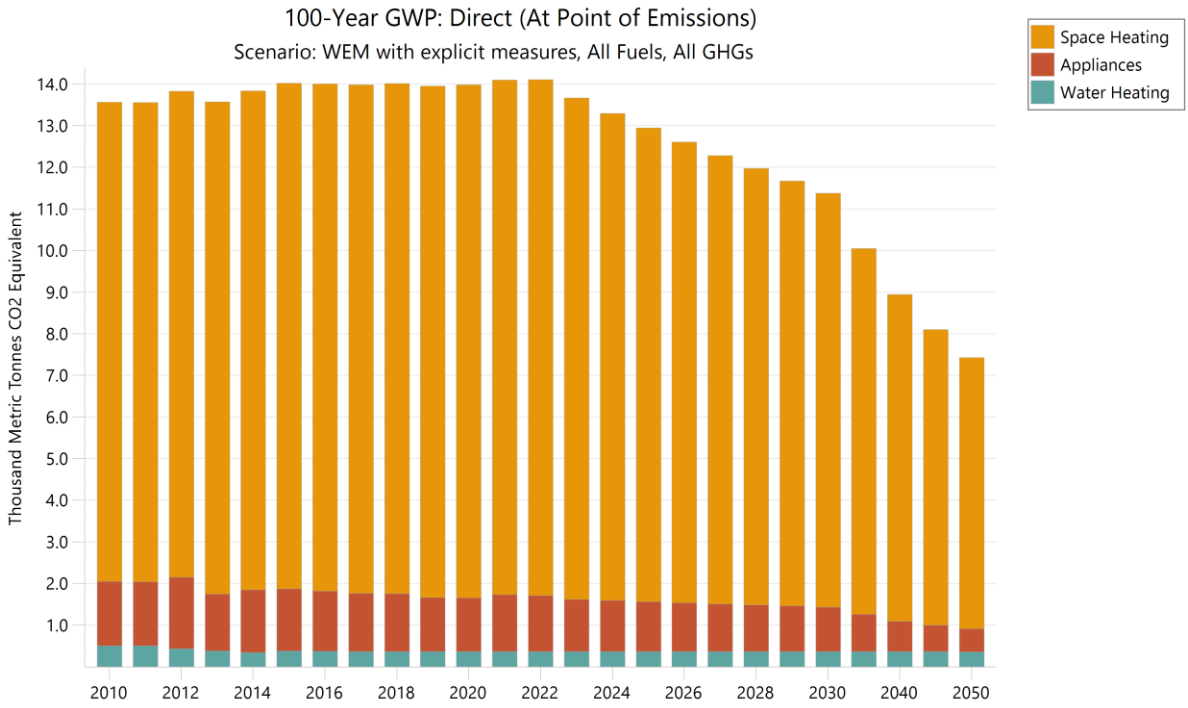



*Figure 30: GHG emissions (CO2eq) for the residential sector for the historic years 2010-2022 and as projected for 2023-2030, 2035 and 2040, 2045 and 2050 with existing measures*

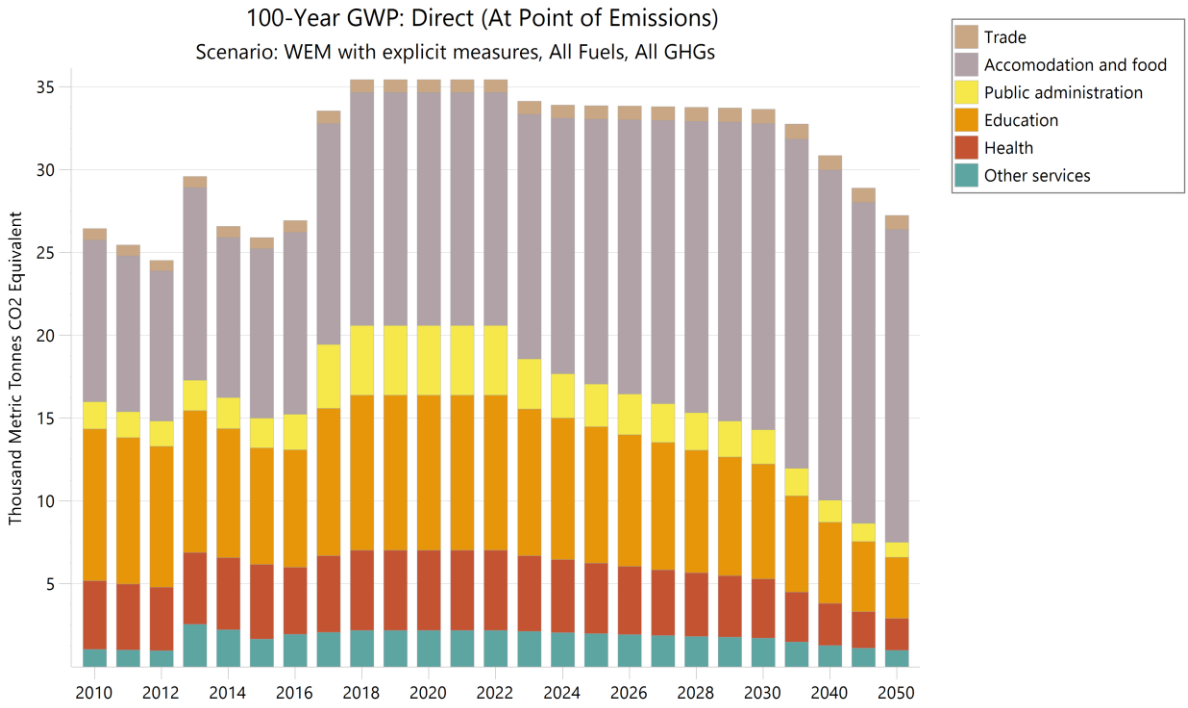



*Figure 31: GHG emissions (CO2eq) for the services sector for the historic years 2010-2022 and as projected for 2023-2030, 2035 and 2040, 2045 and 2050 with existing measures*

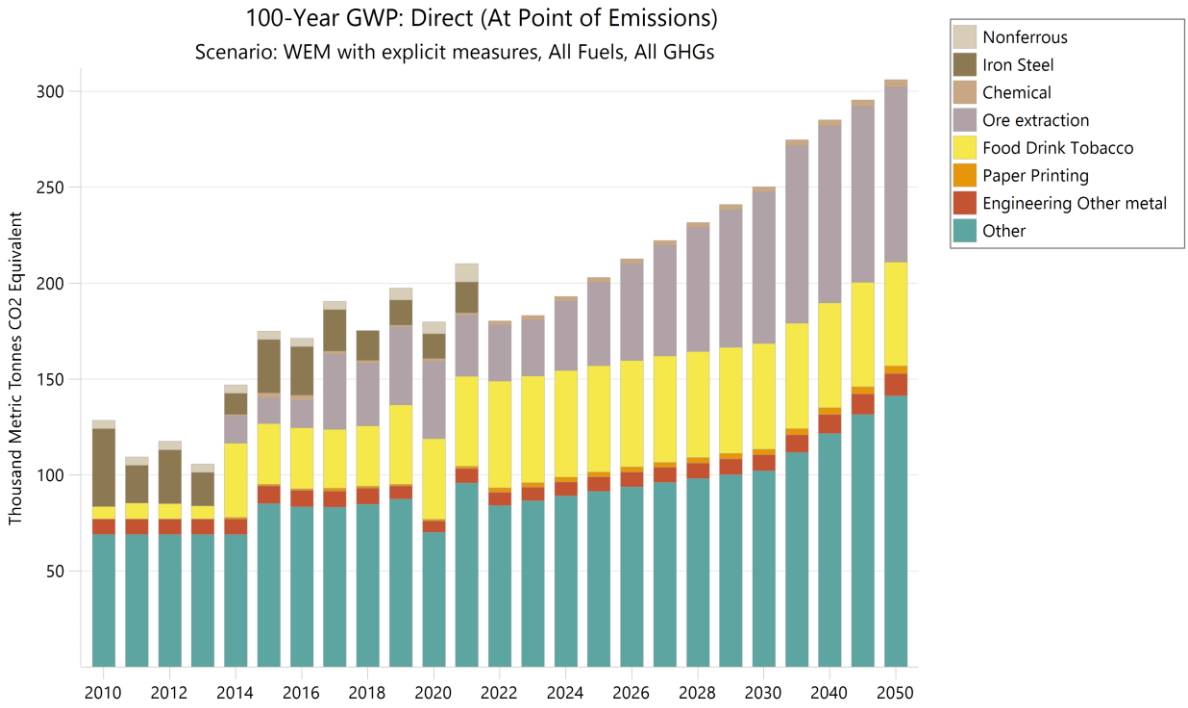



*Figure 32: GHG emissions (CO2eq) for the industry (energy demand) for the historic years 2010-2022 and as projected for 2023-2030, 2035 and 2040, 2045 and 2050 with existing measures*

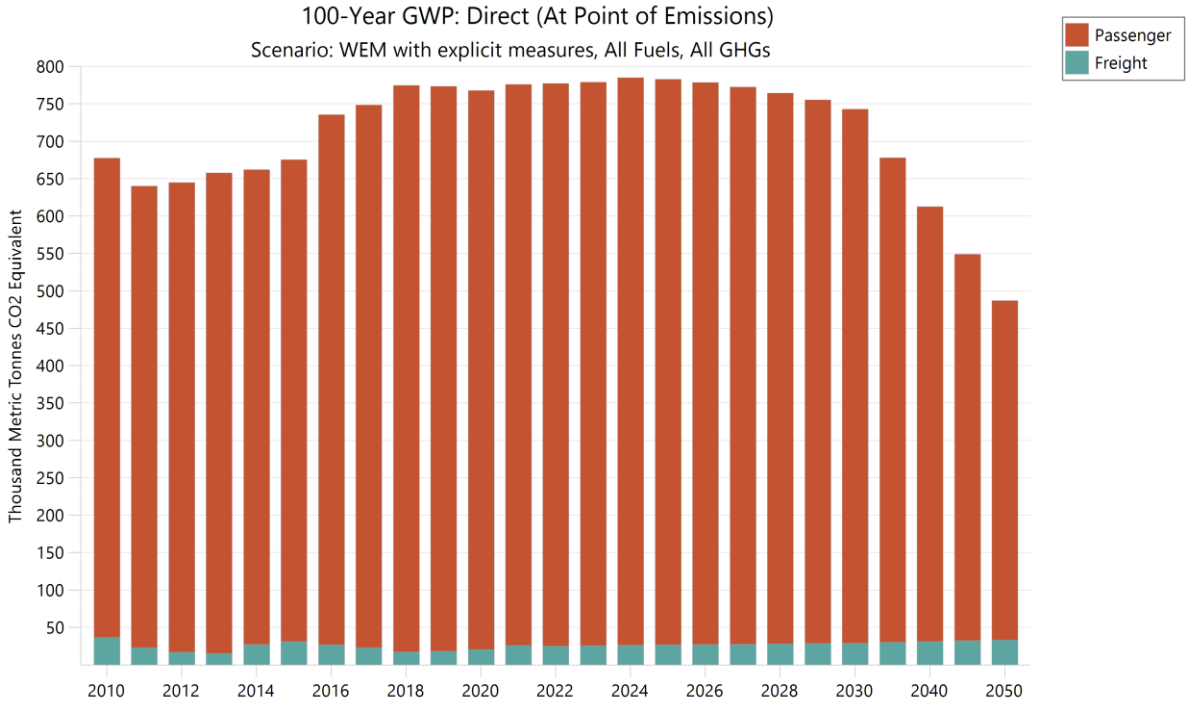



*Figure 33: GHG emissions (CO2eq) for the transport sector for the historic years 2010-2022 and as projected for 2023-2030, 2035 and 2040, 2045 and 2050 with existing measures*

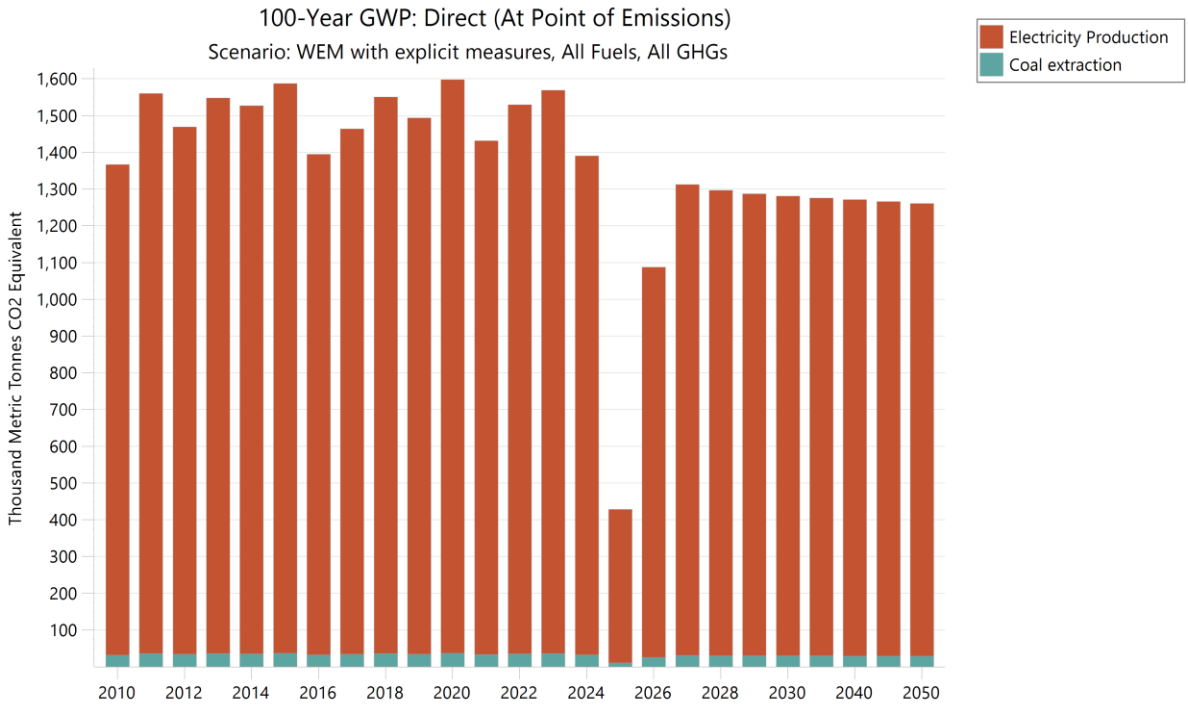



*Figure 34: GHG emissions (CO2eq) for the transformation sector for the historic years 2010-2022 and as projected for 2023-2030, 2035 and 2040, 2045 and 2050 with existing measures*

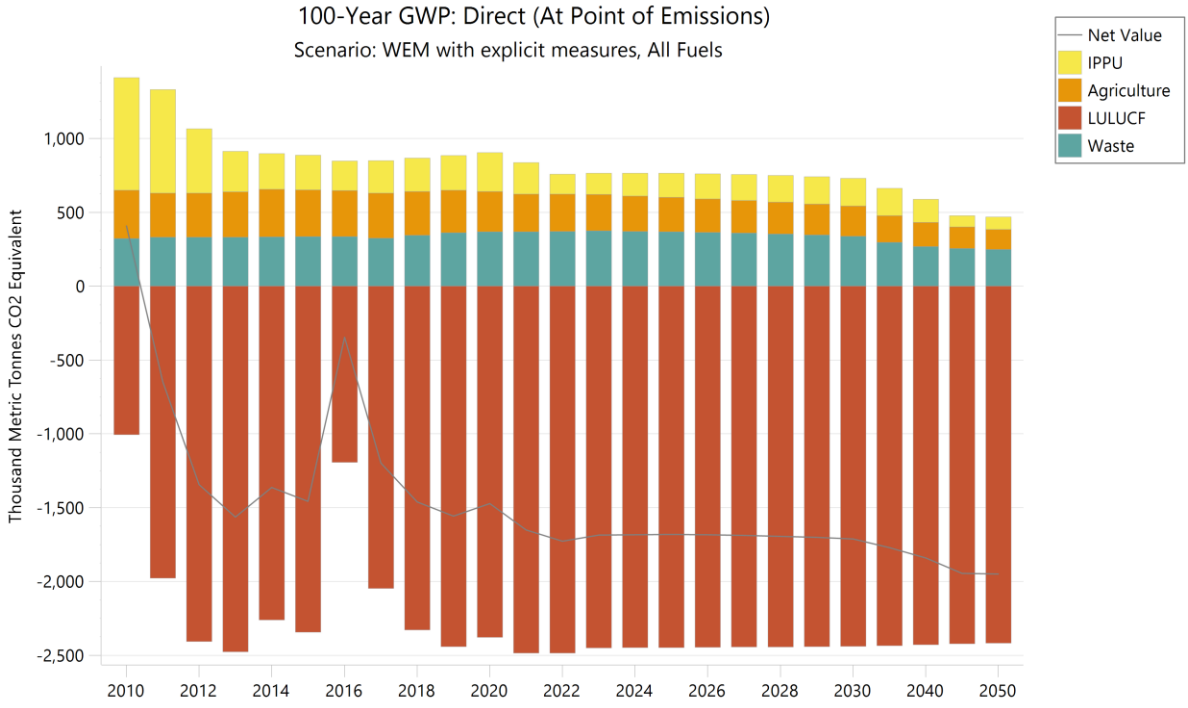



*Figure 35: Non-energy related GHG emissions (CO2eq) for the historic years 2010-2022 and as projected for 2023-2030, 2035 and 2040, 2045 and 2050 with existing measures*

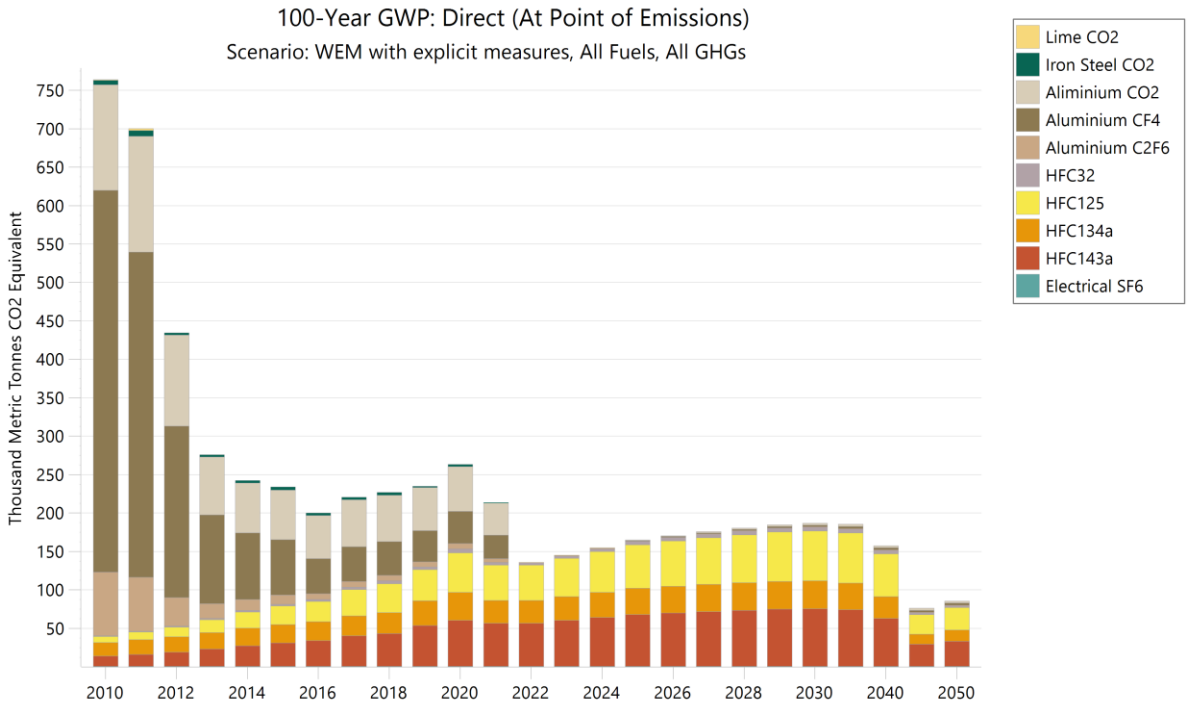



*Figure 36: GHG emissions (CO2eq) from industrial processes and product use for the historic years 2010-2022 and as projected for 2023-2030, 2035 and 2040, 2045 and 2050 with existing measures*

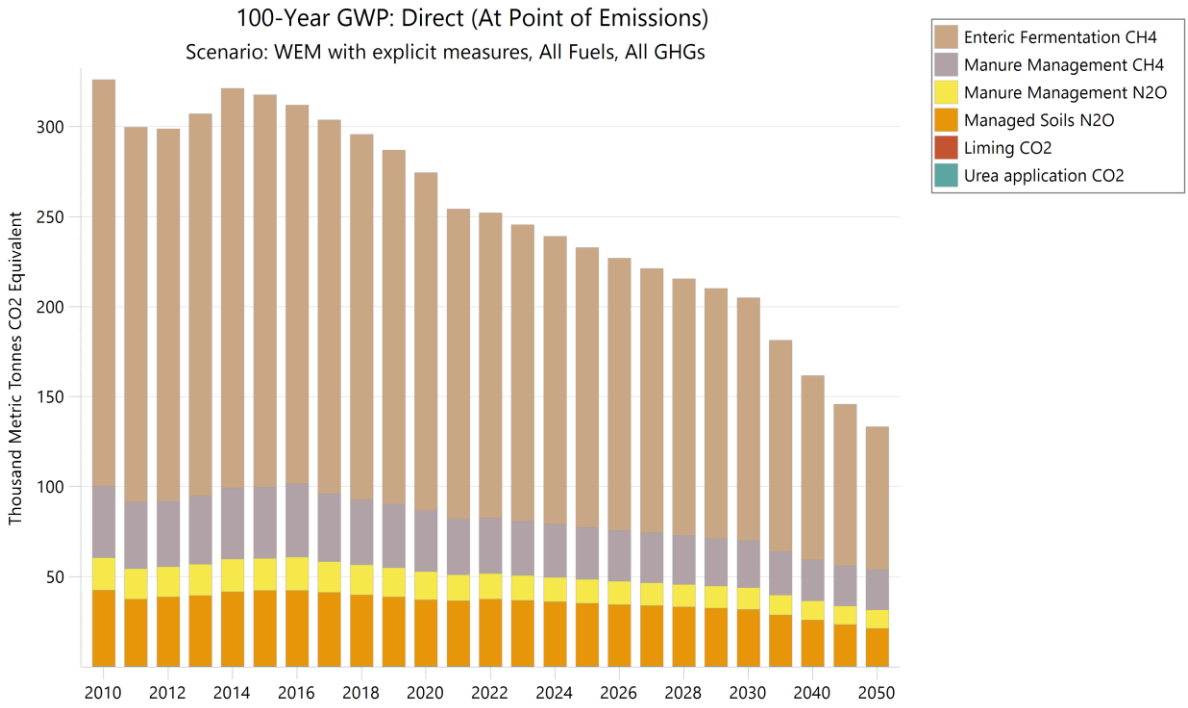



*Figure 37: Non-energy related GHG emissions (CO2eq) from agricultural activities for the historic years 2010-2022 and as projected for 2023-2030, 2035 and 2040, 2045 and 2050 with existing measures*

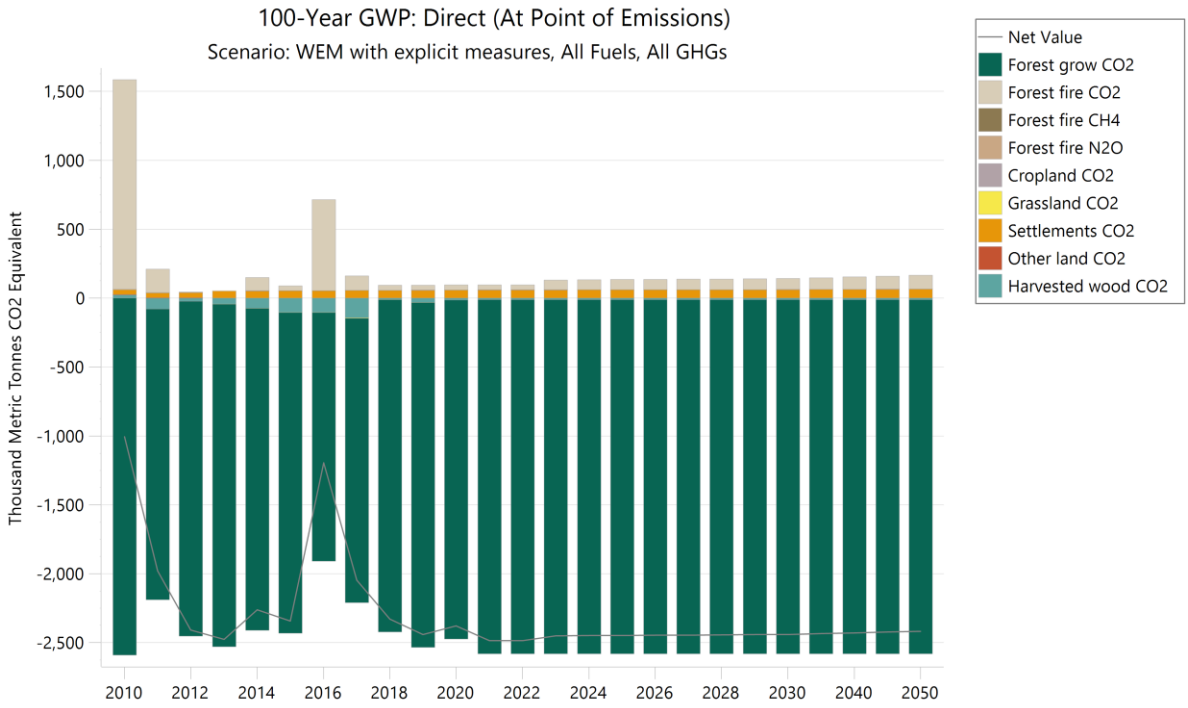



*Figure 38: Non-energy GHG emissions (CO2eq) from land-use, land-use change and forestry (LULUCF) for the historic years 2010-2022 and as projected for 2023-2030, 2035 and 2040, 2045 and 2050 with existing measures*

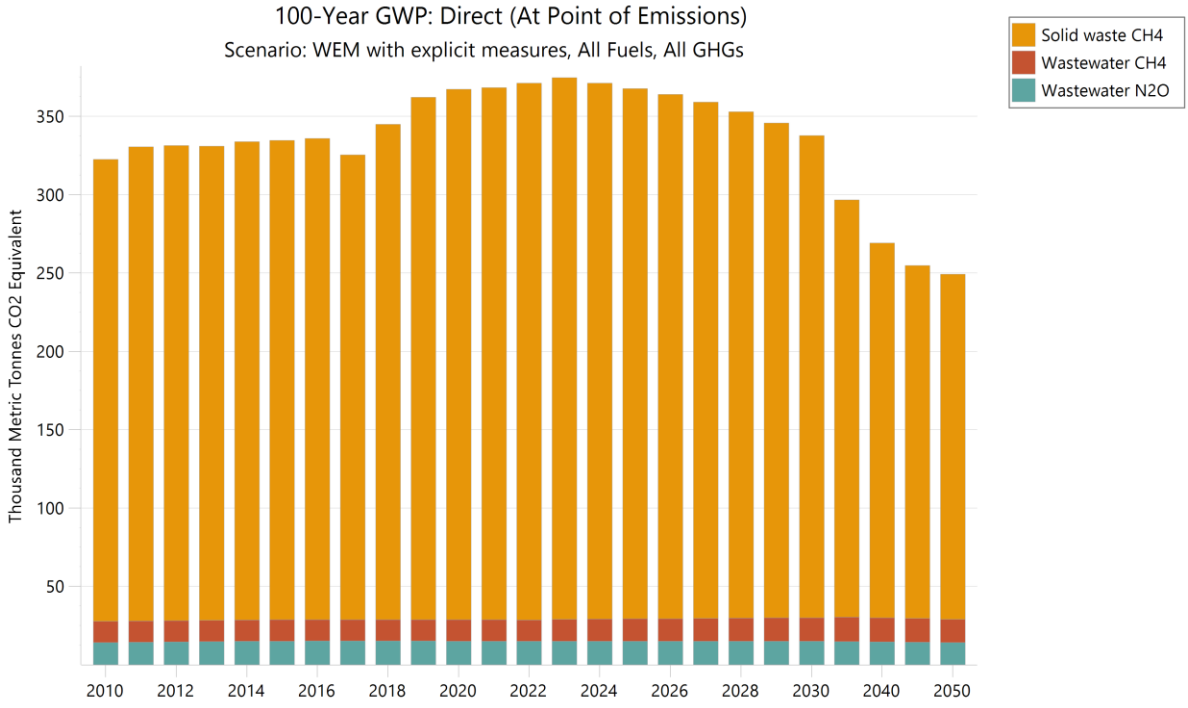



*Figure 39: Non-energy GHG emissions (CO2eq) from the waste sector for the historic years 2010-2022 and as projected for 2023-2030, 2035 and 2040, 2045 and 2050 with existing measures*

| Branch | 2010 | 2015 | 2018 | 2022 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|
| Energy Demand | 846.0 | 909.2 | 1,010.9 | 1,018.2 | 1,043.7 | 1,049.1 | 1,006.3 | 948.5 | 892.1 | 838.3 |
| Transformation | 1,366.4 | 1,587.0 | 1,550.1 | 1,529.6 | 427.9 | 1,280.6 | 1,275.7 | 1,270.8 | 1,265.9 | 1,261.0 |
| Non Energy | 406.7 | -1,457.3 | -1,461.5 | -1,726.4 | -1,681.7 | -1,711.4 | -1,770.9 | -1,839.9 | -1,945.5 | -1,948.7 |
| Total | 2,619.1 | 1,038.9 | 1,099.5 | 821.4 | -210.1 | 618.3 | 511.1 | 379.4 | 212.5 | 150.6 |
| Energy Demand | | | | | | | | | | |
| Residential | 13.6 | 14.0 | 14.0 | 14.1 | 12.9 | 11.4 | 10.0 | 8.9 | 8.1 | 7.4 |
| Services | 26.4 | 25.9 | 35.4 | 35.4 | 33.9 | 33.6 | 32.7 | 30.8 | 28.9 | 27.2 |
| Industry | 128.5 | 175.0 | 175.3 | 180.3 | 202.9 | 250.2 | 274.7 | 285.1 | 295.6 | 306.0 |
| Transport | 677.5 | 675.3 | 774.9 | 777.0 | 782.8 | 742.7 | 677.8 | 612.7 | 548.6 | 486.9 |
| Agriculture Forestry | - | 19.1 | 11.4 | 11.4 | 11.3 | 11.2 | 11.1 | 11.0 | 10.8 | 10.7 |
| Total | 846.0 | 909.2 | 1,010.9 | 1,018.2 | 1,043.7 | 1,049.1 | 1,006.3 | 948.5 | 892.1 | 838.3 |
| Residential | | | | | | | | | | |
| Space Heating | 11.5 | 12.1 | 12.3 | 12.4 | 11.4 | 9.9 | 8.8 | 7.9 | 7.1 | 6.5 |
| Appliances | 1.5 | 1.5 | 1.4 | 1.3 | 1.2 | 1.1 | 0.9 | 0.7 | 0.6 | 0.5 |
| Water Heating | 0.5 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| Total | 13.6 | 14.0 | 14.0 | 14.1 | 12.9 | 11.4 | 10.0 | 8.9 | 8.1 | 7.4 |
| Services | | | | | | | | | | |
| Trade | 0.7 | 0.7 | 0.8 | 0.8 | 0.8 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 |
| Accomodation and food | 9.8 | 10.2 | 14.1 | 14.1 | 16.0 | 18.5 | 19.9 | 19.9 | 19.4 | 18.9 |
| Public administration | 1.6 | 1.8 | 4.2 | 4.2 | 2.6 | 2.1 | 1.7 | 1.3 | 1.1 | 0.9 |
| Education | 9.2 | 7.0 | 9.3 | 9.3 | 8.2 | 6.9 | 5.8 | 4.9 | 4.2 | 3.7 |
| Health | 4.1 | 4.5 | 4.8 | 4.8 | 4.3 | 3.6 | 3.0 | 2.5 | 2.2 | 1.9 |
| Other services | 1.1 | 1.7 | 2.2 | 2.2 | 2.0 | 1.7 | 1.5 | 1.3 | 1.1 | 1.0 |
| Total | 26.4 | 25.9 | 35.4 | 35.4 | 33.9 | 33.6 | 32.7 | 30.8 | 28.9 | 27.2 |
| Industry | | | | | | | | | | |
| Nonferrous | 4.4 | 4.4 | - | - | - | - | - | - | - | - |
| Iron Steel | 40.6 | 27.9 | 15.6 | - | - | - | - | - | - | - |
| Chemical | 0.0 | 2.7 | 1.7 | 2.3 | 2.5 | 2.8 | 3.1 | 3.4 | 3.6 | 3.9 |
| Ore extraction | - | 13.2 | 32.5 | 29.0 | 43.3 | 78.7 | 92.5 | 92.0 | 91.6 | 91.1 |
| Food Drink Tobacco | 6.5 | 31.6 | 31.5 | 55.7 | 55.6 | 55.3 | 55.0 | 54.8 | 54.5 | 54.2 |
| Paper Printing | - | 0.9 | 0.9 | 2.3 | 2.5 | 2.8 | 3.1 | 3.4 | 3.7 | 3.9 |
| Engineering Other metal | 8.0 | 9.2 | 8.5 | 6.9 | 7.5 | 8.4 | 9.2 | 10.0 | 10.8 | 11.6 |
| Other | 68.9 | 85.0 | 84.7 | 84.0 | 91.4 | 102.1 | 111.8 | 121.6 | 131.4 | 141.2 |
| Total | 128.5 | 175.0 | 175.3 | 180.3 | 202.9 | 250.2 | 274.7 | 285.1 | 295.6 | 306.0 |
| Transport | | | | | | | | | | |
| Passenger | 640.8 | 644.4 | 757.6 | 752.2 | 755.9 | 714.1 | 647.8 | 581.5 | 516.5 | 453.9 |
| Freight | 36.8 | 30.9 | 17.3 | 24.8 | 26.8 | 28.6 | 30.0 | 31.1 | 32.2 | 33.1 |
| Total | 677.5 | 675.3 | 774.9 | 777.0 | 782.8 | 742.7 | 677.8 | 612.7 | 548.6 | 486.9 |
| Transformation | | | | | | | | | | |
| Electricity Production | 1,334.8 | 1,550.0 | 1,514.3 | 1,494.3 | 417.7 | 1,251.0 | 1,246.3 | 1,241.5 | 1,236.7 | 1,231.9 |
| Biomass District Heating | - | - | - | - | - | - | - | - | - | - |
| Coal extraction | 31.6 | 37.1 | 35.8 | 35.3 | 10.2 | 29.6 | 29.4 | 29.3 | 29.2 | 29.1 |

| Branch | 2010 | 2015 | 2018 | 2022 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|
| Total | 1,366.4 | 1,587.0 | 1,550.1 | 1,529.6 | 427.9 | 1,280.6 | 1,275.7 | 1,270.8 | 1,265.9 | 1,261.0 |
| Non Energy | | | | | | | | | | |
| IPPU | 763.7 | 233.9 | 226.7 | 135.9 | 164.9 | 186.5 | 185.4 | 157.5 | 76.2 | 85.6 |
| Agriculture | 326.0 | 317.7 | 295.7 | 252.1 | 232.9 | 204.9 | 181.3 | 161.8 | 145.9 | 133.3 |
| LULUCF | -1,005.5 | -2,343.5 | -2,328.8 | -2,485.7 | -2,447.2 | -2,440.4 | -2,434.2 | -2,428.2 | -2,422.4 | -2,416.8 |
| Waste | 322.5 | 334.7 | 345.0 | 371.2 | 367.7 | 337.6 | 296.6 | 269.1 | 254.9 | 249.2 |
| Total | 406.7 | -1,457.3 | -1,461.5 | -1,726.4 | -1,681.7 | -1,711.4 | -1,770.9 | -1,839.9 | -1,945.5 | -1,948.7 |
| IPPU | | | | | | | | | | |
| Lime CO2 | 0.6 | - | - | - | - | - | - | - | - | - |
| Iron Steel CO2 | 6.0 | 4.2 | 3.4 | - | - | - | - | - | - | - |
| Aliminium CO2 | 136.9 | 64.5 | 60.4 | 0.3 | 0.8 | 2.2 | 2.8 | 2.8 | 2.8 | 2.8 |
| Aluminium CF4 | 497.2 | 71.9 | 43.9 | 0.2 | 0.8 | 2.3 | 2.8 | 2.8 | 2.8 | 2.8 |
| Aluminium C2F6 | 82.8 | 12.0 | 7.3 | 0.0 | 0.1 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 |
| HFC32 | 0.8 | 2.2 | 3.7 | 3.3 | 4.3 | 5.1 | 5.3 | 4.6 | 2.2 | 2.5 |
| HFC125 | 7.8 | 24.3 | 37.6 | 46.1 | 56.9 | 64.9 | 65.0 | 55.4 | 25.8 | 29.3 |
| HFC134a | 17.9 | 23.6 | 27.3 | 29.4 | 34.1 | 36.3 | 34.8 | 28.7 | 13.1 | 14.6 |
| HFC143a | 13.5 | 30.9 | 42.8 | 56.2 | 67.5 | 75.0 | 73.9 | 62.2 | 28.7 | 32.5 |
| HFC227ea | - | - | - | - | - | - | - | - | - | - |
| Electrical SF6 | 0.2 | 0.3 | 0.4 | 0.5 | 0.3 | 0.4 | 0.4 | 0.4 | 0.5 | 0.5 |
| Total | 763.7 | 233.9 | 226.7 | 135.9 | 164.9 | 186.5 | 185.4 | 157.5 | 76.2 | 85.6 |
| Agriculture | | | | | | | | | | |
| Enteric Fermentation CH4 | 225.7 | 218.1 | 202.9 | 169.4 | 155.4 | 134.9 | 117.4 | 102.5 | 90.0 | 79.4 |
| Manure Management CH4 | 39.7 | 39.4 | 36.2 | 30.9 | 28.8 | 26.1 | 24.0 | 22.7 | 22.1 | 22.3 |
| Manure Management N2O | 18.1 | 18.0 | 16.7 | 14.2 | 13.3 | 12.1 | 11.1 | 10.6 | 10.3 | 10.4 |
| Managed Soils N2O | 42.1 | 41.9 | 39.5 | 37.1 | 34.9 | 31.4 | 28.4 | 25.6 | 23.1 | 20.8 |
| Liming CO2 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Urea application CO2 | 0.4 | 0.3 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| Total | 326.0 | 317.7 | 295.7 | 252.1 | 232.9 | 204.9 | 181.3 | 161.8 | 145.9 | 133.3 |
| LULUCF | | | | | | | | | | |
| Forest growth CO2 | -2,590.7 | -2,325.6 | -2,410.2 | -2,569.0 | -2,569.0 | -2,569.0 | -2,569.0 | -2,569.0 | -2,569.0 | -2,569.0 |
| Forest fire CO2 | 1,522.5 | 34.2 | 36.3 | 36.3 | 74.0 | 79.2 | 84.4 | 89.6 | 94.8 | 100.0 |
| Forest fire CH4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Forest fire N2O | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Cropland CO2 | 0.7 | 0.5 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| Grassland CO2 | 0.3 | -0.6 | -0.9 | - | - | - | - | - | - | - |
| Wetlands CO2 | - | - | - | - | - | - | - | - | - | - |
| Settlements CO2 | 35.5 | 53.4 | 56.4 | 59.2 | 60.0 | 61.5 | 62.6 | 63.3 | 63.9 | 64.3 |
| Other land CO2 | 1.9 | - | - | - | - | - | - | - | - | - |
| Harvested wood CO2 | 24.0 | -105.3 | -11.0 | -12.7 | -12.7 | -12.7 | -12.7 | -12.7 | -12.7 | -12.7 |
| Total | -1,005.5 | -2,343.5 | -2,328.8 | -2,485.7 | -2,447.2 | -2,440.4 | -2,434.2 | -2,428.2 | -2,422.4 | -2,416.8 |
| Waste | | | | | | | | | | |
| Solid waste CH4 | 294.8 | 305.8 | 316.1 | 342.6 | 338.4 | 307.6 | 266.2 | 239.0 | 225.3 | 220.2 |

| Branch | 2010 | 2015 | 2018 | 2022 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|
| Wastewater CH4 | 13.7 | 13.7 | 13.7 | 13.6 | 14.3 | 15.0 | 15.6 | 15.4 | 15.1 | 14.9 |
| Wastewater N2O | 14.1 | 15.1 | 15.1 | 15.0 | 15.0 | 15.0 | 14.8 | 14.6 | 14.4 | 14.1 |
| Total | 322.5 | 334.7 | 345.0 | 371.2 | 367.7 | 337.6 | 296.6 | 269.1 | 254.9 | 249.2 |

*Table 4.5: GHG emissions (kt CO2eq) for different branches of the economy, as determined for the historic years 2010, 2015, 2018, 2020, 2022 and as projected for 2025, 2030, 2035 2040 and 2050 with existing measures*

Some of the emissions account for gases other than CO2. As noted above, these are given in terms of their 100-year global warming potential CO2-equivalent. For completeness, the following table gives the factor used to calculate this value from physical emissions of the respective gases.

| Common name | Abbreviation | GWP (100 yr: tCO2eq/t) |
|---|---|---|
| Carbon Dioxide | CO2 | 1 |
| Methane | CH4 | 30 |
| Nitrous Oxide | N2O | 265 |
| HFC-125 | CHF2CF3 | 3170 |
| HFC-134a | CH2FCF3 | 1300 |
| Sulphur hexafluoride | SF6 | 23500 |
| PFC-14 | CF4 | 6630 |
| PFC-116 | C2F6 | 11100 |
| HFC-143a | CH3CF3 | 4800 |
| HFC-227ea | CF3CHFCF3 | 3350 |
| HFC-32 | CH2F2 | 677 |

*Table 4.6: 100 year global warming potential for those gases considered in the projection.*

### 4.2.2 Renewable Energy

*Current share of renewable energy in gross final energy consumption and in different sectors (heating and cooling, electricity and transport) as well as per technology in each of these sectors*

Current overall RES share (2022 as drawn from the modelling study) is at 45.5% with RES-E at 65.3%. Current values in renewable energy are discussed in conjunction with projections with existing measures in the next section.

| Indicator | 2022 |
|---|---|
| RES | 45.5 |
| RES T | 1.5 |
| RES E | 65.3 |
| RES HC | 63.1 |

*Table 4.7: RES indicators in base year*

| Indicator | 2022 |
|---|---|
| RES E hydro | 60.5 |
| RES E wind | 4.8 |
| RES E solar | 0.1 |

*Table 4.8: RES E indicator structure per technology in base year*

### *Indicative projections of development with existing policies for the year 2030 (with an outlook to the year 2040)*

Renewable shares in final energy consumption are determined according to Directive 2009/28/EC (RED; EU (2009); also see European Commission (2018)). The following figures show historic data in RES share for 2010-2018 and projections with existing measures. For the share in transport (RES-T), this includes the multipliers for the use of electricity in road and rail transport, which explains the strong increase (electricity is used to meet 2.1% of final energy demand in the transport sector in 2030, increasing to 6.6% in 2040 in the scenario with existing measures). No advanced biofuels (with increased multipliers) are considered. The share of renewable energy in heating and cooling (RES-HC) falls as the share of wood for heating decreases. The share of renewable electricity (RES-E) is largely determined by hydropower, with a small share of wind energy. Subsequent figures give technological details on each RES indicator.

Figure 40 gives historic values as calculated from the model underlying this document. In addition to the standard RES indicators, the figure also gives the overall RES share except for the use of wood in all sectors. This shows that the use of wood as energy carrier presents a substantial part of the overall final energy demand. However, as RES share decreases, the share of RES share ex wood stays constant, showing that this importance is projected to decline.

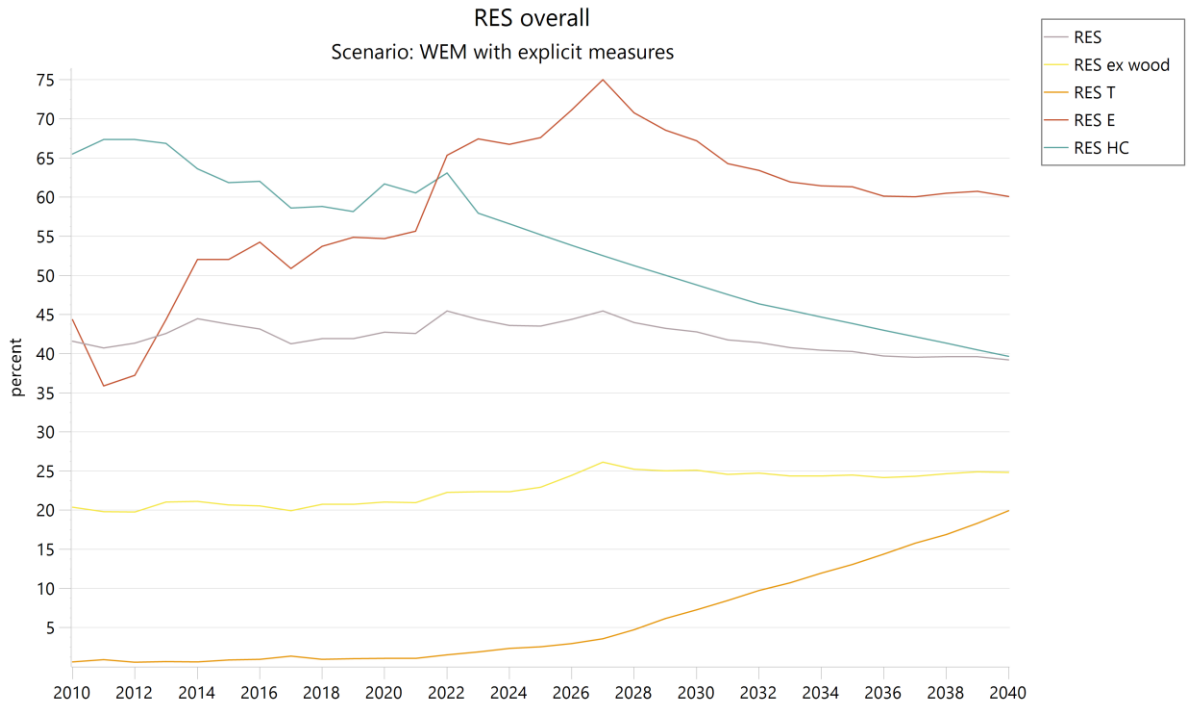



*Figure 40: RES shares in final energy demand, calculated according to RED (Directive 2009/28/EC) for historic years 2010-2022 and projections up to year 2040 with existing measures*

| Values in [%] | 2010 | 2015 | 2018 | 2022 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|
| RES | 41.6 | 43.8 | 41.9 | 45.5 | 43.5 | 42.8 | 40.3 | 39.2 | 39.3 | 38.8 |
| RES ex wood | 20.4 | 20.7 | 20.8 | 22.3 | 22.9 | 25.1 | 24.5 | 24.8 | 26.0 | 26.7 |
| RES T | 0.6 | 0.9 | 0.9 | 1.5 | 2.6 | 7.3 | 13.1 | 20.0 | 27.8 | 36.5 |
| RES E | 44.4 | 52.0 | 53.7 | 65.3 | 67.6 | 67.2 | 61.3 | 60.1 | 61.0 | 60.4 |
| RES HC | 65.5 | 61.9 | 58.8 | 63.1 | 55.2 | 48.8 | 43.9 | 39.7 | 36.0 | 32.5 |

*Table 4.9: RES shares in final energy demand, calculated according to RED (Directive 2009/28/EC) for historic years 2010, 2015, 2018, 2022 and projections up to year 2050 in five year time steps with existing measures*

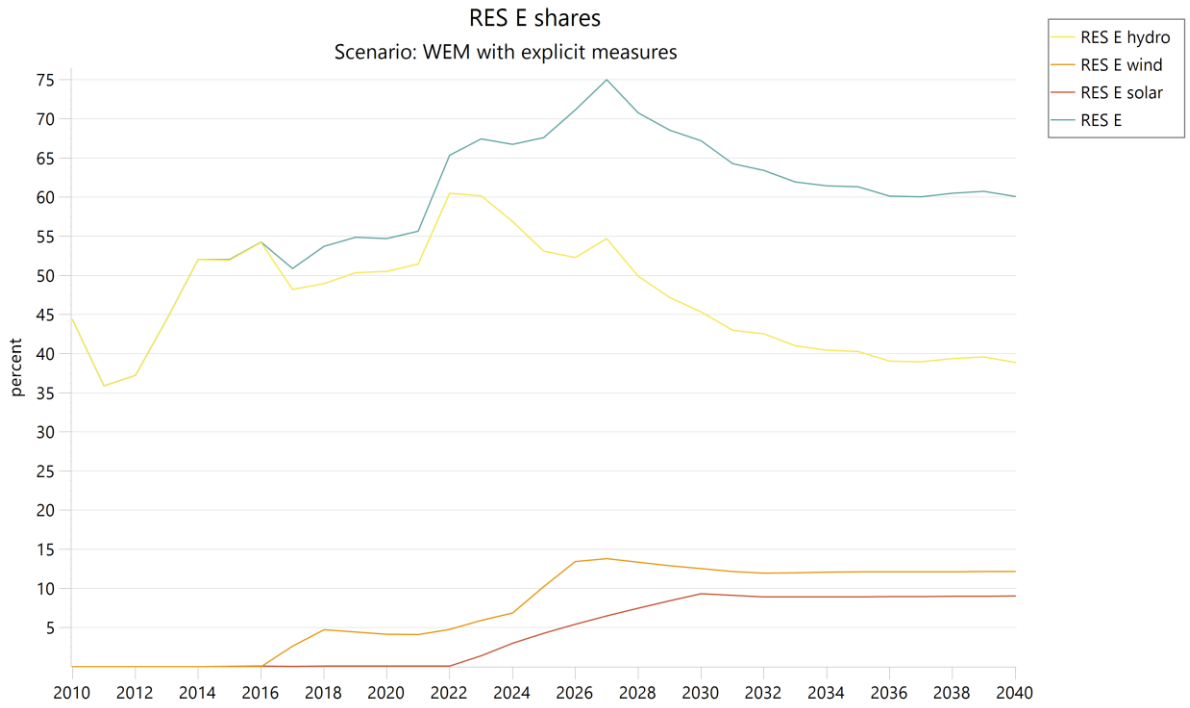



*Figure 41: RES-E share and components thereof, calculated according to RED (Directive 2009/28/EC) for historic years 2010-2022 and projections up to year 2040 with existing measures*

| Values in [%] | 2010 | 2015 | 2018 | 2022 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|
| RES E hydro | 44.4 | 52.0 | 48.9 | 60.5 | 53.1 | 45.3 | 40.3 | 38.9 | 39.7 | 39.2 |
| RES E wind | - | - | 4.7 | 4.8 | 10.2 | 12.5 | 12.1 | 12.2 | 12.2 | 12.1 |
| RES E solar | - | 0.1 | 0.1 | 0.1 | 4.3 | 9.3 | 8.9 | 9.0 | 9.1 | 9.1 |
| RES E | 44.4 | 52.0 | 53.7 | 65.3 | 67.6 | 67.2 | 61.3 | 60.1 | 61.0 | 60.4 |

*Table 4.10: RES E shares in final energy demand, calculated according to RED (Directive 2009/28/EC) for historic years 2010, 2015, 2018, 2022 and projections up to year 2050 in five year time steps with existing measures*

The following figure shows fuels currently used in the transport sector and projections until 2050. No biodiesel share is considered and this is not projected to play a role with existing measures. Electricity is used to meet a limited share of energy demand in the transport sector.

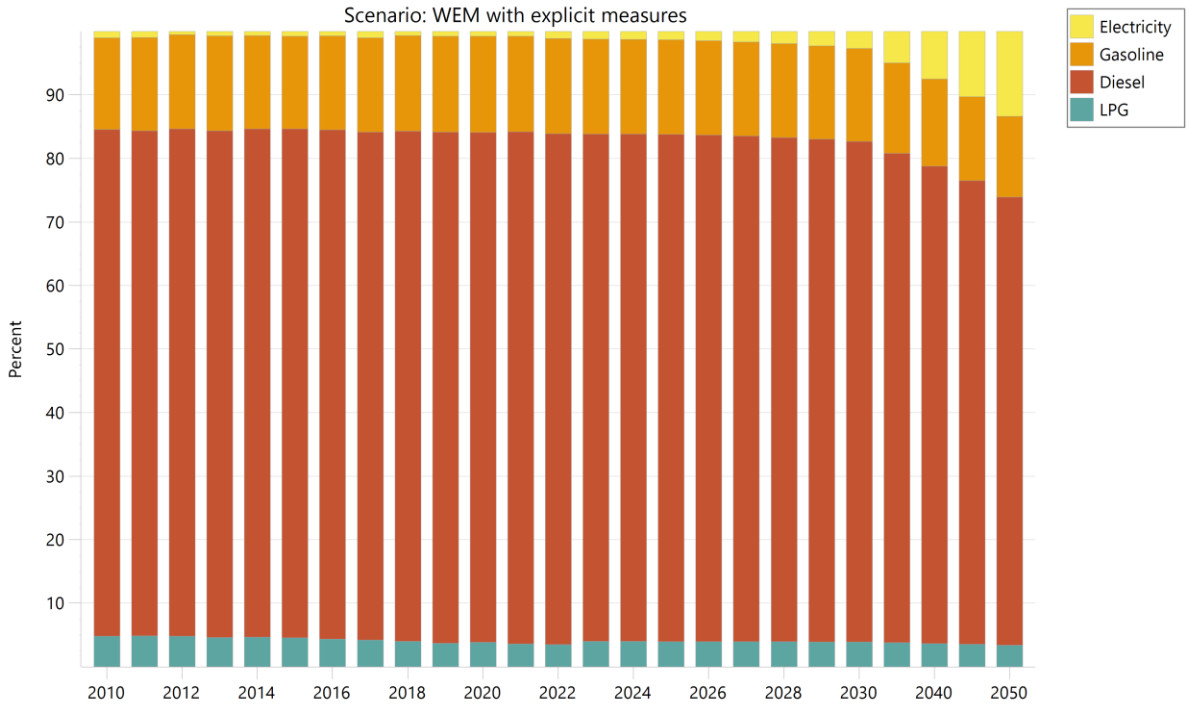



*Figure 42: Energy sources in the transport sector given in percent of total demand to accompany and explain the RES-T share given in Figure 40*

| Fuel | 2010 | 2017 | 2018 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|
| Electricity | 1.0% | 0.7% | 0.7% | 1.1% | 1.3% | 2.7% | 5.0% | 7.5% | 10.3% | 13.4% |
| Gasoline | 14.5% | 14.6% | 15.0% | 15.0% | 14.9% | 14.6% | 14.2% | 13.7% | 13.2% | 12.7% |
| Diesel | 79.7% | 80.1% | 80.3% | 80.4% | 79.8% | 78.8% | 77.0% | 75.1% | 73.0% | 70.6% |
| Hydrogen | - | - | - | - | - | - | - | - | - | - |
| CNG | 4.8% | 4.6% | 4.0% | 3.5% | 4.0% | 3.9% | 3.8% | 3.7% | 3.5% | 3.4% |
| Biodiesel | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Hybrid Diesel | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Hybrid Gasoline | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Total | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

*Table 4.11: Shares of technologies in the transport sector for historic years 2010, 2015, 2018, 2022 and as projected up to year 2050 with existing measures*

The RES-HC share combines all renewable energies other than electricity, heat and bioliquids in sectors other than transport. This concerns the residential, services, industry, agriculture and forestry sector and the fuels wind, solar, wood, hydro and biomass. Of these, only wood plays a substantial role, which is used mainly for space and water heating and cooking as well as some industrial and agricultural processes. The following table gives the share of wood in total final energy in each of the demand sectors. Note that the RES-HC share reports the share of renewable energy in relation to the final energy demand other than electricity, which explains the higher percentage in RES-HC compared to the values shown in the following table.

| Sector | 2010 | 2015 | 2018 | 2022 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|
| Residential | 58.5% | 56.5% | 55.6% | 55.1% | 54.0% | 51.9% | 49.3% | 46.3% | 43.0% | 39.5% |
| Services | 10.3% | 9.7% | 10.1% | 10.1% | 10.3% | 10.5% | 10.6% | 10.6% | 10.6% | 10.5% |
| Industry | 0.5% | 7.8% | 6.8% | 13.5% | 11.1% | 8.0% | 7.2% | 7.1% | 7.1% | 7.0% |
| Agriculture Forestry | 0.0% | 0.0% | 10.2% | 10.2% | 10.2% | 10.2% | 10.2% | 10.2% | 10.2% | 10.2% |
| Overall | **21.2%** | **23.1%** | **21.2%** | **23.2%** | **20.6%** | **17.7%** | **15.8%** | **14.4%** | **13.3%** | **12.2%** |

*Table 4.12: Shares of wood final energy demand. Note that the share here does not equal the RES HC share, as the reference in RES HC is not final energy, but final energy other than electricity*

Figure 43 shows the final energy demand for space heating in the residential sector as the sector with the largest demand in renewable energy other than electricity. The final energy demand decreases over time as buildings are renovated, explained in section 4.1. The renovation leads to a decrease in the final energy intensity for heating. In addition, it is assumed that heat pumps replace electricity for heating if deep renovation takes place, where deep renovation is understood as e.g. replacing windows in line with SLED (2015). The energy contained in the ambient heat is not explicitly reflected in the projection, only the electricity used to run the heat pump. This determines the final energy intensity of space heating, which consequently sees a strong reduction.

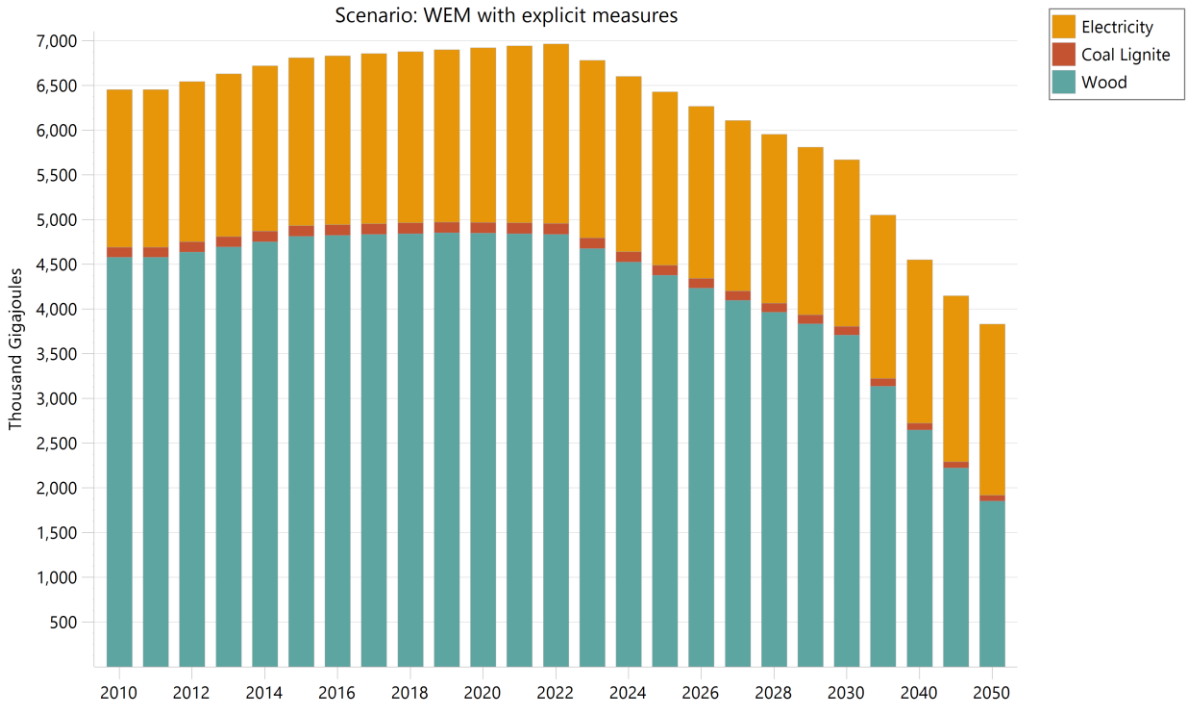



*Figure 43: Final energy and fuels used in the residential sector for space heating across all building classes and geographic zones for historic years 2010-2022 and as projected for up to year 2030 and up to 2050 in five year steps with existing measures*

## 4.3 Dimension Energy Efficiency

*Current primary and final energy consumption in the economy and per sector (including industry, residential, service and transport)*

The current final energy consumption of Montenegro (2018) is at 820.2 ktoe, with primary energy consumption at 1203 ktoe. Historic values for the years 2010 to 2018 are shown below in combination with projections considering existing policies and measures.

*Current potential for the application of high-efficiency cogeneration and efficient district heating and cooling*

The power supply of Montenegro is currently based on hydropower and the thermal power plant in Pljevlja, with small shares of solar PV and wind. The thermal power plant presents the chance for cogeneration of heat and a related project is considered as an additional measure, described in chapter 5. There is limited industry that could provide a source for cogeneration, potentially the iron and steel manufacturing. There is a general potential for district heating, as the use of fuel wood for heating is high, particularly in older buildings.

*Projections considering existing energy efficiency policies, measures and programmes as described in point 1.2. (ii) for primary and final energy consumption for each sector at least until 2040 (including for the year 2030)*

Net primary energy supply in Montenegro is currently (2018 value) at 1203 ktoe and is projected to remain in this order of magnitude, with a value of 1196 ktoe by 2030 and 1163 ktoe by 2040 with existing measures. Figure 44 shows the projection of the primary energy supply. The figure shows net values of each fuel category, e.g., electricity is only displayed when it is not produced in the country from primary energy sources (mostly hydro and coal), but imported. There is almost no net export of primary energy, an exception being the historic year 2018 with limited net export of electricity.

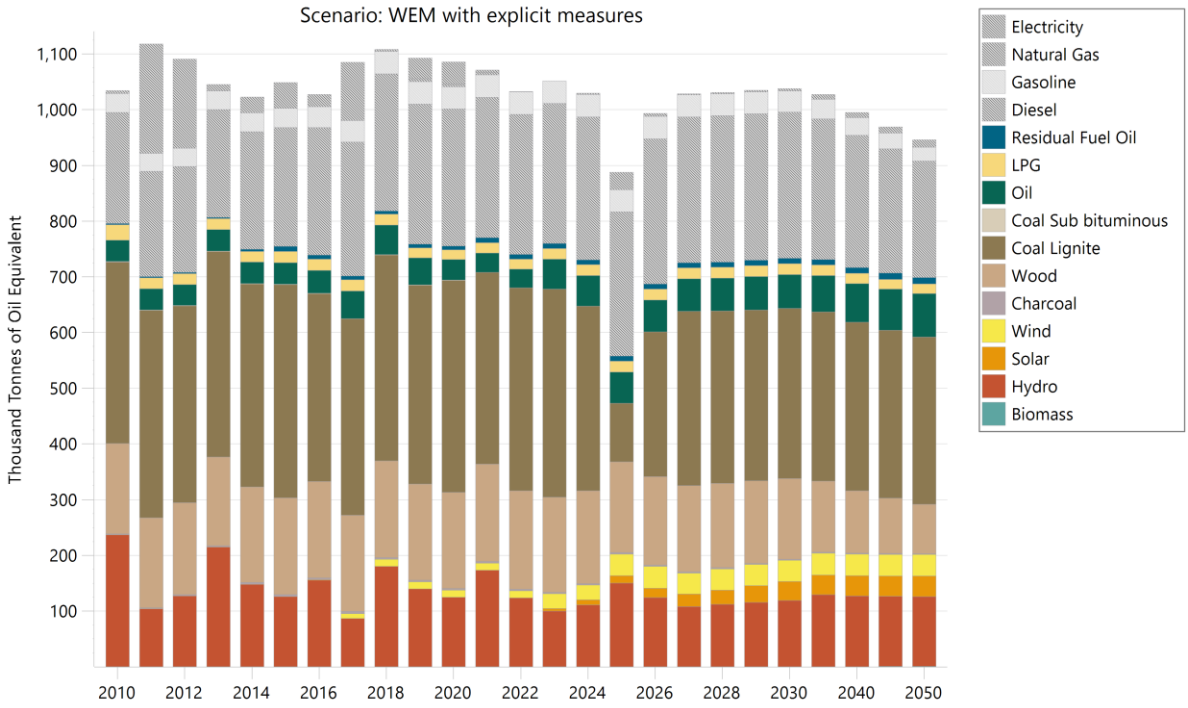



*Figure 44: Primary energy supply for historic years 2010-2022 and as projected up to the year 2030 and 2050 in five year steps with existing measures*

| Fuel | 2010 | 2015 | 2018 | 2022 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|
| Electricity | 5.3 | 45.8 | 0.1 | 1.0 | 31.1 | 4.0 | 8.8 | 9.4 | 10.8 | 13.0 |
| Natural Gas | - | - | 3.7 | - | - | - | - | - | - | - |
| Gasoline | 33.8 | 34.9 | 40.3 | 40.3 | 40.3 | 38.3 | 35.0 | 31.7 | 28.5 | 25.4 |
| Diesel | 199.4 | 213.2 | 245.9 | 251.3 | 258.6 | 262.4 | 252.2 | 237.3 | 222.7 | 208.6 |
| Residual Fuel Oil | 2.4 | 8.9 | 5.8 | 8.7 | 9.1 | 9.7 | 10.2 | 10.8 | 11.3 | 11.8 |
| LPG | 27.8 | 20.3 | 19.6 | 17.6 | 19.4 | 19.4 | 19.0 | 18.4 | 17.8 | 17.1 |
| Oil | 38.2 | 38.9 | 53.4 | 33.9 | 56.2 | 60.9 | 65.1 | 69.3 | 73.5 | 77.9 |
| Coal Sub bituminous | 0.8 | 0.5 | 0.4 | - | - | - | - | - | - | - |
| Coal Lignite | 326.0 | 383.0 | 369.7 | 364.2 | 105.3 | 305.4 | 304.0 | 302.8 | 301.5 | 300.3 |
| Wood | 162.0 | 173.7 | 173.8 | 176.6 | 162.9 | 144.7 | 127.6 | 112.0 | 99.7 | 88.9 |
| Charcoal | 2.0 | 3.3 | 3.0 | 3.0 | 2.4 | 2.0 | 1.7 | 1.4 | 1.2 | 1.1 |
| Wind | - | - | 12.4 | 12.4 | 39.0 | 38.3 | 39.0 | 39.0 | 39.0 | 39.0 |
| Solar | 0.1 | 0.2 | 0.3 | 0.3 | 13.2 | 33.7 | 35.6 | 35.9 | 36.5 | 37.1 |
| Hydro | 236.5 | 125.5 | 179.9 | 123.4 | 150.0 | 119.0 | 128.8 | 127.0 | 126.0 | 125.3 |
| Biomass | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 |
| **Total** | **1,034.2** | **1,048.5** | **1,108.5** | **1,032.8** | **887.7** | **1,037.9** | **1,027.3** | **995.2** | **968.8** | **945.9** |

*Table 4.13: Primary energy supply for historic years 2010-2022 and as projected up to the year 2030 and for 2035 and 2040 with existing measures*

Final energy consumption is currently (2018 value) at 820.2 ktoe, projected to increase to 856 ktoe by 2030 and then decrease to 822 ktoe by 2050. Final energy consumption is used synonymous to final energy demand and abbreviated by FEC in the following. Table 4.14 gives

the total final energy demand. The ratio of FEC to TPES is also given, remaining at approximately 71% throughout. This is largely determined by the efficiency of the thermal power plant. Figure 45 and Table 4.15 show the share of different sectors in final energy demand.
Following this, a series of figures show the final energy demand per sector, broken down to respective subsectors, again for historic values from 2010 to 2018, projections until the year 2030 and for 2035 and onward to 2050 in five year time steps. As with GHG emissions, this is followed by a table, which gives the values for 2010, 2017-2018, and 2020 to 2050 in five year time steps.

| | 2010 | 2015 | 2018 | 2022 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|
| Final energy demand [ktoe] | 764.6 | 752.6 | 821.1 | 761.6 | 790.7 | 817.3 | 807.2 | 777.5 | 753.2 | 732.4 |
| FEC to TPES | 73.9% | 71.8% | 74.1% | 73.7% | 89.1% | 78.7% | 78.6% | 78.1% | 77.7% | 77.4% |

*Table 4.14: Final energy demand for historic years 2010, 2015, 2018, 2022 and as projected up to the year 2030 as well as up to 2050 in five year time steps with existing measures*

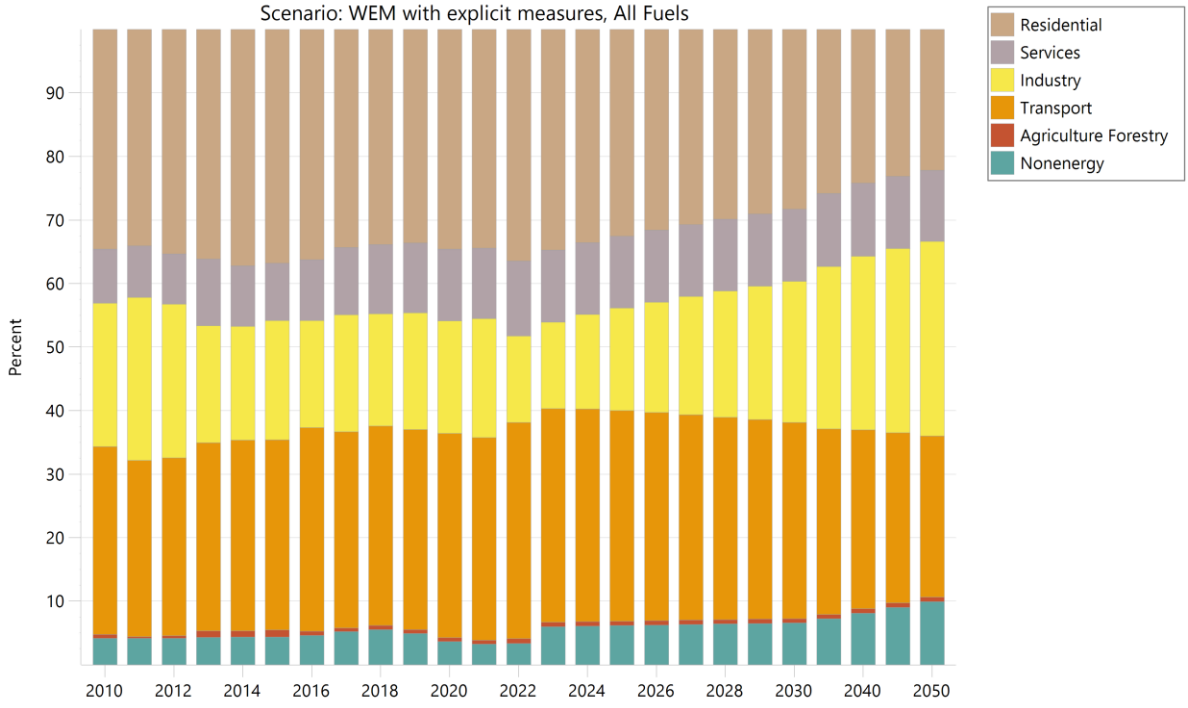



*Figure 45: Shares of final energy demand for the demand sectors for historic years 2010, 2015, 2018,2022 and as projected up to the year 2030 as well as up to 2050 in five year time steps with existing measures*

| Branch | 2010 | 2015 | 2018 | 2022 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|
| Residential | 34.6% | 36.8% | 33.9% | 36.5% | 32.6% | 28.3% | 25.8% | 24.2% | 23.1% | 22.2% |
| Services | 8.5% | 9.0% | 10.9% | 11.8% | 11.3% | 11.3% | 11.5% | 11.5% | 11.3% | 11.2% |
| Industry | 22.6% | 18.8% | 17.7% | 13.6% | 16.1% | 22.3% | 25.6% | 27.3% | 29.0% | 30.6% |
| Transport | 29.6% | 29.9% | 31.4% | 34.0% | 33.1% | 30.9% | 29.2% | 28.1% | 26.8% | 25.3% |
| Agriculture Forestry | 0.6% | 1.1% | 0.7% | 0.7% | 0.7% | 0.7% | 0.7% | 0.7% | 0.7% | 0.7% |
| Nonenergy | 4.2% | 4.4% | 5.5% | 3.4% | 6.2% | 6.6% | 7.2% | 8.1% | 9.0% | 9.9% |
| Total | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |

*Table 4.15: Shares of final energy demand for the demand sectors for historic years 2010, 2015, 2018, 2022 and as projected up to the year 2030 as well as up to 2050 in five year time steps with existing measures*

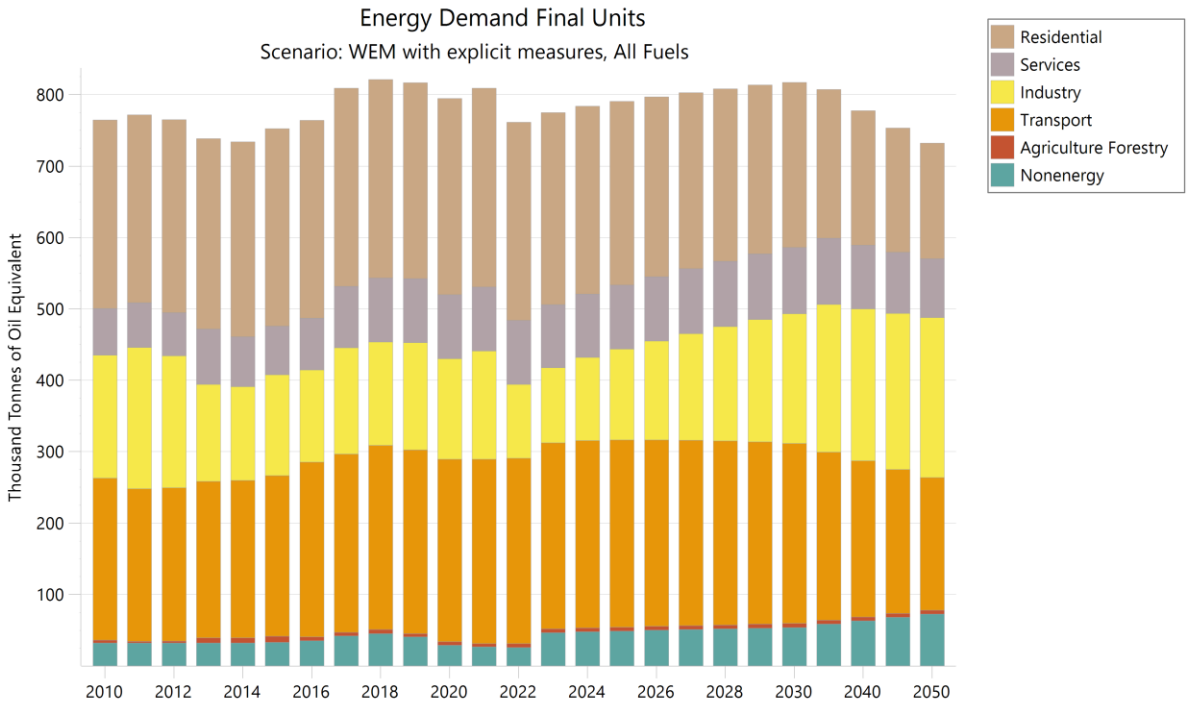



*Figure 46: Final energy consumption (ktoe) for all main demand sectors for historic values from 2010, 2015, 2018, 2022 and as projected with existing measures until 2050, given for 2023-2030 and for 2035 to 2050 in five year time steps*

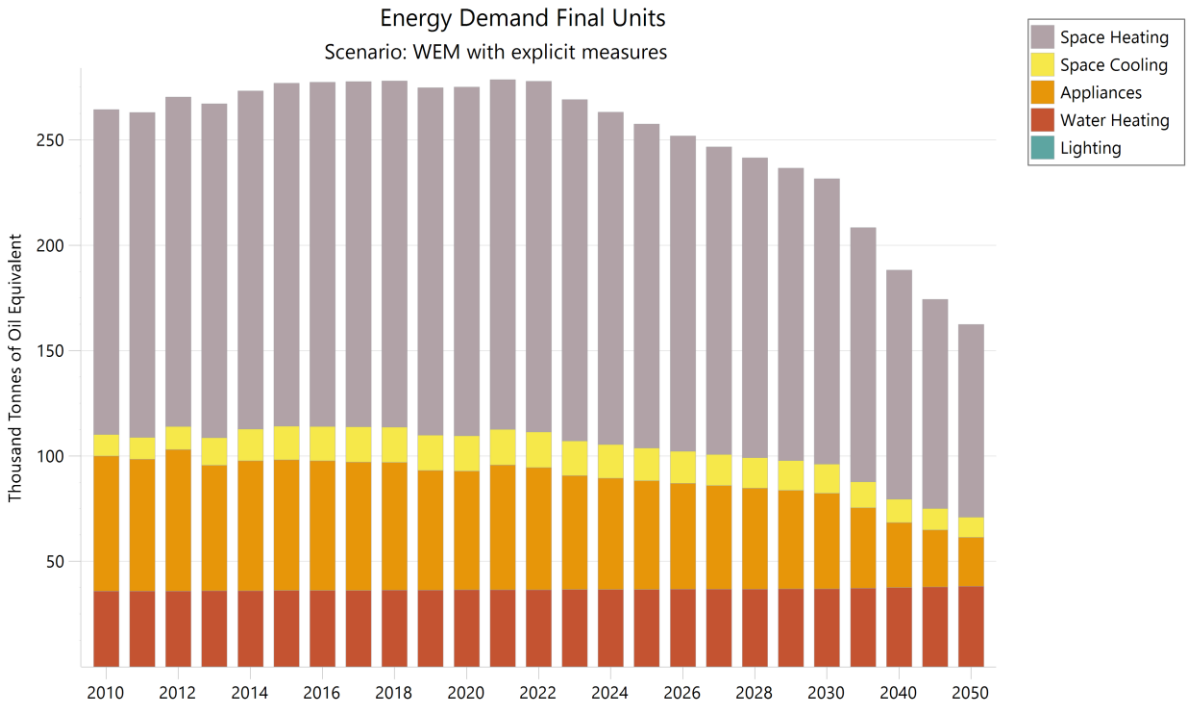



*Figure 47: Final energy consumption (ktoe) for the residential sector for historic values from 2010-2022 and as projected with existing measures until 2050, given for 2023-2030 and for 2035 to 2050 in five year time steps*

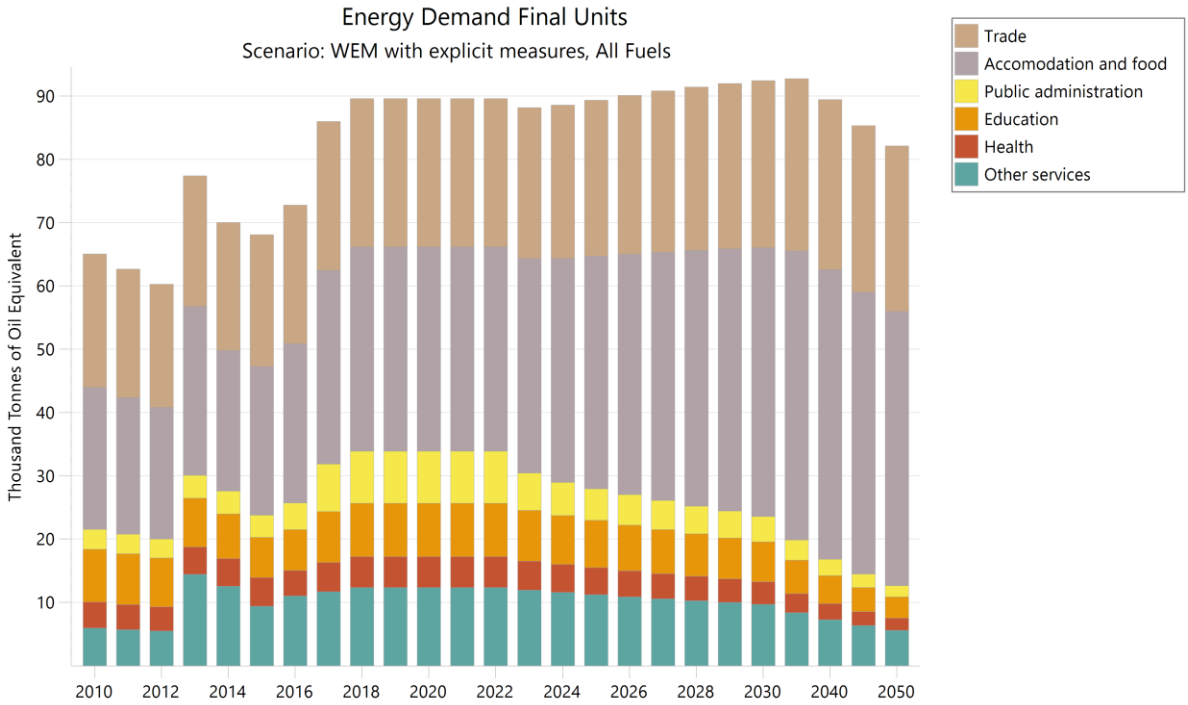



*Figure 48: Final energy consumption (ktoe) for the services sector for historic values from 2010-2022 and as projected with existing measures until 2050, given for 2023-2030 and for 2035 to 2050 in five year time steps*

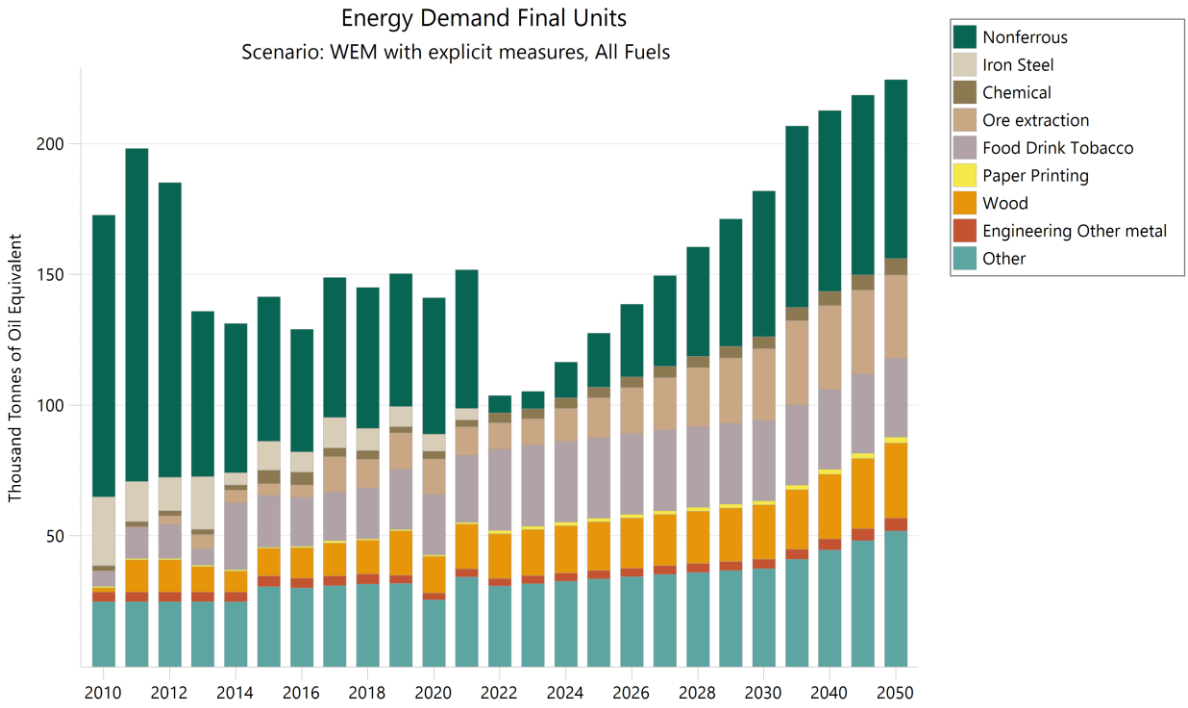



*Figure 49: Final energy consumption (ktoe) for the industry sector for historic values from 2010-2022 and as projected with existing measures until 2050, given for 2023-2030 and for 2035 to 2050 in five year time steps*

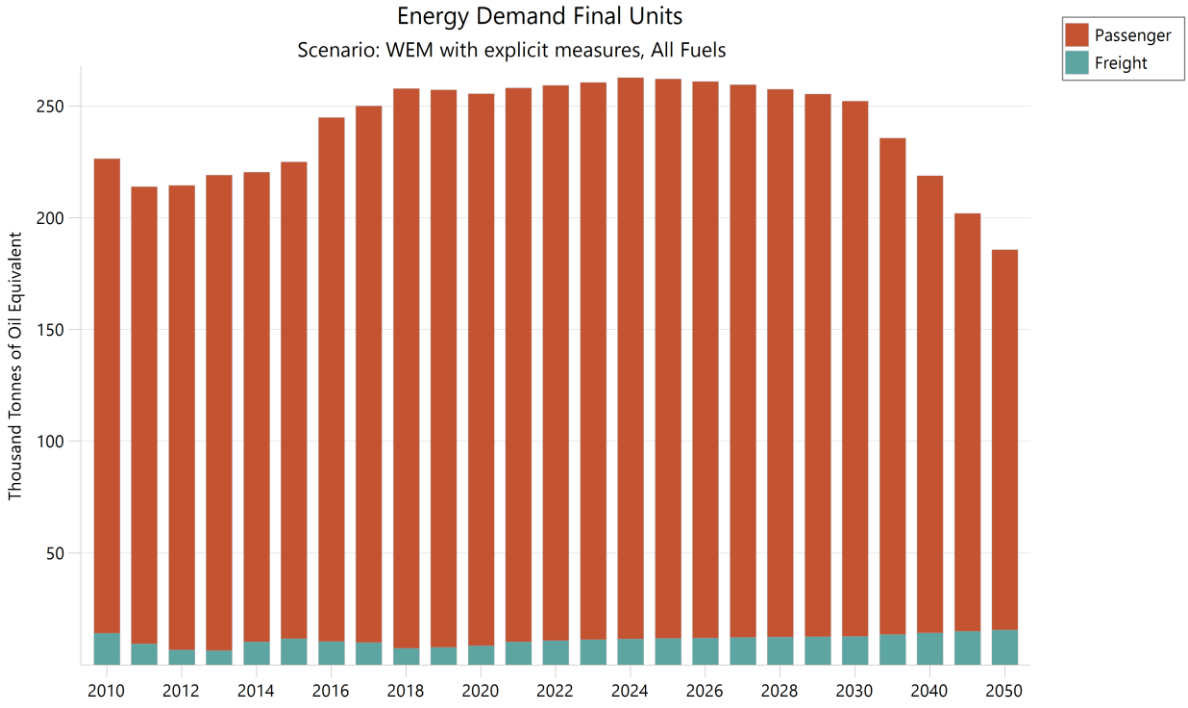



*Figure 50: Final energy consumption (ktoe) for the transport sector for historic values from 2010-2022 and as projected with existing measures until 2050, given for 2023-2030 and for 2035 to 2050 in five year time steps*

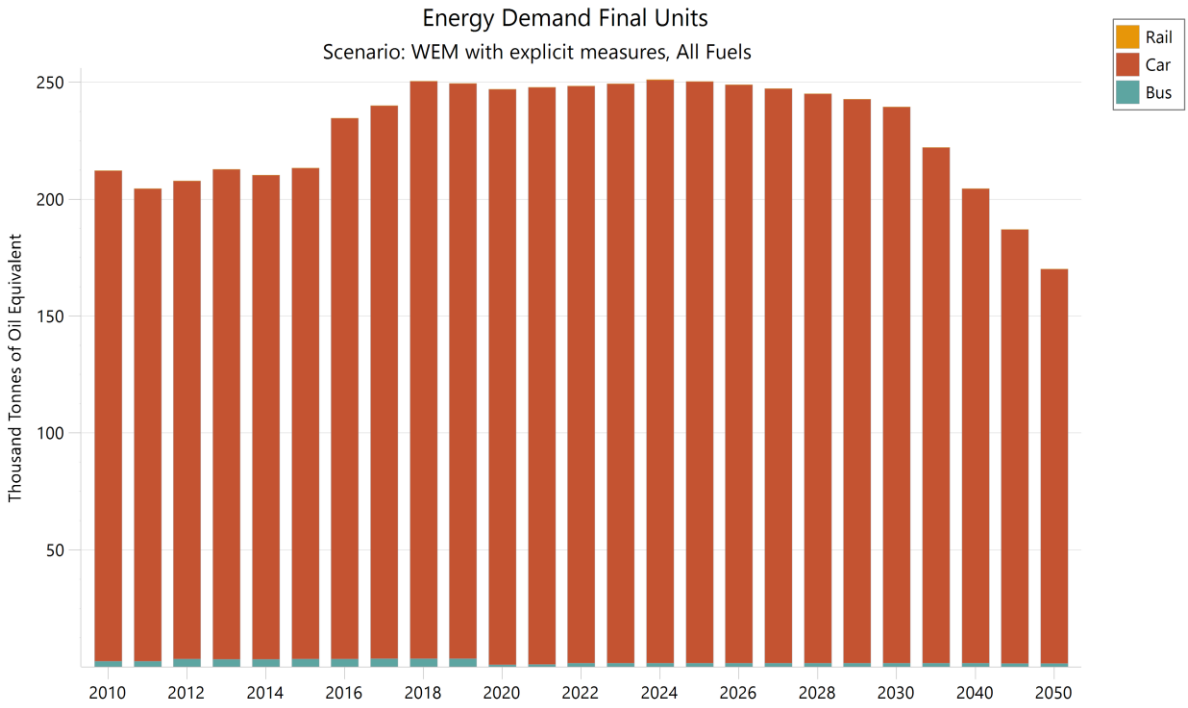



*Figure 51: Final energy consumption (ktoe) for passenger transport for historic values from 2010-2022 and as projected with existing measures until 2050, given for 2023-2030 and for 2035 to 2050 in five year time steps*

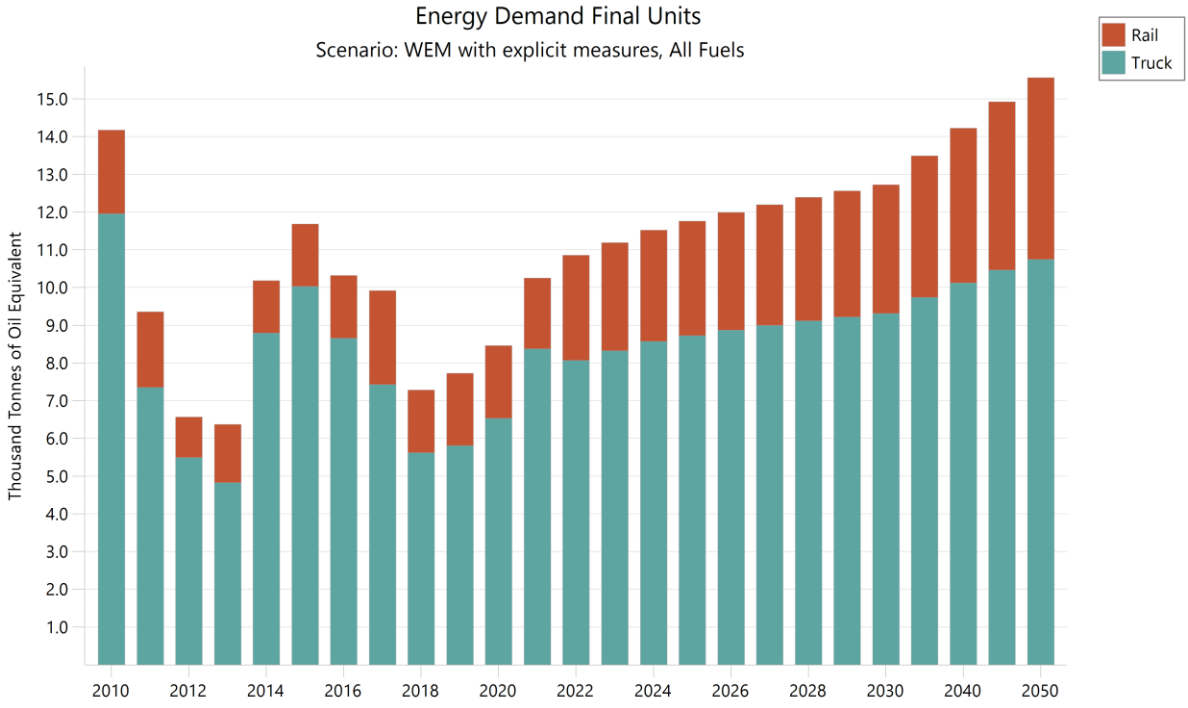



*Figure 52: Final energy consumption (ktoe) for freight transport for historic values from 2010-2022 and as projected with existing measures until 2050, given for 2023-2030 and for 2035 to 2050 in five year time steps*

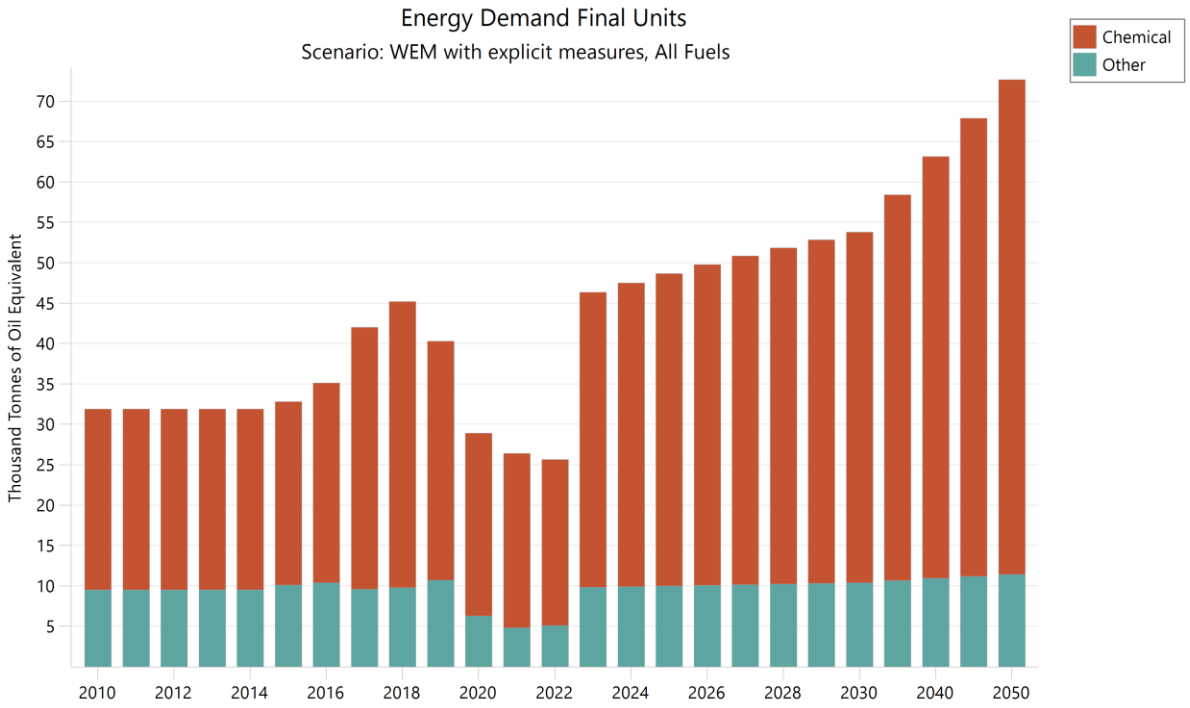



*Figure 53: Final energy consumption (ktoe) for non-energy use of energy carriers for historic values from 2010-2022 and as projected with existing measures until 2050, given for 2023-2030 and for 2035 to 2050 in five year time steps*

| Branch | 2010 | 2015 | 2018 | 2022 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|
| Residential | 264.3 | 276.8 | 278.0 | 277.8 | 257.4 | 231.5 | 208.4 | 188.2 | 174.2 | 162.4 |
| Services | 65.0 | 68.1 | 89.6 | 89.6 | 89.4 | 92.4 | 92.7 | 89.4 | 85.3 | 82.1 |
| Industry | 172.6 | 141.4 | 145.0 | 103.6 | 127.6 | 181.9 | 206.7 | 212.6 | 218.5 | 224.4 |
| Transport | 226.5 | 225.0 | 257.8 | 259.3 | 262.1 | 252.2 | 235.6 | 218.7 | 201.9 | 185.6 |
| Agriculture Forestry | 4.3 | 8.4 | 5.6 | 5.6 | 5.6 | 5.5 | 5.4 | 5.4 | 5.3 | 5.3 |
| Nonenergy | 31.9 | 32.8 | 45.2 | 25.6 | 48.6 | 53.8 | 58.4 | 63.1 | 67.9 | 72.6 |
| Total | 764.6 | 752.6 | 821.1 | 761.6 | 790.7 | 817.3 | 807.2 | 777.5 | 753.2 | 732.4 |
| Residential | | | | | | | | | | |
| Space Heating | 154.2 | 162.7 | 164.3 | 166.4 | 153.6 | 135.4 | 120.6 | 108.7 | 99.1 | 91.5 |
| Space Cooling | 10.2 | 16.0 | 16.8 | 16.9 | 15.6 | 13.8 | 12.4 | 11.2 | 10.3 | 9.6 |
| Appliances | 64.1 | 62.0 | 60.6 | 58.0 | 51.5 | 45.3 | 38.1 | 30.9 | 27.1 | 23.3 |
| Water Heating | 35.8 | 36.1 | 36.3 | 36.5 | 36.7 | 36.9 | 37.2 | 37.5 | 37.8 | 38.1 |
| Lighting | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 264.3 | 276.8 | 278.0 | 277.8 | 257.4 | 231.5 | 208.4 | 188.2 | 174.2 | 162.4 |
| Services | | | | | | | | | | |
| Trade | 21.1 | 20.9 | 23.5 | 23.5 | 24.7 | 26.4 | 27.2 | 26.9 | 26.4 | 26.2 |
| Accomodation and food | 22.4 | 23.4 | 32.3 | 32.3 | 36.7 | 42.4 | 45.6 | 45.7 | 44.5 | 43.3 |
| Public administration | 3.2 | 3.5 | 8.2 | 8.2 | 5.0 | 4.0 | 3.2 | 2.6 | 2.1 | 1.8 |
| Education | 8.3 | 6.4 | 8.5 | 8.5 | 7.5 | 6.3 | 5.3 | 4.4 | 3.8 | 3.4 |
| Health | 4.1 | 4.5 | 4.8 | 4.8 | 4.3 | 3.6 | 3.0 | 2.5 | 2.2 | 1.9 |

| Branch | 2010 | 2015 | 2018 | 2022 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|
| Other services | 5.9 | 9.4 | 12.4 | 12.4 | 11.2 | 9.7 | 8.4 | 7.2 | 6.3 | 5.6 |
| Total | 65.0 | 68.1 | 89.6 | 89.6 | 89.4 | 92.4 | 92.7 | 89.4 | 85.3 | 82.1 |
| Industry | | | | | | | | | | |
| Nonferrous | 107.7 | 55.2 | 53.8 | 6.7 | 20.7 | 55.7 | 69.4 | 69.0 | 68.7 | 68.4 |
| Iron Steel | 26.3 | 11.1 | 8.5 | - | - | - | - | - | - | - |
| Chemical | 2.0 | 5.2 | 3.3 | 3.7 | 4.1 | 4.5 | 5.0 | 5.4 | 5.8 | 6.3 |
| Glass Pottery Building mat | - | - | - | - | - | - | - | - | - | - |
| Ore extraction | 0.4 | 4.5 | 11.3 | 10.2 | 15.2 | 27.6 | 32.4 | 32.3 | 32.1 | 31.9 |
| Food Drink Tobacco | 5.5 | 19.6 | 19.1 | 30.9 | 30.8 | 30.6 | 30.5 | 30.3 | 30.2 | 30.0 |
| Textile Leather Clothing | - | - | - | - | - | - | - | - | - | - |
| Paper Printing | 0.6 | 0.6 | 0.6 | 1.4 | 1.5 | 1.6 | 1.8 | 2.0 | 2.1 | 2.3 |
| Wood | 1.6 | 10.5 | 13.0 | 17.1 | 18.6 | 20.8 | 22.7 | 24.7 | 26.7 | 28.7 |
| Other | 24.9 | 30.6 | 31.6 | 30.8 | 33.6 | 37.5 | 41.0 | 44.6 | 48.3 | 51.9 |
| Engineering Other metal | 3.6 | 4.1 | 3.7 | 2.9 | 3.2 | 3.5 | 3.9 | 4.2 | 4.5 | 4.9 |
| Total | 172.6 | 141.4 | 145.0 | 103.6 | 127.6 | 181.9 | 206.7 | 212.6 | 218.5 | 224.4 |
| Transport | | | | | | | | | | |
| Passenger | 212.3 | 213.4 | 250.5 | 248.5 | 250.3 | 239.5 | 222.1 | 204.5 | 187.0 | 170.1 |
| Freight | 14.2 | 11.7 | 7.3 | 10.9 | 11.8 | 12.7 | 13.5 | 14.2 | 14.9 | 15.6 |
| Total | 226.5 | 225.0 | 257.8 | 259.3 | 262.1 | 252.2 | 235.6 | 218.7 | 201.9 | 185.6 |
| Passenger transport | | | | | | | | | | |
| Motorcycle | - | - | - | - | - | - | - | - | - | - |
| Car | 209.9 | 210.1 | 247.0 | 246.9 | 248.8 | 237.9 | 220.6 | 203.0 | 185.6 | 168.7 |
| Bus | 2.4 | 3.2 | 3.4 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.4 | 1.4 |
| Rail | . | . | . | . | . | . | . | . | . | . |
| Total | 212.3 | 213.4 | 250.5 | 248.5 | 250.3 | 239.5 | 222.1 | 204.5 | 187.0 | 170.1 |
| Freight transport | | | | | | | | | | |
| Rail | 2.2 | 1.6 | 1.7 | 2.8 | 3.0 | 3.4 | 3.8 | 4.1 | 4.5 | 4.8 |
| Truck | 12.0 | 10.0 | 5.6 | 8.1 | 8.7 | 9.3 | 9.7 | 10.1 | 10.5 | 10.7 |
| Total | 14.2 | 11.7 | 7.3 | 10.9 | 11.8 | 12.7 | 13.5 | 14.2 | 14.9 | 15.6 |
| Non-energy demand | | | | | | | | | | |
| Chemical | 22.4 | 22.7 | 35.4 | 20.5 | 38.7 | 43.4 | 47.7 | 52.2 | 56.7 | 61.2 |
| Other | 9.5 | 10.1 | 9.8 | 5.1 | 10.0 | 10.4 | 10.7 | 11.0 | 11.2 | 11.4 |
| Total | 31.9 | 32.8 | 45.2 | 25.6 | 48.6 | 53.8 | 58.4 | 63.1 | 67.9 | 72.6 |

*Table 4.16: Final energy consumption (ktoe) for different demand sectors for historic values 2010, 2015, 2018, 2022 and as projected with existing measures until 2050, given in five year time steps*

## *Cost-optimal levels of minimum energy performance requirements resulting from national calculations, in accordance with Article 5 of Directive 2010/31/EU*

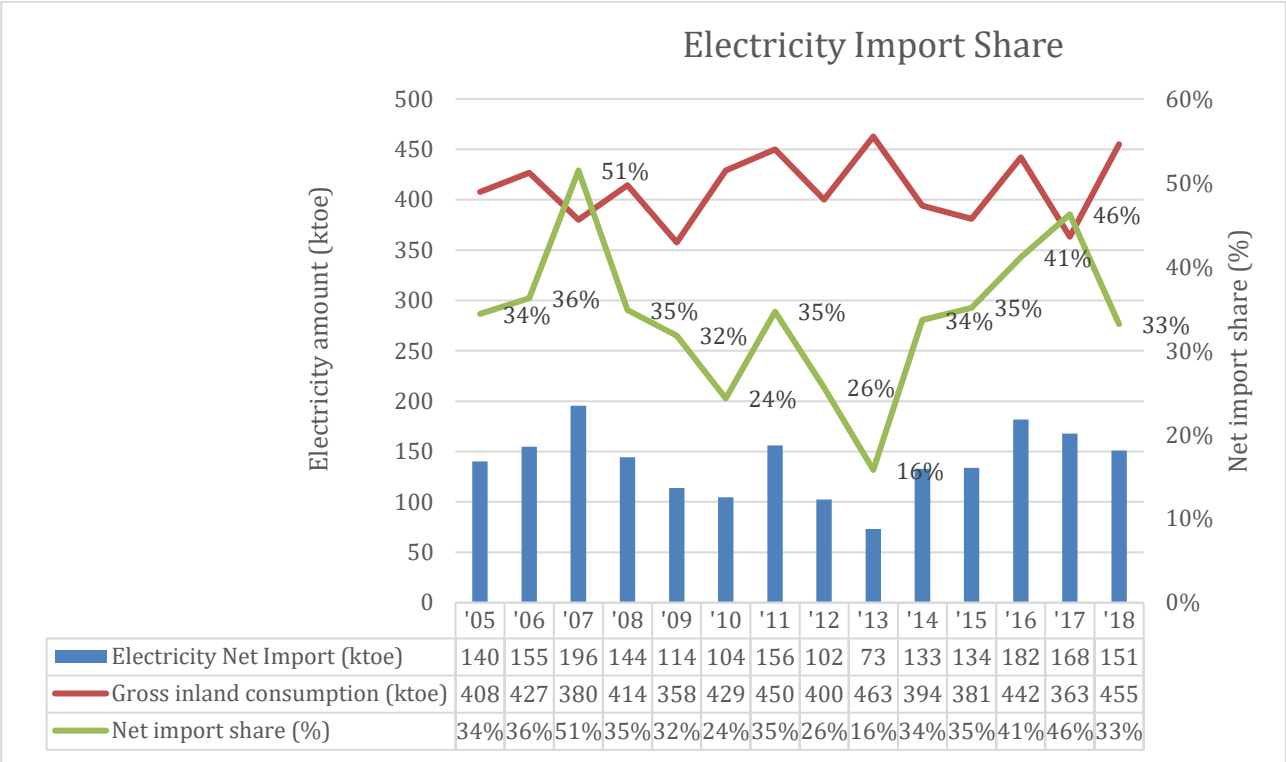
Note: *To be completed at a later stage.*

## 4.4 Dimension Energy Security

*Current energy mix, domestic energy resources, import dependency including relevant risks*

The current electricity mix of Montenegro consists of hydropower and Lignite coal power. At a currently still low but rising level, solar power is entering the mix.
Critical for energy security is the dependence on unflexible lignite coal power from the Pljevlja Thermal Power Plant (TPP) that generates about 60% of all Montenegrin GHG emissions. Being used as a base load source of electricity, emissions are not going to decrease when keeping up the status quo. In 2025, Pljevlja power plant will be off grid for eight months for ecological refurbishment that integrates filtering systems for Nitrogen Oxides (NOx) and Sulfur Dioxide ($SO_2$) to bring it into compliance with the EU Large Combustion Plants Directive (European Union 2001) that entered into effect in the Energy Community Contracting Parties in January of 2018. Montenegro to date made use of the opt-out clause for Pljevlja which exempted the plant from compliance, however limiting its allowed operating hours to 20,000 hours between 01.01.2018 and 31.12.2023 (Energy Community Secretariat 2020). Reporting of operating hours of Pljevlja (European Environment Agency 2021) confirm that the 20,000 hours have been surpassed already in late 2020 and the plant therefore does not have the permission to run under the directive. In terms of energy security, uncertainties about the status pose risks in energy supply. Under the current regime with Pljevlja TPP running in base load, impacts of dry years with little hydroelectric output are not influencing supply security significantly. However, in the case of decommissioning of the TPP, no other energy source can currently fill the gap. It is important to point out that although there is a certain surplus of electricity production with respect to needs of domestic consumption at annual level, there is a constant need for import of electricity during the summer (higher consumption due to the touristic season) and dry months. Variable hydrological situation makes import planning more challenging and it is subjected to increased costs due to electricity availability and cross border capacity allocation. Taking into account that the electricity price for distribution consumers is subsidized (significantly lower than the market price), the importance of stable domestic production of electricity is evident.

Figure 54 shows the total gross inland consumption with yearly fluctuations remaining between 380 ktoe and 460 ktoe (red line, values in ktoe are given in the table). Net imports are shown in columns and the net import share as a second line (with values given in the plot).




| | '05 | '06 | '07 | '08 | '09 | '10 | '11 | '12 | '13 | '14 | '15 | '16 | '17 | '18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Electricity Net Import (ktoe) | 140 | 155 | 196 | 144 | 114 | 104 | 156 | 102 | 73 | 133 | 134 | 182 | 168 | 151 |
| Gross inland consumption (ktoe) | 408 | 427 | 380 | 414 | 358 | 429 | 450 | 400 | 463 | 394 | 381 | 442 | 363 | 455 |
| Net import share (%) | 34% | 36% | 51% | 35% | 32% | 24% | 35% | 26% | 16% | 34% | 35% | 41% | 46% | 33% |

*Figure 54: Electricity import share (historical data 2005 - 2018)*

Fossil fuels play another important role in total Montenegrin energy supply. The country only produces lignite coal in the Pljevlja coal mines. In all other products, especially oil products, it is dependent on imports. A natural gas infrastructure does not exist and Montenegro is not connected to international natural gas pipelines. Lignite coal is exclusively used for the Pljevlja TPP. Some residential buildings in the area of the Pljevlja coal mines also use the coal for space heating.

### *Projections of development with existing policies and measures at least until 2040 (including for the year 2030)*

For projections from 2023 to 2040, the gross inland consumption of electricity is expected to increase significantly, decelerating slightly in 2030. Due to insufficient capacities, the net imports will continually rise from 21% in 2019 to 47% in 2030 and 56% in 2040 (with a drop to 19% due to the 2020 COVID-19 economic downturn). The cause for this increase is the increase in electricity consumption and the decrease in hydroelectric output due to falling precipitation levels. Climate conditions are expected to lead to a decrease by 20% in output for run-of-river hydroelectric plants and 15% in reservoir hydroelectric plants under 2010-levels until 2050. Output of Solar power however is expected to increase by 5% until 2050 over 2010-levels (World Bank ESMAP 2009).

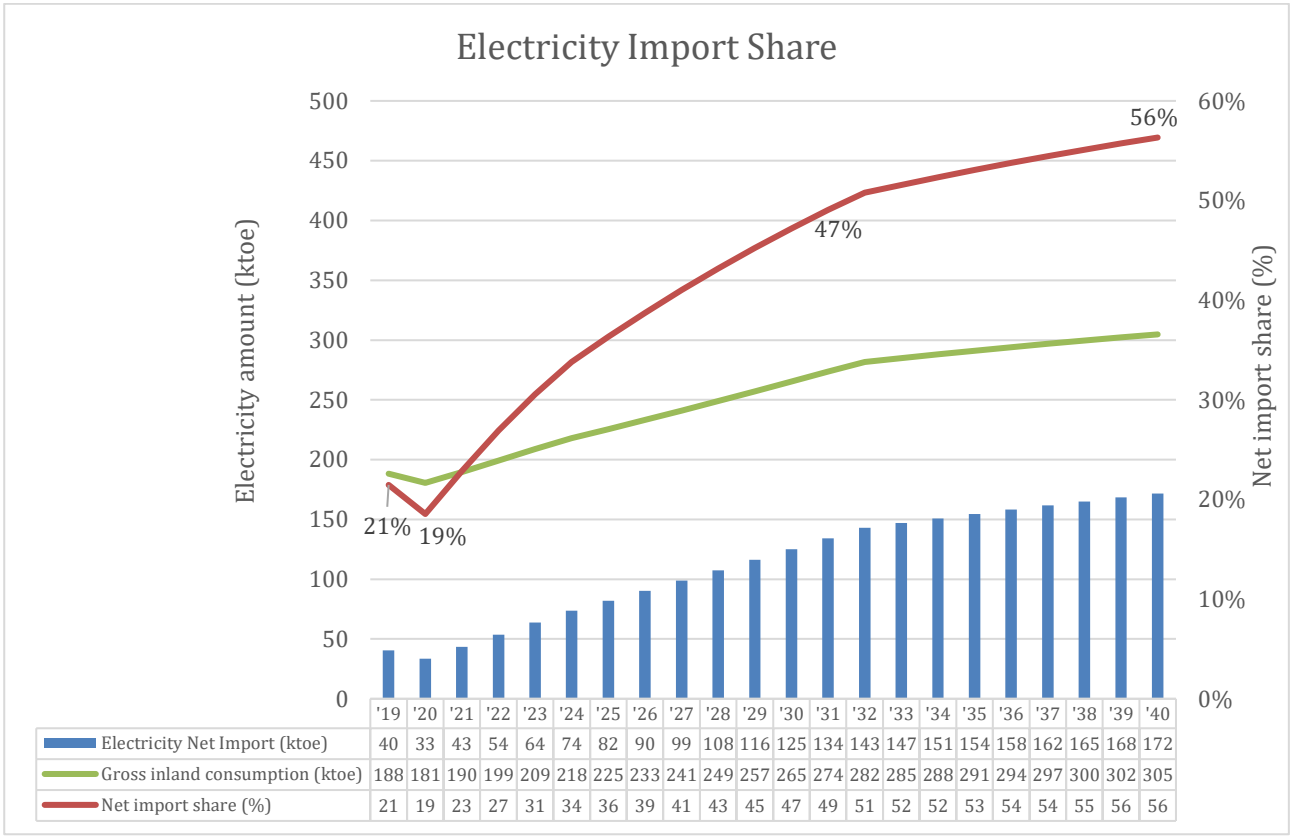



*Figure 55: Electricity import share (projection 2019 - 2040)*

## 4.5 Dimension internal energy market

### 4.5.1 Electricity interconnectivity

*Current interconnection level and main interconnectors*

Montenegro has nine interconnection lines with a total installed capacity of 5.542 MW with all neighbouring countries except Croatia (Energy Community Secretariat 2021) as shown in Table 4.17.

| Voltage Level (kV) | Bus 1 (domestic) | Bus 2 (non-domestic) | From Albania to | Max active power (MW) |
|---|---|---|---|---|
| 400 | Ribarevine | Peja 3 | Kosovo | 1185 |
| 400 | Lastva | Trebinje | Bosnia and Herzegovina | 1196 |
| 400 | Podgorica | Tirana 2 | Albania | 1197 |
| 500 (HVDC) | Lastva | Villanova | Italy | 600 |
| 220 | Podgorica | Koplik | Albania | 270 |
| 220 | HPP Piva | Sarajevo 20 | Bosnia and Herzegovina | 329 |

| | | | | |
|---|---|---|---|---|
| 220 | HPP Perucica | Trebinje | Bosnia and Herzegovina | 271 |
| 220 | Pljevlja | Bajina Basta | Serbia | 247 |
| 220 | Pljevlja | Pozega | Serbia | 247 |
| | | | | |

*Table 4.17: Existing cross-border interconnectors. Source: (Energy Community Secretariat 2021)*

In the years between 2005 and 2018, electricity imports using these interconnectors varied between 204 GWh in 2013 and 1586 GWh in 2005 (average 1211 GWh). Exports varied between 0 and 2934 GWh (average 325 GWh). The interconnection usage (imports + exports) varied between 44 GWh in 2005 and 976 GWh in 2018 (average 411 GWh).

Figure 56 shows a scheme of cross-border interconnectors including nominal interconnector transmission capacity (max active Power in MW) and the maximum cross-border capacity given to market participants for commercial use (NTC).

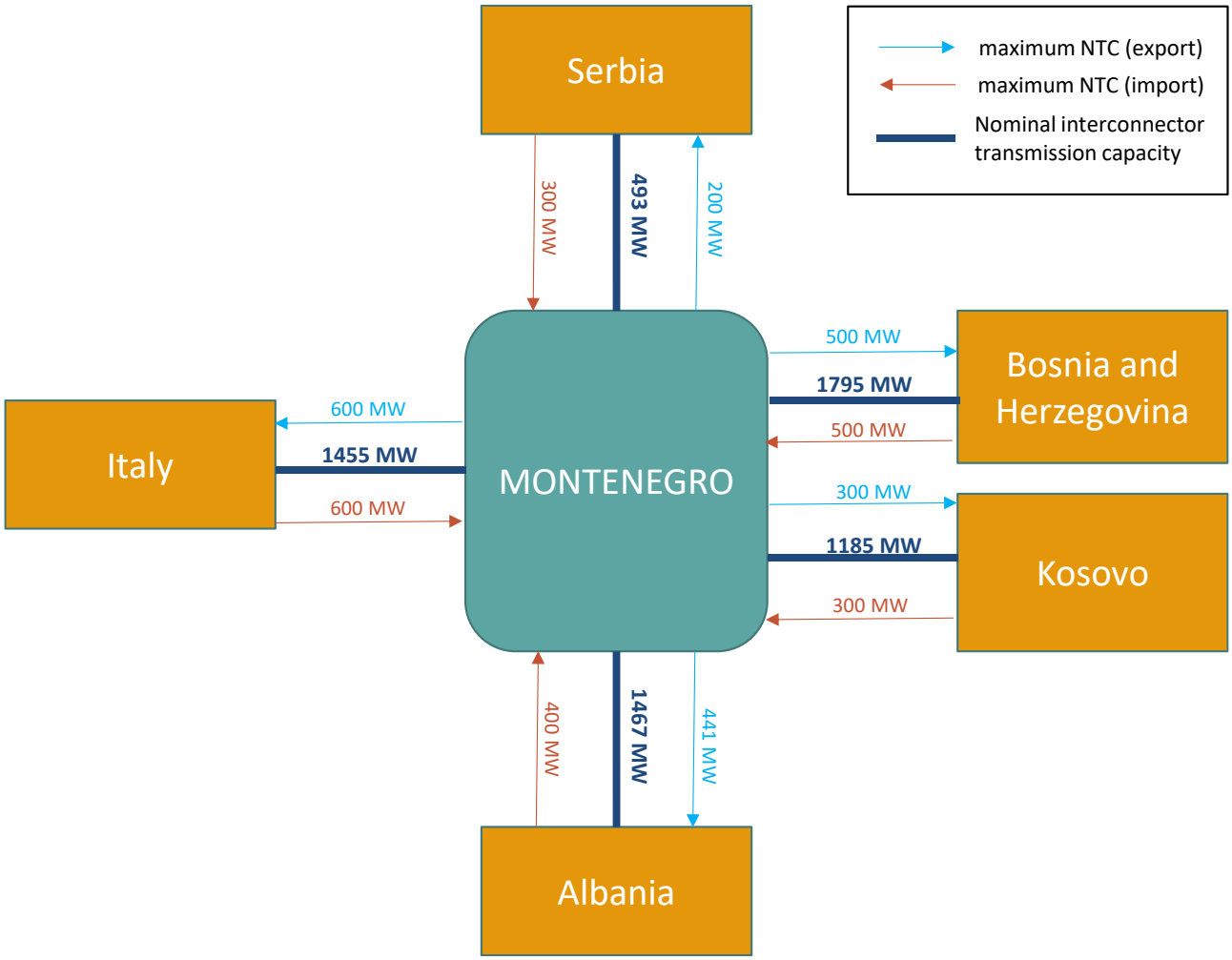



*Figure 56: Interconnector capacities. Source: Energy Community Secretariat 2021*

For the calculation of the interconnectivity target, the NTC in import direction is put in relation to the renewable power generation capacity. As shown in Table 4.18: Interconnection levels in Montenegro, it follows that the interconnection target of 15% until 2030 has been reached over

15-fold already and will continue to be reached at least until 2040 in the scenario with existing measures. Due to the insufficient energy supply capacity in the country, the renewable capacity is expected to increase with further policies decreasing the interconnection level. With high import amounts, in the past and future (see Figure 55), strong interconnection capacities have been and will continue to be an important pillar of Montenegrin energy security.

| Year | 2019 | 2021 | 2030 | 2040 |
|---|---|---|---|---|
| Renewable Capacity (MW) | 778 | 789 | 870 | 870 |
| Max NTC Import (MW) | 2.100 | 2.100 | 2.100 | 2.100 |
| Interconnection Level | 270% | 266% | 241% | 241% |

Table 4.18: Interconnection levels in Montenegro

*Projections of interconnector expansion requirements (including for the year 2030)*

The network development plan of Montenegro foresees a new 400 kV interconnection line between Pljevlja in Montenegro and Bajina Basta in Serbia with a capacity of 1197 MW. It is planned to be commissioned in 2025 equipped with one circuit only. The second one may be installed several years later.
The HVDC power link to Italy was initially planned with a transmission capacity of 1000 MW. It was constructed and commissioned with an initial capacity of 600 MW and should in the future be expanded. However, the project has been postponed and the new commissioning date is unknown (Energy Community Secretariat 2021).

### 4.5.2 Energy transmission infrastructure

*Key characteristics of the existing transmission infrastructure for electricity and gas*

To date, Montenegro does not have a natural gas transmission infrastructure and is not connected to international natural gas pipelines or LNG Terminals. The following analysis is therefore confined to the electricity transmission infrastructure. Information stems mainly from the Transmission System Development Plan of Montenegro 2020-2029 (CGES 2019b).

The Power Transmission System of Montenegro operates 24 Substations (400 kV, 220 kV, and 110 kV) as well as

- 284.3 km of 400 kV lines,
- 399.3 km of 220 kV lines,
- 649.8 km of 110 kV lines.

About 50% of the power lines are running at 110 kV and are concentrated in the coastal region of the country. Due to the expected increased demand in the future, they are more likely to be replaced with priority over the other voltages. The 400 kV lines are part of the three 400kV international interconnection transmission lines to Kosovo, Bosnia and Herzegovina and Albania (Table 4.17) as well as Ribarevine to Podgorica 2 and Ribarevine to Pljevlja. The two main hydroelectric power plants Piva and Perućica are connected to the 220 kV and 110 kV network.
This structure is characterised by the dynamic that the 400 and 220 kV overhead lines are underloaded, mostly connecting the same system components or working in parallel. The 110

kV network is characterised by the injection of the significant part of HPP Perućica generation towards Podgorica, as well as the fact that the whole consumer area of the coastal area is supplied with power via overloaded 110 kV overhead lines from the direction of Podgorica as the main power-supply point and from the direction of Trebinje (B&H) wherefrom the west coastal area is supplied with power (Herceg Novi and Tivat). With the entry into operation of SS Lastva and the entry into operation of WPP Možura, the situation will considerably change and lead to unloading of the mentioned directions (CGES 2019b).

Figure 57 shows the geographic distribution of the main transmission lines of Montenegro.

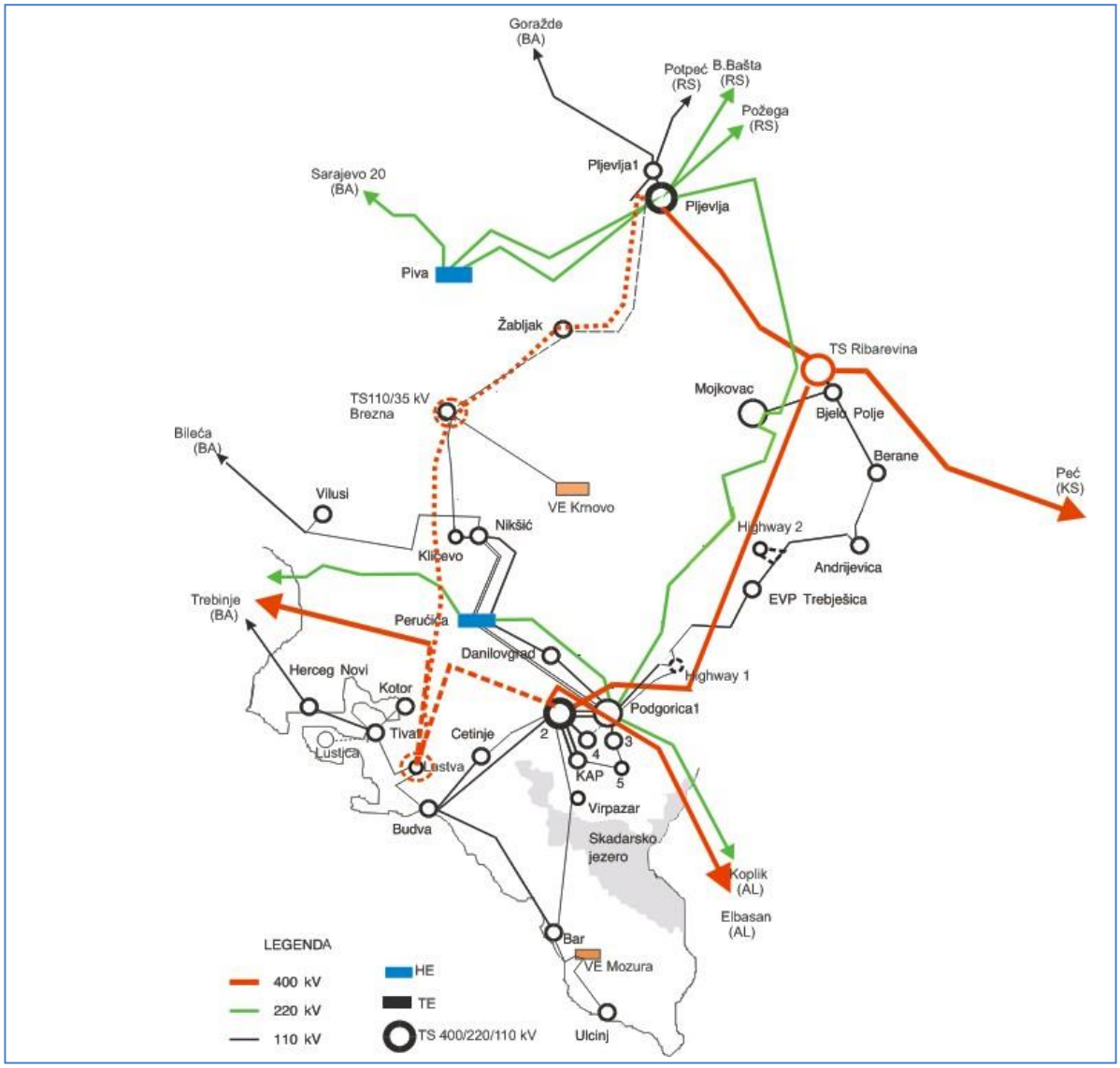



*Figure 57: Map of main transmission of Montenegro. Source: CGES 2019b*

### *Projections of network expansion requirements at least until 2040 (including for the year 2030)*

Transmission losses accounted for 3.8% of energy consumption in 2018. This number does not include distribution grid losses (CGES 2019b).

According to model calculations from the scenario with existing measures, the annual increase in energy demand amounts to an average of one percent per year between 2019 and 2040. In sum, electricity demand increases from 275 ktoe in 2019 to 314 ktoe in 2030 and 329 ktoe in 2040. At the same time, production capacities increase from 1003 MW in 2019 to 1094 MW in 2030 and remaining constant after that according to existing measures. Additional measures, as presented in chapter 5, will further widen production capacity.

The Transmission System Development Plan of Montenegro 2020-2029 (CGES 2019b) and CGES Investment Plan 2020 - 2022 (CGES 2019a) foresee a number of projects for improving transmission networks as presented in Table 4.19.

| **Project** | • **Benefits** |
|---|---|
| Construction of SS 400/110 /35 kV Lastva (IPI007) | • connection of interconnection link between Montenegro and Italy by submarine cable;<br>• reduction of losses;<br>• providing a more reliable and secure supply of consumers with electricity in the coastal area of Montenegro;<br>• improving voltage and reactive conditions;<br>• load shedding of transmission capacity in the coastal area. |
| Construction of 400 kV OHL Lastva-Čevo | • connection of interconnection link between Montenegro and Italy through submarine cable;<br>• fulfilment of N-1 security criterion in case of transit via HVDC cable;<br>• improving voltage and reactive conditions in 400 kV network of Montenegro;<br>• reduction of losses in the transmission network (by higher utilisation of 400 kV network). |
| Construction of 400 OHL Čevo-Pljevlja | • fulfilment of N-1 security criterion in case of transit via HVDC cable;<br>• improving voltage and reactive conditions in 400 kV network of Montenegro;<br>• reducing transmission network losses (through a higher use of 400 kV);<br>• providing bi-directional power supply of SS Brezna and SS Žabljak. |
| Construction of SS 110/35 kV Luštica with connection to 110 kV transmission network (IPI030) | • allowing connection of new consumers in the subject region including also the consumption of the "Luštica Bay" complex in full capacity 40 MW<br>• providing reliable and safe supply of consumers of the entire region with electricity, whereby ensuring supply from 110 kV transmission network. |

| | |
|---|---|
| Construction of 400kV OHL Pljevlja 2-Bajina Bašta-Višegrad (IPI009) | • increasing border transmission capacity towards Bosnia and Herzegovina and Serbia,<br>• improving voltage and reactive conditions in the 400 kV network of Montenegro,<br>• loss reduction in transmission network,<br>• the project is part of a broader, international project linking the electric power systems of Montenegro, Serbia and Bosnia and Herzegovina at the 400 kV level, which is of regional importance,<br>• allows full merger of market system. |
| Construction of 110 kV OHL Vilusi-Herceg Novi | • ensuring bidirectional supply of SS Vilusi,<br>• ensuring bidirectional supply of SS Herceg Novi from transmission network of Montenegro,<br>• solving the problem of overload of 110 kV OHL Herceg Novi-Trebinje,<br>• ensuring reliable and safe supply of consumers with electricity in the region of Vilusi and Herceg- Novi. |
| Reconstruction of SS 110/35 kV Vilusi and Herceg Novi | • ensuring safer, more reliable and high quality supply of consumers in the area of Vilusi and Herceg Novi,<br>• allowing construction of 110 kV OHL Vilusi-H.Novi to reduce dependence on power supply of 110 kV substations in Montenegro from neighbouring transmission network (BiH). |
| Reconstruction of systems of protection, control and auxiliary consumption in SS 220/110/35 kV Podgorica 1 | • reduction of duration of no-load time due to unreliable operation of protections,<br>• improvement of operating capability of EPS of Montenegro,<br>• increasing availability of transmission network elements,<br>• extending the useful life of main transmission network elements,<br>• reduction of maintenance costs due to the possibility of remote access to protection devices,<br>• use of data from protection devices for rationalisation of maintenance plans,<br>• use of data for developing various types of analyses and studies. |
| Reconstruction of protection and control in the rest of 110 kV network | • reduction of duration of no-load time due to unreliable operation of protections,<br>• improvement of operating capability of EPS of Montenegro,<br>• increasing availability of transmission network elements,<br>• extending the useful life of main transmission network elements, |

| | |
|---|---|
| | • reduction of maintenance costs due to the possibility of remote access to protection devices,<br>• use of data from protection devices for rationalisation of maintenance plans,<br>• use of data for developing various types of analyses and studies. |
| Construction of 110kV OHL Virpazar-Ulcinj (IPI015) | • loss reduction,<br>• ensuring reliable and safe supply of consumers with electricity (bi-directional supply of SS 110/35 kV Ulcinj),<br>• improvement of voltage reactive conditions,<br>• allowing more stable operation of future WPP Možura. |
| Replacement of HV equipment in substations (IPR034) | • more reliable operation of switchgear,<br>• decreasing maintenance costs,<br>• decreasing number and duration of unplanned interruptions in supply,<br>• achieving preconditions for remote control from the competent dispatching centre,<br>• increasing availability of transmission network elements,<br>• extending the useful life of main transmission network elements. |
| Construction of SS 110/35 kV Buljarica and its connection to 110 kV network (IPI056) | • increased quality of supplied electricity,<br>• reduced distribution network losses,<br>• reduced unsupplied electricity,<br>• safer and more reliable supply of the coastal region (Budva and Bar). |
| Reconstruction of 110 kV OHL Podgorica-Danilovgrad-Perućica (IPR089) | • increased transmission power of 110 kV overhead line from HPP Perućica,<br>• ensuring conditions for further development of generation capacities in this part of the state,<br>• ensuring reliable and safe supply of consumers in the area of Danilovgrad with electricity,<br>• higher operational safety of the overhead line,<br>• reduced maintenance cost. |
| Video surveillance of substations and protection of CGES facilities (IPD016) | • providing video surveillance of substations as additional security in the process of remote control of substations,<br>• implementation of legal regulations,<br>• better security of property and persons. |
| Reconstruction of OHL 110 kV Podgorica2- Virpazar (31-1u) (IPR059) | • Increasing of operational reliability of the overhead line,<br>• increasing the security of supply to the consumption areas of Bar, Virpazar and Ulcinj, especially in the |

| | |
|---|---|
| | summer months when there is a high load on the southern part of the coast,<br>• lower maintenance costs. |
| Reconstruction of a part of OHL 110kV Nikšić-Vilusi (IPR072) | • higher level of operational capability of the overhead line,<br>• reduction of OHL maintenance costs,<br>• reduction of duration of no-load condition of the overhead line. |
| Reconstruction of anchor parts of gantry towers of OHL 110 kV Bar-Ulcinj (IPR061) | • increasing static reliability of anchor towers and avoiding major damages,<br>• providing more reliable supply of electricity to consumers on the territory of Ulcinj<br>• increasing operational capability of the overhead line |
| Reconstruction of fire protection system in NDC (NDC104) | • ensuring safe work of employees,<br>• respecting the legislation,<br>• protection of CGES property |
| SS 400/110/35 kV Brezna (IPI019) | • creating preconditions for connection of generation facilities in this region;<br>• improving the supply reliability in Piva region (Brezna, Plužine, Unač, Mratinje, Crkvičko Polje);<br>• more reliable supply of Žabljak after the construction of 400+110 kV OHL Čevo-Pljevlja. |

*Table 4.19: Ongoing and planned transmission network projects. Source: CGES 2019a*

### 4.5.3 Electricity and gas markets, energy prices

*Current situation of electricity and gas markets including energy prices*

Note: *To be completed at a later stage*.

*Projections of development with existing policies and measures at least until 2040*

Note: *To be completed at a later stage*.

## 4.6 Dimension research, innovation and competitiveness

*Current situation in the low-carbon-technologies sector and, to the extent possible, its position on the global market (that analysis has to be carried out at Union or global level)*

A study to provide such information has not been completed for Montenegro.

*Current level of public and, where available, private research and innovation spending on low-carbon-technologies, current number of patents and current number of researchers*

In the period 2018-2020 there were 11 research and / or innovation projects dealing with low-carbon technologies co-financed by the Ministry of Science. Eight projects were led by Universities and 3 projects by the private sector, while effective collaboration was present in all. Total value of these projects was: EUR 803,254 with EUR 490,182 funded from the state budget and EUR 313,072 was own contribution. Out of the last figure EUR 177,752 was the contribution from the business sector. The average value of project is EUR 73,023. It should be noted that these figures do not include all the projects realized in the country but only those supported by the Ministry. The official R&D statistics does not allow for identification of expenditure and personnel data for low-carbon technologies fields. Production of such statistics would require adjustments of the statistical methodology and tools. Montenegrin R&D statistics is fully aligned with the EU statistics.

- 2018: EUR 523,879 (5 projects)
- 2019: EUR 214,387 (3 projects)
- 2020: EUR 64,988 (3 projects)

Out of 31 patents registered at the Directorate for the protection of intellectual property of the Ministry of Economic Development for the territory of Montenegro, in the period 2018-2021, 7 were from the low-carbon technologies, where 6 patents are from authors who are Montenegrin nationals.

*Breakdown of current price elements that make up the main three prices components (energy, network and taxes/levies)*

| Price element | Percent share |
|---|---|
| Energy | 48.46 % |
| Network | 45.12 % |
| Market Operator | 0.015 % |
| subventions for energy producers from renewable sources, for consumers over 300kWh | 6.17 % |
| VAT | + 21% |

*Table 4.20: Breakdown of current price elements that make up the main prices components*

*Description of energy subsidies including fossil fuels*

*Subsidies foreseen under the Action plan for energy efficiency 2019-2021*

- Subsidy for purchase of electric and hybrid vehicles, up to EUR 5,000 for one buyer; budget for 2021 is EUR 100,000 implemented through Eco Fund of Montenegro
- Subsidized loans (up to EUR 10,000, 0% interest rate, 6-years repayment), for installation of EE heating / cooling systems, thermo-insulation and PV-s in households (project: Energy Efficient Home); implemented by Ministry and commercial banks, from 2020 through EBRD-GEFF Residential project. In 2019 the Government subsidized loans with the amount of EUR 100,000 from the budget, where 187 households received loans and installed EE appliances.
- New grant scheme under preparation from 2021: EE measures for sector of commercial services and industry; foreseen total budget of the measure is EUR 25,000. Exploration and preparation of the scheme were supported under EU-IPA project BESME in 2020.
- Subsidies for investments in EE measures for energy supply – transformation, transmission and distribution – infrastructure projects financed by energy subjects; measure introduced since 2011 and has achieved high benefits in cost reductions.

*Subsidies for producers of energy from renewable sources*

Subsidies for producers of energy from renewable sources were introduced from 2014. The regulating policy of subsidies for electricity produced from renewable sources - solar and wind power plants and small hydro power plants is the Regulation on the fee for encouraging the production of electricity from renewable sources and highly efficient cogeneration. There are currently 28 small hydropower plants, two wind farms and five solar power plants up to one megawatt (MW). According to data from the Montenegrin electricity market operator (COTEE) in 2020, EUR 19.42 M incentives was paid to privileged producers and totally from May 2014 to the end of 2020, a total of EUR 52.25 M. The Regulation also stipulates that electricity end customers from the households' category are exempted from paying the fee for stimulating production from renewable energy sources for the first 300 kilowatt hours (kWh) of electricity consumed on a monthly basis. The producer exercises the right to incentivizing measures on the basis of the decision of the Energy Regulatory Agency and regulated communal activities. Based on that decision, a purchase agreement is concluded with COTEE, on the basis of which the payment is made.

In April 2021 there were 23 producers with the status of privileged producer and 20 producers with the status of temporarily privileged producers. Among the privileged producers, there are small hydropower plants (18), wind power plants (2) and solar power plants (8). Among the temporarily privileged producers, there are small hydropower plants (11) and solar power plants (9). Further construction of the small hydro power plants has been banned by the Government, in 2021, while the existing concession agreements are under revision.

*Subsidies for fossil fuel production*

The electricity generation capacity from coal accounts for 21.9% of the total capacity and 41% of the production. The only thermal power plant operates as a part of the majority state-owned company Elektroprivreda Crne Gore (EPCG). The Pljevlja Thermal Power Plant is supplied with coal from the Pljevlja coal mine, which in 2018 became wholly-owned by EPCG. In line with the study *An analysis of Direct Subsidies to Coal and Lignite Electricity Production in the Energy*

*Community Contracting Parties 2018–2019* (Miljević 2020), estimated amount of subsidies in Montenegro during the observed period was EUR 1.14 million. Fiscal support includes the arrears of the Pljevlja coal mine in tax and contributions, which the government consolidated and reprogrammed over five years, with 2017 as the repayment starting date. Public finance subsidies are related to a government guaranteed loan provided by KfW to the TPP. Finally there was no state-owned enterprise investment support during the 2018–2019. More data can be found in the following tables, produced within the above mentioned study on coal subsidies.

| Activity / instrument | 2018 | 2019 | 2018–2019 average per year |
|---|---|---|---|
| **Fiscal support** | 0,36 | 0,16 | 0,26 |
| **Public finance support** | 0,37 | 0,25 | 0,31 |
| **SOE investment support** | 0,00 | 0,00 | 0,00 |
| **TOTAL:** | **0,73** | **0,41** | **0,57** |

*Table 4.21: Estimated amount of subsidies in Montenegro in EUR million (Miljević 2020)*

| Electricity Facts and Figures | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|
| **Description of data (unit)** | | | | | |
| **Electricity production [GWh]** | 2.872 | 3.023 | 2.343 | 3.744 | 3.383 |
| **Gross electricity consumption [GWh]** | 3.466 | 3.328 | 4.744 | 3.468 | 3.461 |
| **Final consumption of electricity [GWh]** | 2.876 | 2.794 | 4.210 | 2.945 | 2.967 |
| **Consumption structure [GWh]** | | | | | |
| Industrial,transport,services and other non-residential sectors | 1.625 | 1.543 | 2.924 | 1.659 | 1.677 |
| Households (residential customers) | 1.251 | 1.251 | 1.286 | 1.286 | 1.290 |
| **Capacity of power plants [MW] by source:** | 886 | 892 | 972 | 973 | 1.029 |
| Coal-fired | 219 | 219 | 219 | 219 | 225 |
| Hydro | 668 | 674 | 681 | 682 | 684 |
| Other renewable | 0 | 0 | 72 | 72 | 120 |
| **Electricity generation in coal-fired TPP [GWh]** | 1.412 | 1.216 | 1.265 | 1.444 | 1.390 |
| **Share of coal-fired el. generation in total el. production** | 49% | 40% | 54% | 39% | 41% |
| **Share of coal-fired el. generation in final el. consumption** | 49% | 44% | 30% | 49% | 47% |

*Table 4.22: Overview of electricity generation in Montenegro (Miljević 2020)*

# 5 ASSESSMENT OF IMPACTS OF PLANNED POLICIES AND MEASURES

## 5.1 Impacts of planned policies and measures described in section 3 on energy system and GHG emissions and removals, including comparison to projections with existing policies and measures (as described in section 4)

This section addresses the impacts of planned policies and measures described in Chapter 3 on the energy system and GHG emissions and removals, including a comparison to projections with existing policies and measures (as described in section 4). As discussed below, one of the key parameters of the energy and GHG balance is the operation of the thermal power plant in Pljevlja.

*i. Projections of the development of the energy system and GHG emissions and removals as well as, where relevant, of emissions of air pollutants in accordance with Directive (EU) 2016/2284 under the planned policies and measures at least until ten year after the period covered by the plan (including for the last year of the period covered by the plan), including relevant Union policies and measures*

The scenario presented in this section is the scenario With Additional Measures (WAM). This scenario includes the phasing out the use of the thermal power plant in Pljevlja which remains in operation until 2040 and is then kept as cold reserve in the system. The power plant is currently a major source of emissions in Montenegro. This scenario is named WAM in the following table (in the figures we use the full description *WAM 0: WAM Additional measures until Pljevlja 4.5khours*).

The following table gives an overview of relevant 2030 target values without accounting for negative emissions from LULUCF. Details and more time steps are given in the following subsections.

| | | WEM | WAM |
|---|---|---|---|
| **Energy demand** | Absolute values | 9505.3 GWh | 8974.1 GWh |
| | Reduction relative to 2022 | +6.8% | +1.3%<br>(-5.5% reduction relative to WEM) |
| **Renewable energy share** | RES E | 66.3% | 79.4% |
| | RES overall | 42.5% | 53.3% |
| **GHG emissions** | Absolute values | 3058.7 kt CO2eq | 2401.1 kt CO2eq |
| | Reduction relative to 2022 | -7.5% | -27.4% |

*Table 5.1: Overview of energy efficiency, renewable energy share and GHG emission target values (year 2030) achieved in WEM and the WAM scenario.*

### 5.1.1 Impacts of planned additional policies and measures

This section describes the development of GHG emissions, renewable energy shares and energy efficiency targets of the scenario considering the additional policies and measures described under Chapter 3. It is referred to as WAM scenario in the following text and tables (it is referred to as *WAM additional measures but Pljevlja 4.5 khours* in the figures).

#### *5.1.1.1 Dimension Decarbonisation*

##### 5.1.1.1.1 Greenhouse Gas Emissions with LULUCF

In terms of GHG emissions with LULUCF, the WEM scenario leads to total emissions of 618 kt CO2eq in 2030, whereas the values in WAM reach -216 kt CO2eq, which corresponds to a reduction of -101.5% relative to WEM values. Table 5.2 shows an overview of values for WEM and WAM. In comparison with the base year 2022, WAM entails a decrease of 126.3 % in 2030, with a further decrease of emissions seen in the years after 2030, reaching values 333.2% below 2022 in 2050. The WEM scenario sees also decrease of emissions by 24.7% in 2030 and a decrease by 81.7% in 2050. Table 5.2 lists the values shown in the figures for historic years (2010, 2015, 2018, 2022) as well as projections for 2025, 2030, 2035, 2040, 2045 and 2050.

| Branch | 2010 | 2015 | 2018 | 2022 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|
| WAM | | | | | | | | | | |
| Demand | 846 | 909 | 1,011 | 1,018 | 1,020 | 814 | 642 | 531 | 471 | 413 |
| Transformation | 1,366 | 1,587 | 1,550 | 1,530 | 428 | 1,014 | 1,014 | 1,014 | 36 | 36 |
| Non Energy | 407 | -1,457 | -1,461 | -1,726 | -1,866 | -2,043 | -2,125 | -2,217 | -2,339 | -2,365 |
| Total WAM | 2,619 | 1,039 | 1,099 | 821 | -419 | -216 | -469 | -672 | -1,832 | -1,916 |
| WAM reduction relative to 2022 [%] | | | | | -151.0% | -126.3% | -157.2% | -181.8% | -323.0% | -333.2% |
| WEM | | | | | | | | | | |
| Demand | 846 | 909 | 1,011 | 1,018 | 1,044 | 1,049 | 1,006 | 948 | 892 | 838 |
| Transformation | 1,366 | 1,587 | 1,550 | 1,530 | 428 | 1,281 | 1,276 | 1,271 | 1,266 | 1,261 |
| Non Energy | 407 | -1,457 | -1,461 | -1,726 | -1,682 | -1,711 | -1,771 | -1,840 | -1,945 | -1,949 |
| Total WEM | 2,619 | 1,039 | 1,099 | 821 | -210 | 618 | 511 | 379 | 212 | 151 |
| WEM reduction relativ to 2022 [%] | | | | | -125.6% | -24.7% | -37.8% | -53.8% | -74.1% | -81.7% |
| Relative reduction (WAM vs. WEM) [%] | | | | | -25.4% | -101.5% | -119.4% | -128.0% | -248.9% | -251.6% |

*Table 5.2: GHG emissions (in Thousand Tonnes of $CO_2$eq) for the whole economy in the WEM and WAM scenarios*

The following figures give an overview of the sectoral split of GHG emissions in WAM (note that the results are presented in five year intervals after 2030). Starting with the total emissions in Figure 58 and sectoral direct emissions in Figure 59. Figure 60 and Figure 61 show the difference of the emissions to the WEM scenario. The drop in emissions in 2025 is connected with the rehabilitation of the thermal power plant, which will not be available at full capacity during part of the year.

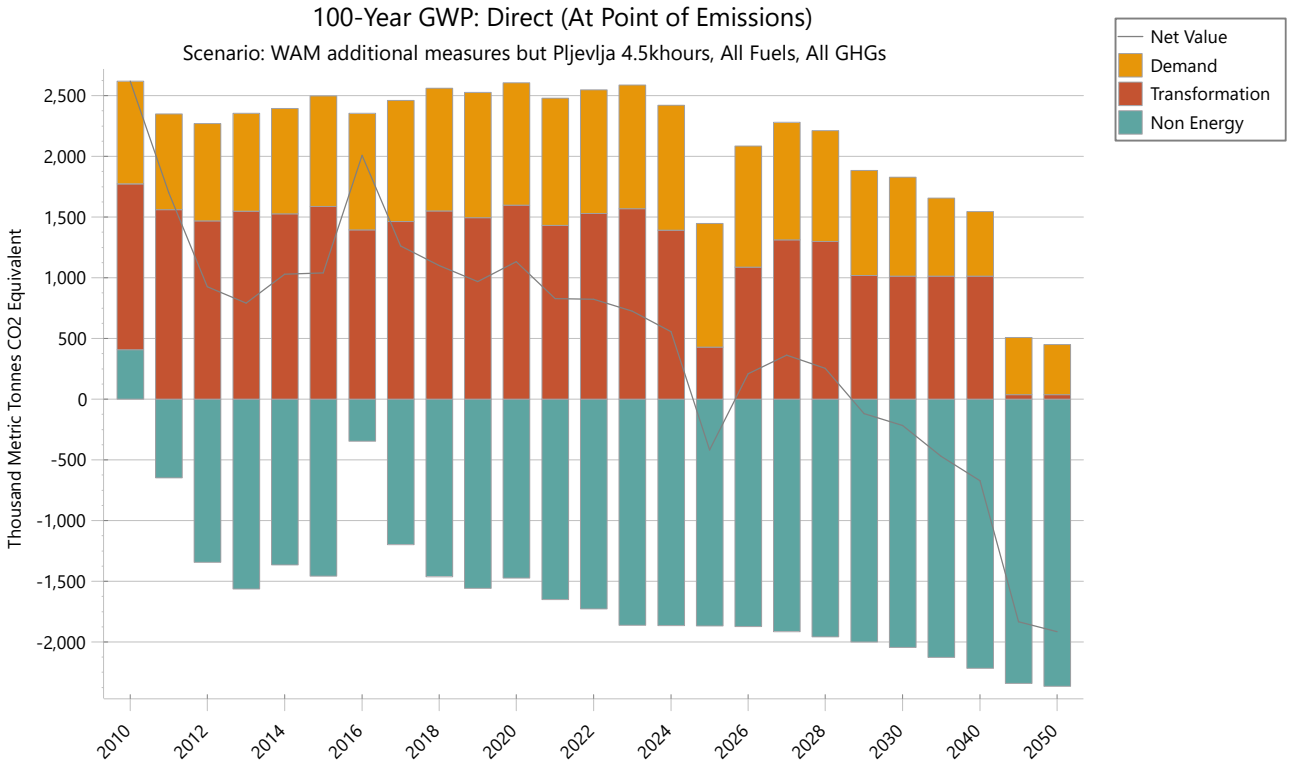



*Figure 58: GHG emissions ($CO_2eq$) for the whole economy for the historic years 2010-2022 and as projected for 2023-2050 on sectoral level.*

As can be seen in Figure 61, until 2040 the largest part of emissions reduction appears in the non-energy and demand sectors, while by 2045 the largest part of emissions reduction is due to the transformation sector and the phasing out of the thermal power plant.

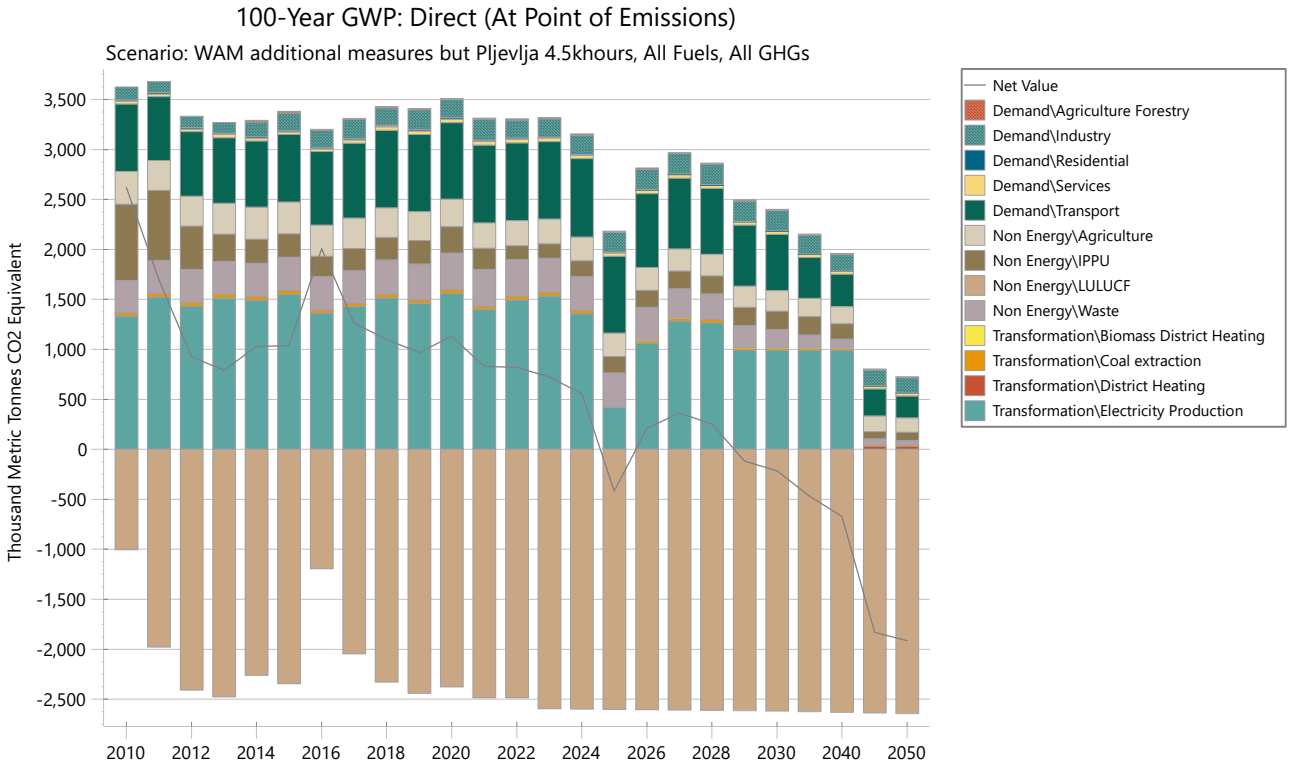



*Figure 59: GHG emissions ($CO_2eq$) for the whole economy for the historic years 2010-2022 and as projected for 2023-2050 on sub-sectoral level.*

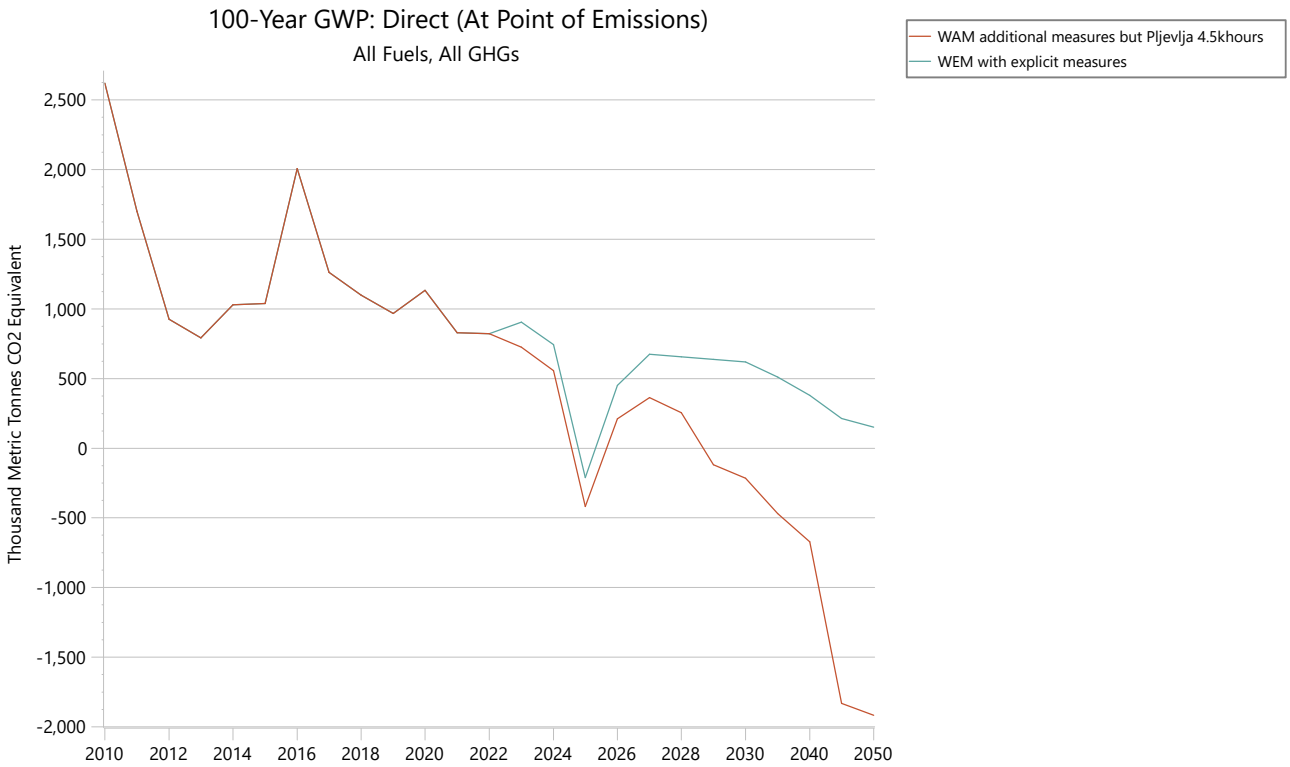



*Figure 60: GHG emissions ($CO_2eq$) for the whole economy for the historic years 2010-2022 and as projected for 2023-2050, WAM and WEM*

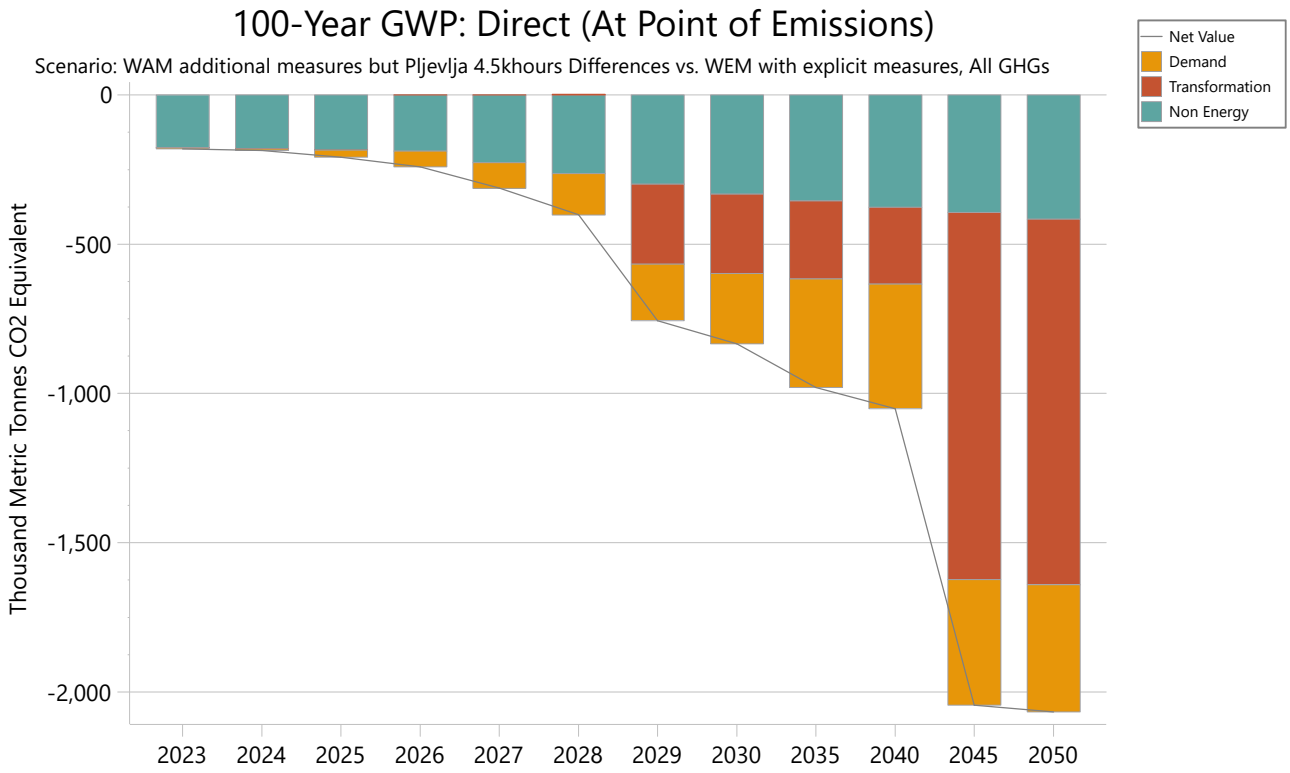



*Figure 61: GHG emissions ($CO_2eq$) for the whole economy for the historic years 2010-2022 and as projected for 2023-2050 (WAM). Differences between WAM and WEM broken down into subcategories.*

#### 5.1.1.1.2 Renewable energy share

The renewable energy share is calculated according to EUROSTAT SHARES methodology. The SHARES method accounts for the share of renewable electricity (RES E), which is one of the basic starting points. RES-E is used in the overall share of renewable energy (RES) and the renewable energy share in the transport sector (RES T). In addition, SHARES accounts for the share of renewable energy in heating and cooling other than electricity (RES HC).

The following Figure 62 shows RES E, RES T and overall RES share. For RES E, it is interesting to note that the share in WAM first increases in discrete steps and then decreases and again increases at the end. This behaviour is a statistical artefact when combining the plans for hydro power plants (large power plants in Komarnica and Moraca coming online) with the SHARES methodology. The RES E share according to SHARES foresees to multiply the average availability of hydro power plants (average over the past 15 years) with the current capacity to calculate the average generation from hydro power plants in a certain year. Even if a part of the new capacity is not used, the average availability will first be the same as previously (hence a stepwise increase) and then only gradually drop (the decline seen afterwards). In this special case, the RES E share according to SHARES strongly deviates from the measurable RES share. The top right panel of the Figure 62 therefore also gives the simple RES E share, where no normalisation is applied to the hydro power plants. A similar logic applies to wind power (averaged over four years), but this is of less strong influence as wind power plays only a limited role currently and new capacities are actually used by the model.

The overall RES share (bottom left panel) is also influenced by these statistical effects in WAM. When assessing the RES T share (bottom right), it needs to be considered that these values are also strongly influenced by the multipliers applied to certain parts of the energy demand in numerator and denominator, so it should not be mistaken as the measurable share of renewable energy in the transport sector.

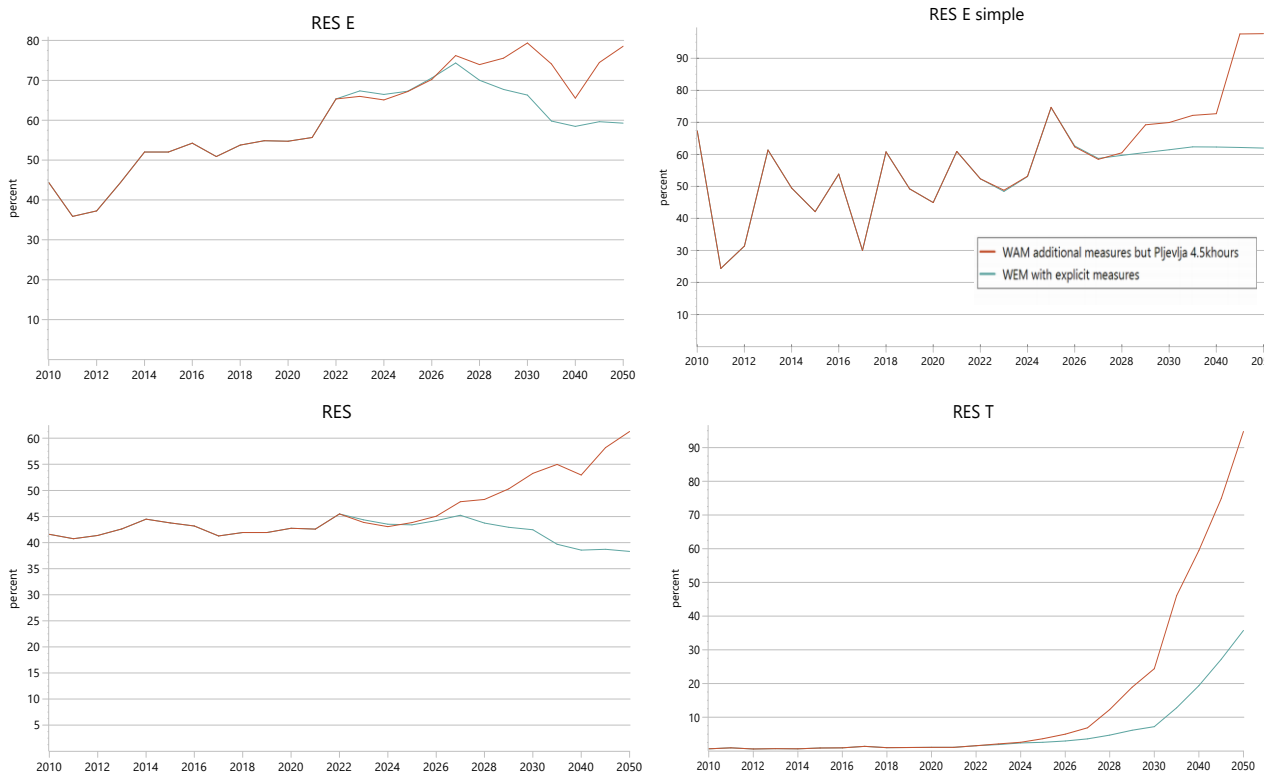



*Figure 62: Overview of the different RES shares (%) for the WEM (blue) and WAM (red) scenario*

For completeness, the following table gives the numbers for different renewable energy indicators in WEM and WAM.

| | 2010 | 2015 | 2018 | 2022 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|
| **WEM** | | | | | | | | | | |
| **RES E** | 44.4 | 52.0 | 53.7 | 65.3 | 67.3 | 66.3 | 59.8 | 58.5 | 59.6 | 59.3 |
| **RES E simple** | 67.4 | 42.1 | 60.8 | 52.4 | 74.6 | 61.5 | 62.4 | 62.3 | 62.2 | 62.0 |
| **RES T** | 0.6 | 0.9 | 0.9 | 1.5 | 2.5 | 7.2 | 12.8 | 19.4 | 27.2 | 35.8 |
| **RES HC** | 65.5 | 61.9 | 58.8 | 63.1 | 55.2 | 48.8 | 43.9 | 39.7 | 36.0 | 32.5 |
| **RES** | 41.6 | 43.8 | 41.9 | 45.5 | 43.4 | 42.5 | 39.7 | 38.5 | 38.7 | 38.3 |
| **WAM** | | | | | | | | | | |
| **RES E** | 44.4 | 52.0 | 53.7 | 65.3 | 67.2 | 79.4 | 74.1 | 65.6 | 74.5 | 78.6 |
| **RES E simple** | 67.4 | 42.1 | 60.8 | 52.4 | 74.7 | 70.0 | 72.2 | 72.7 | 97.6 | 97.7 |
| **RES T** | 0.6 | 0.9 | 0.9 | 1.5 | 3.6 | 24.4 | 46.1 | 59.5 | 74.9 | 94.8 |
| **RES HC** | 65.5 | 61.9 | 58.8 | 63.1 | 54.6 | 49.2 | 48.7 | 49.1 | 47.5 | 46.1 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **RES** | 41.6 | 43.8 | 41.9 | 45.5 | 43.8 | 53.3 | 55.0 | 53.0 | 58.2 | 61.3 |

*Table 5.3: Renewable energy indicators given in percent for the WEM and WAM scenario*

### *5.1.1.2 Dimension Energy Efficiency*

This section details projections with underlying additional measures for the energy consumption of the economy. It starts with an overview of primary energy supply for all fuels, followed by an assessment of final energy demands, also in a sectoral view of final energy consumption.

#### 5.1.1.2.1 Primary Energy Supply

For an analysis of primary energy supply, Table 5.4 shows a comparison of primary energy supply in the WEM scenario (from Chapter 4) and the WAM scenario (this chapter). In both scenarios, net energy demand is slightly decreasing in total towards 2050. While in the WEM scenario, net primary energy consumption increases (compared to 2022) by 0.5 % until 2030 and decreases by 8.4 % until 2050. In the WAM scenario, it decreases by 6.4% in 2030 compared to 2022 and decreases by 32% in 2050. Comparatively, the consumption in the WAM scenario decreases compared to the WEM scenario by 6.9 % in 2030 and 23.6 % in 2050.

| Branch | 2010 | 2015 | 2018 | 2022 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|
| WAM | | | | | | | | | | |
| Exports | - | - | - | - | - | - | - | 0 | 0 | - |
| Imports | 309.8 | 366.0 | 372.4 | 356.0 | 419.2 | 361.9 | 313.6 | 286.6 | 273.3 | 260.6 |
| Production | 724.5 | 682.5 | 736.1 | 676.8 | 467.6 | 604.6 | 612.8 | 603.9 | 450.6 | 441.9 |
| Total WAM | 1,034.2 | 1,048.5 | 1,108.5 | 1,032.8 | 886.9 | 966.6 | 926.4 | 890.6 | 723.9 | 702.6 |
| WAM reduction relative to 2022 [%] | | | | | -14.1% | -6.4% | -10.3% | -13.8% | -29.9% | -32.0% |
| WEM | | | | | | | | | | |
| Exports | - | - | - | - | - | - | - | - | - | - |
| Imports | 309.8 | 366.0 | 372.4 | 356.0 | 419.7 | 400.5 | 394.9 | 380.8 | 367.8 | 356.6 |
| Production | 724.5 | 682.5 | 736.1 | 676.8 | 468.0 | 637.4 | 632.4 | 614.5 | 601.0 | 589.3 |
| Total WEM | 1,034.2 | 1,048.5 | 1,108.5 | 1,032.8 | 887.7 | 1,037.9 | 1,027.3 | 995.2 | 968.8 | 945.9 |
| WEM reduction relative to 2022 [%] | | | | | -14.0% | 0.5% | -0.5% | -3.6% | -6.2% | -8.4% |
| Relative reduction (WAM vs. WEM) [%] | | | | | -0.1% | -6.9% | -9.8% | -10.1% | -23.7% | -23.6% |

*Table 5.4: Primary energy supply [ktoe] in WAM and WEM scenarios*

Figure 63 to Figure 66 show the primary energy supply broken down by energy source as well as a comparison between the WEM and WAM scenarios for the years up to 2050. The drop in in primary energy consumption in 2025 is connected with the rehabilitation of the thermal power plant, as already mentioned above.

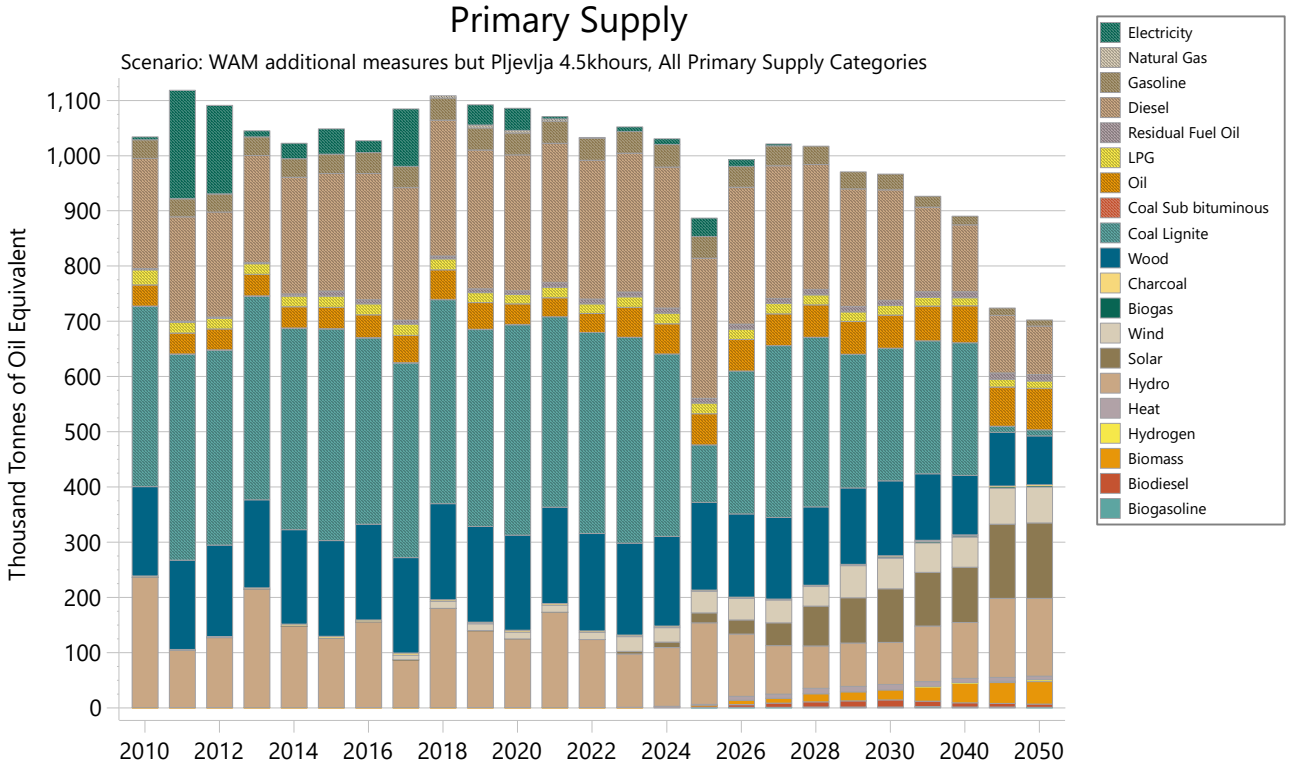



*Figure 63: Primary energy supply by fuels (in ktoe) for historic years 2010-2022 and as projected up to the year 2050 with additional measures*

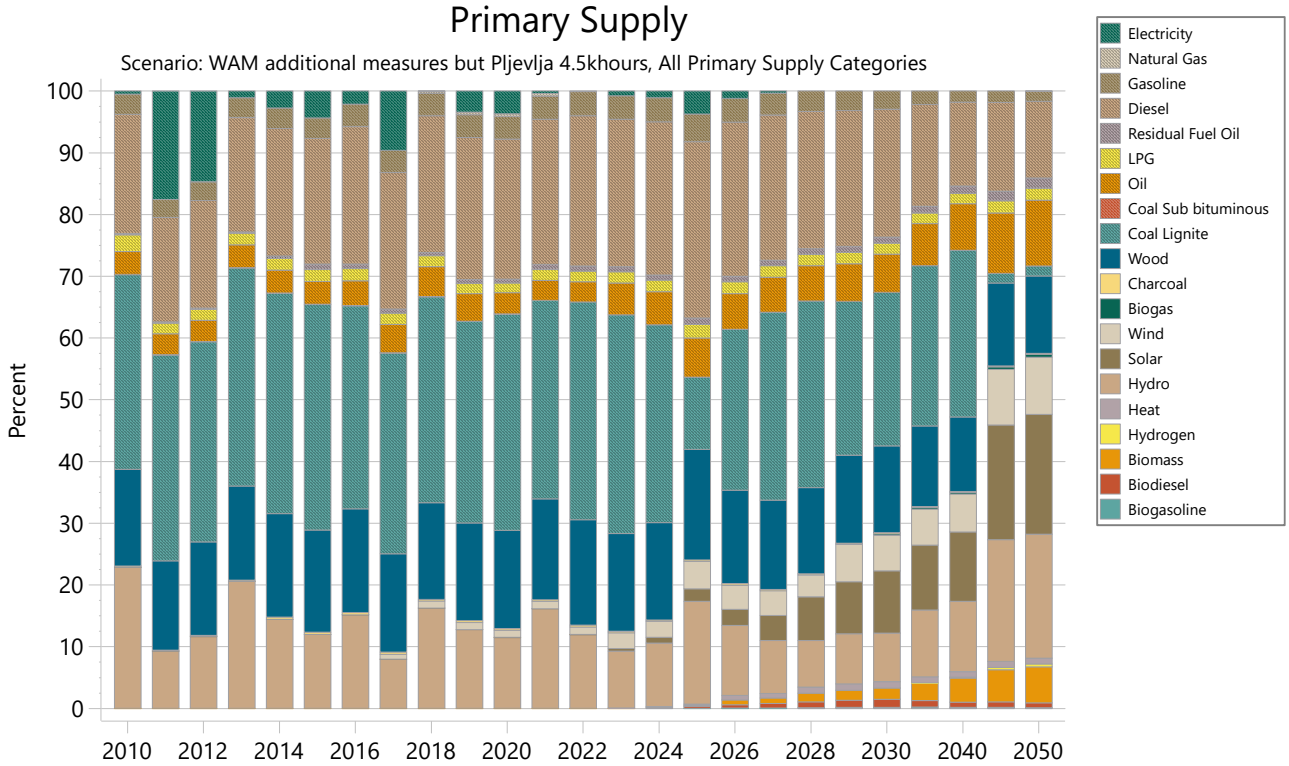



*Figure 64: Share of primary energy supply by fuels (in %) for historic years 2010-2022 and as projected up to the year 2050 with additional measures*

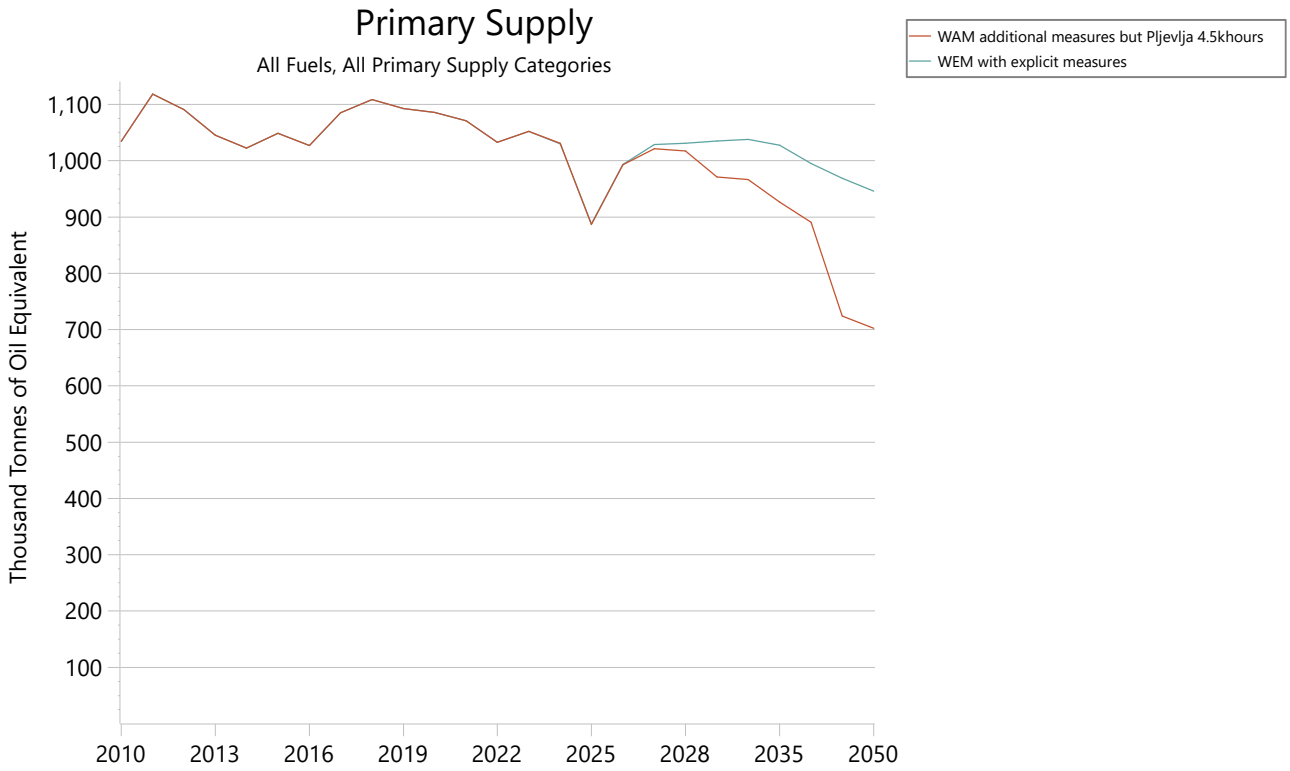



*Figure 65: Net value of primary energy supply for historic years 2010-2022 and as projected for 2023-2050, WAM and WEM*

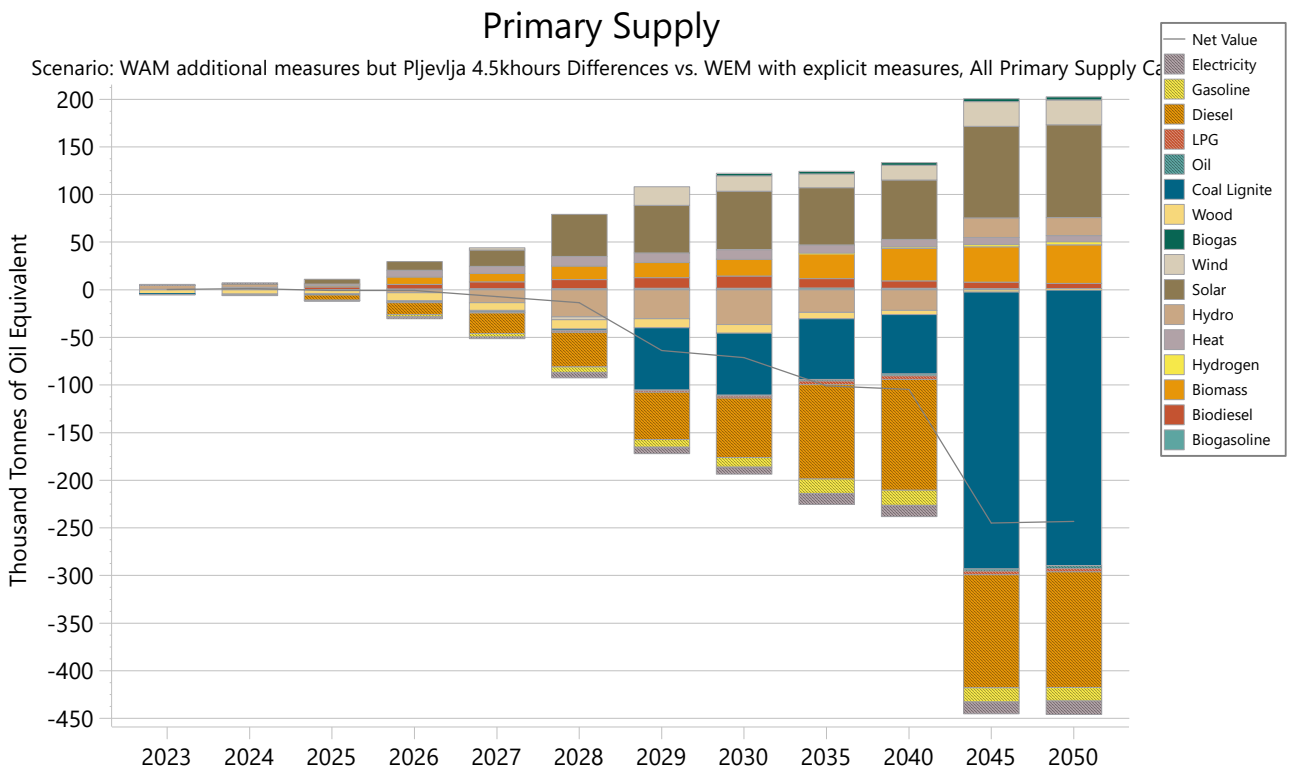



*Figure 66: Primary energy supply projected up to the year 2050. Differences between WAM and WEM broken down into subcategories.*

#### 5.1.1.2.2 Final Energy Demand

To assess the final energy demand in the Montenegrin economy, Table 5.5 shows a comparison of final energy consumption of energy demand sectors between the WEM scenario (from Chapter 4) and the WAM scenario (this chapter).
While in the WEM scenario, final energy consumption increases (compared to 2022) by 7.3 % until 2030 but then decreases by 3.8 % in 2050. WAM scenario increases by 1.3 % until 2030 and then decreases by 14.2 % in 2050. Comparatively, the final energy consumption in the WAM scenario decreases compared to the WEM scenario by 6 % in 2030 and 10.4 % in 2050.

| Branch | 2010 | 2018 | 2020 | 2022 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|
| WAM | | | | | | | | | | |
| Residential | 264.3 | 276.8 | 278.0 | 277.8 | 257.4 | 231.5 | 208.4 | 188.2 | 174.2 | 162.4 |
| Services | 65.0 | 68.1 | 89.6 | 89.6 | 89.4 | 92.4 | 92.7 | 89.4 | 85.3 | 82.1 |
| Industry | 172.6 | 141.4 | 145.0 | 103.6 | 127.4 | 179.2 | 203.7 | 209.9 | 216.2 | 222.4 |
| Transport | 226.5 | 225.0 | 257.8 | 259.3 | 259.8 | 210.2 | 164.0 | 142.2 | 126.9 | 111.7 |
| Agriculture Forestry | 4.3 | 8.4 | 5.6 | 5.6 | 5.6 | 5.5 | 5.4 | 5.4 | 5.3 | 5.3 |
| Non Energy | 31.9 | 32.8 | 45.2 | 25.6 | 48.6 | 52.8 | 56.6 | 61.0 | 65.4 | 69.7 |
| Total WAM | 764.6 | 752.6 | 821.1 | 761.6 | 788.2 | 771.6 | 730.8 | 696.2 | 673.4 | 653.6 |
| WAM reduction relative to 2022 [%] | | | | | 3.5% | 1.3% | -4.0% | -8.6% | -11.6% | -14.2% |
| WEM | | | | | | | | | | |
| Residential | 264.3 | 276.8 | 278.0 | 277.8 | 257.4 | 231.5 | 208.4 | 188.2 | 174.2 | 162.4 |
| Services | 65.0 | 68.1 | 89.6 | 89.6 | 89.4 | 92.4 | 92.7 | 89.4 | 85.3 | 82.1 |
| Industry | 172.6 | 141.4 | 145.0 | 103.6 | 127.6 | 181.9 | 206.7 | 212.6 | 218.5 | 224.4 |
| Transport | 226.5 | 225.0 | 257.8 | 259.3 | 262.1 | 252.2 | 235.6 | 218.7 | 201.9 | 185.6 |
| Agriculture Forestry | 4.3 | 8.4 | 5.6 | 5.6 | 5.6 | 5.5 | 5.4 | 5.4 | 5.3 | 5.3 |
| Non Energy | 31.9 | 32.8 | 45.2 | 25.6 | 48.6 | 53.8 | 58.4 | 63.1 | 67.9 | 72.6 |
| Total WEM | 764.6 | 752.6 | 821.1 | 761.6 | 790.7 | 817.3 | 807.2 | 777.5 | 753.2 | 732.4 |
| WEM reduction relative to 2022 [%] | | | | | 3.8% | 7.3% | 6.0% | 2.1% | -1.1% | -3.8% |
| Relative reduction (WAM vs. WEM) [%] | | | | | -0.3% | -6.0% | -10.0% | -10.7% | -10.5% | -10.4% |

*Table 5.5: Final energy consumption (ktoe) for energy demand sectors in the WEM and WAM scenarios*

Figure 67 to Figure 74 show the final energy demand broken down by sector, sub-sector and energy source as well as a comparison between the WEM and WAM scenarios for the years up to 2050. As can be seen in Figure 73, major reduction in final energy consumption between the two scenarios is attributed to the transportation sector.

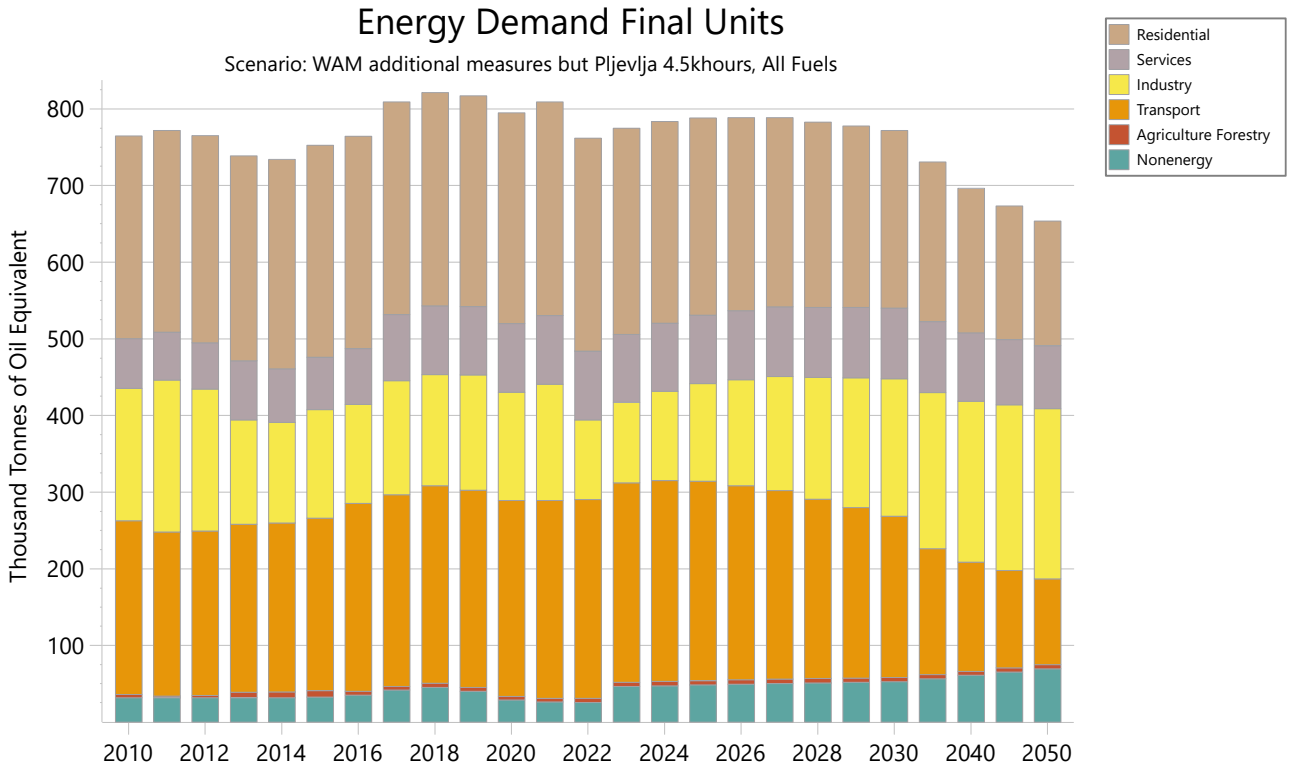



*Figure 67: Final energy demand for the demand sectors for historic years 2010-2022 and as projected up to the year 2050 with additional measures*

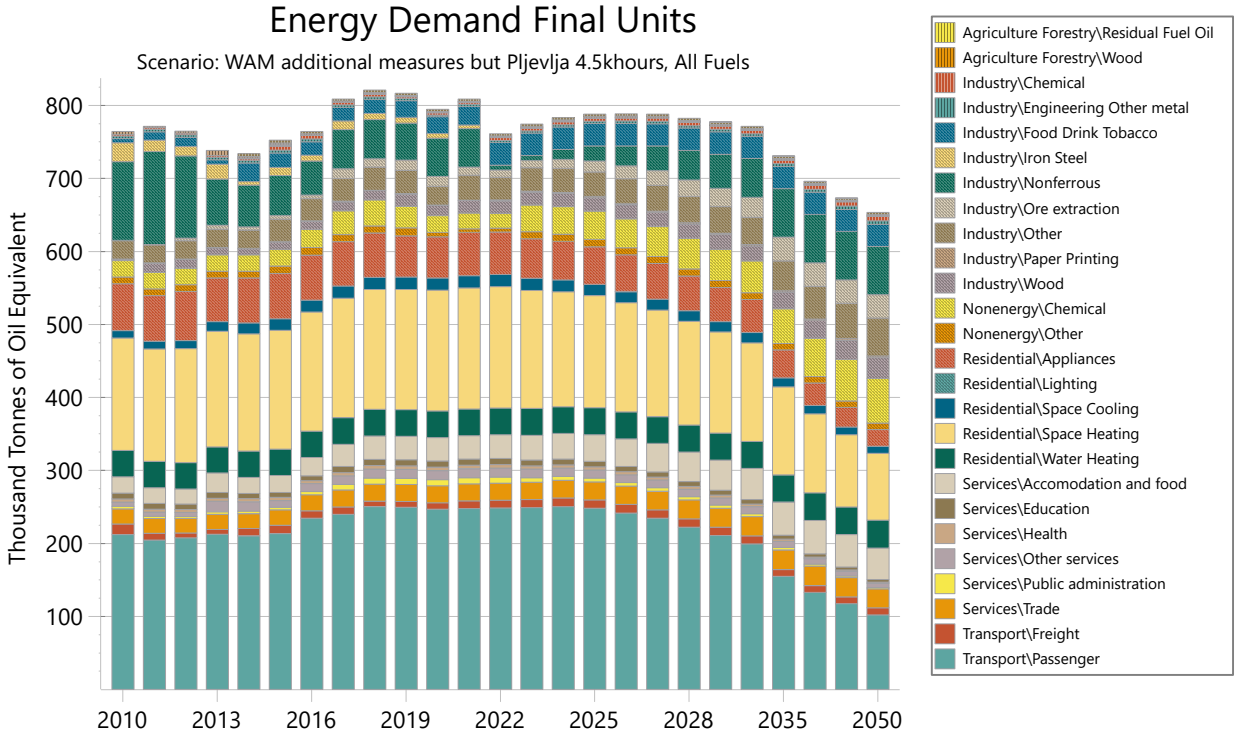



*Figure 68: Final energy demand for the demand sub-sectors for historic years 2010-2022 and as projected up to the year 2050 with additional measures*

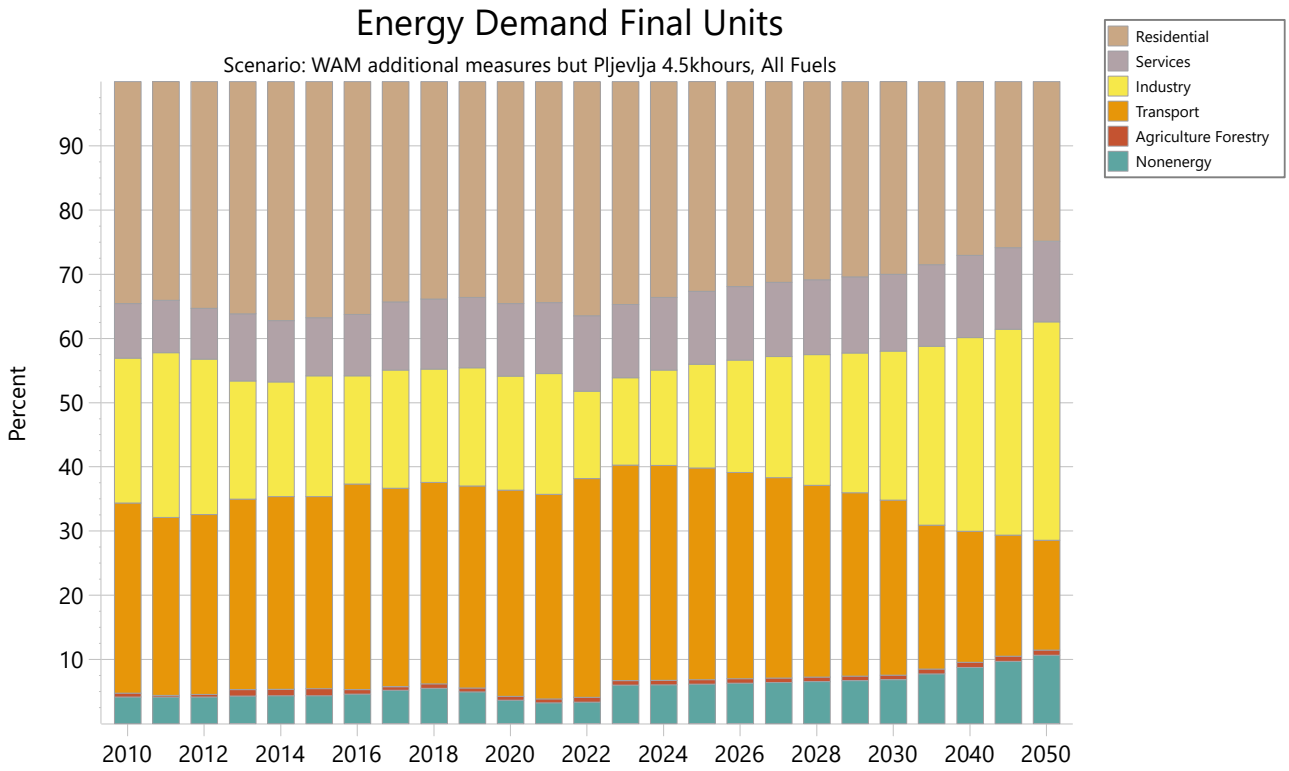



*Figure 69: Shares of final energy demand for the demand sectors for historic years 2010-2022 and as projected up to the year 2050 with additional measures*

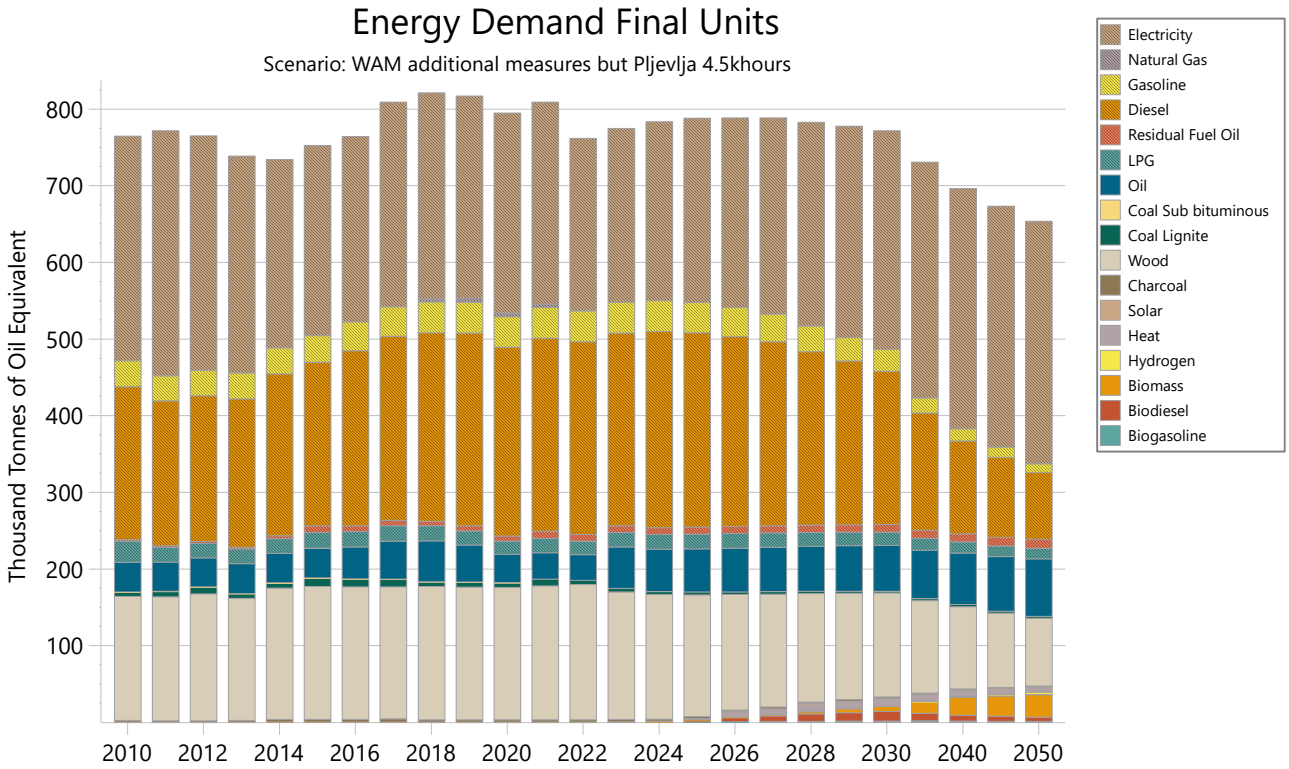



*Figure 70: Fuel split underlying the final energy consumption (ktoe) for all main demand sectors for historic values from 2010-2022 and as projected until 2050*

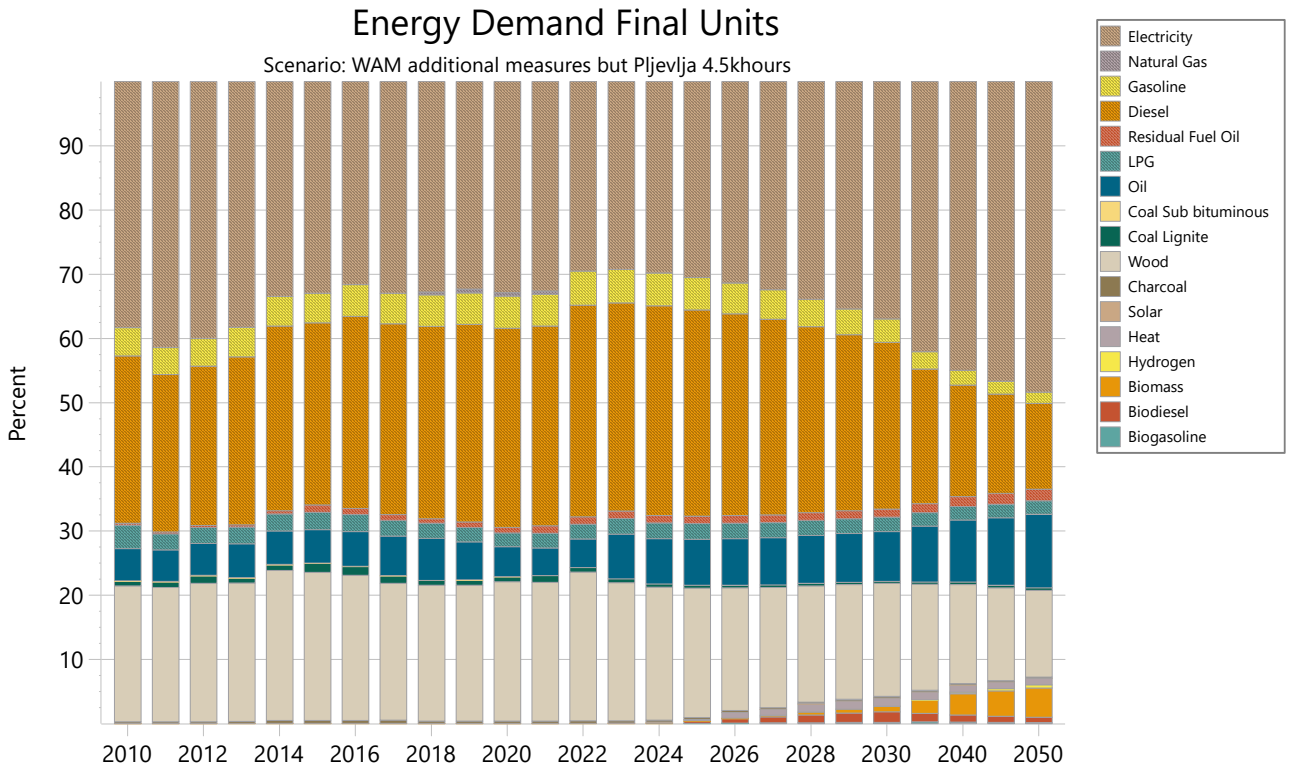



*Figure 71: Share of fuel split underlying the final energy consumption (%) for all main demand sectors for historic values from 2010-2022 and as projected until 2050*

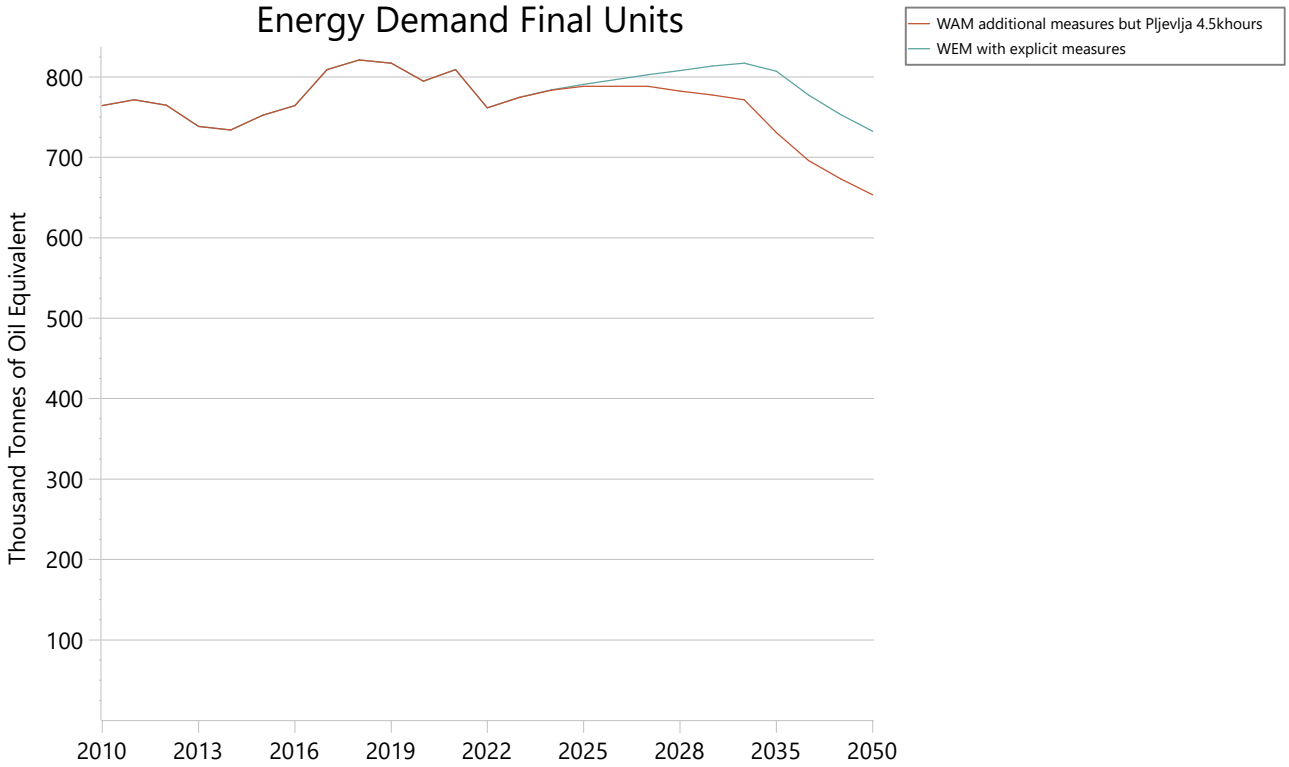



*Figure 72: Final energy consumption (ktoe) for all main demand sectors for historic values from 2010-2022 and as projected until 2050, Scenario comparison with the WEM scenario presented in Chapter 4.*

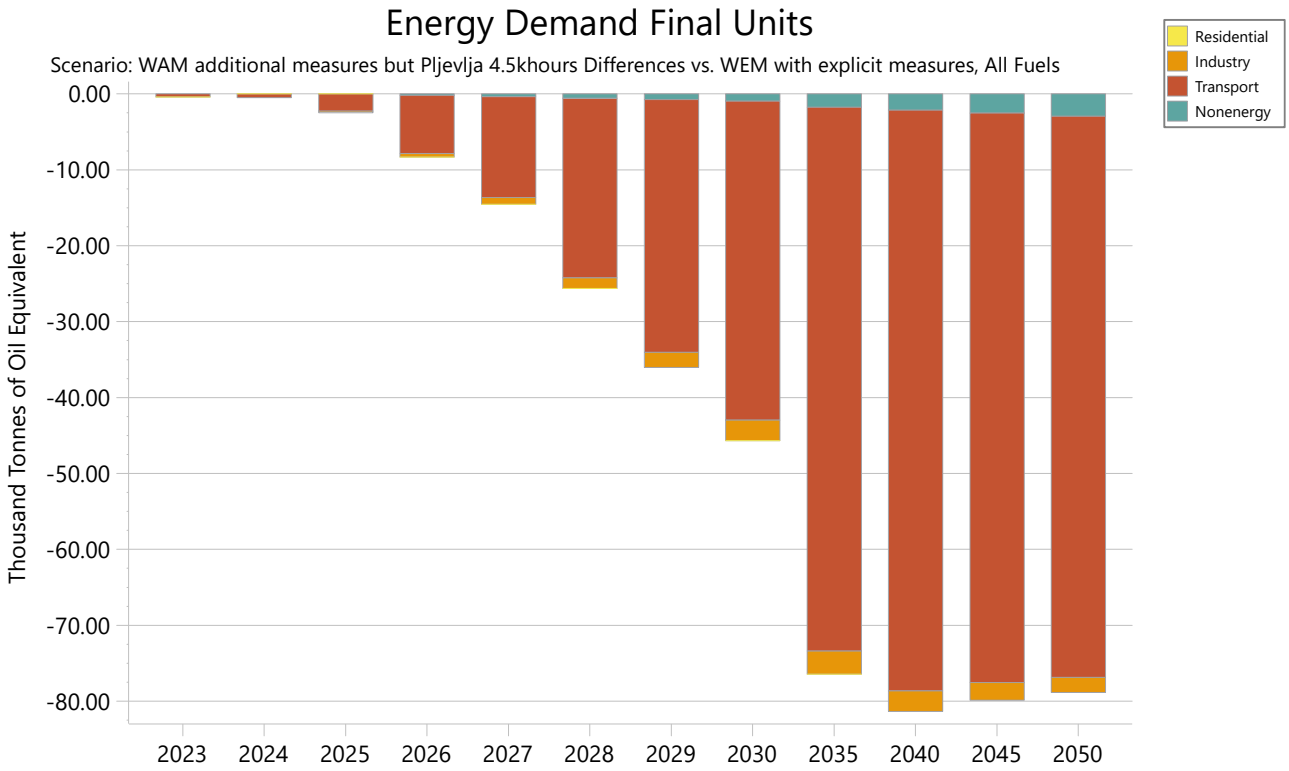



*Figure 73: Final energy consumption (ktoe) for all main demand sectors as projected until 2050, Differences between WAM and WEM broken down into subcategories.*

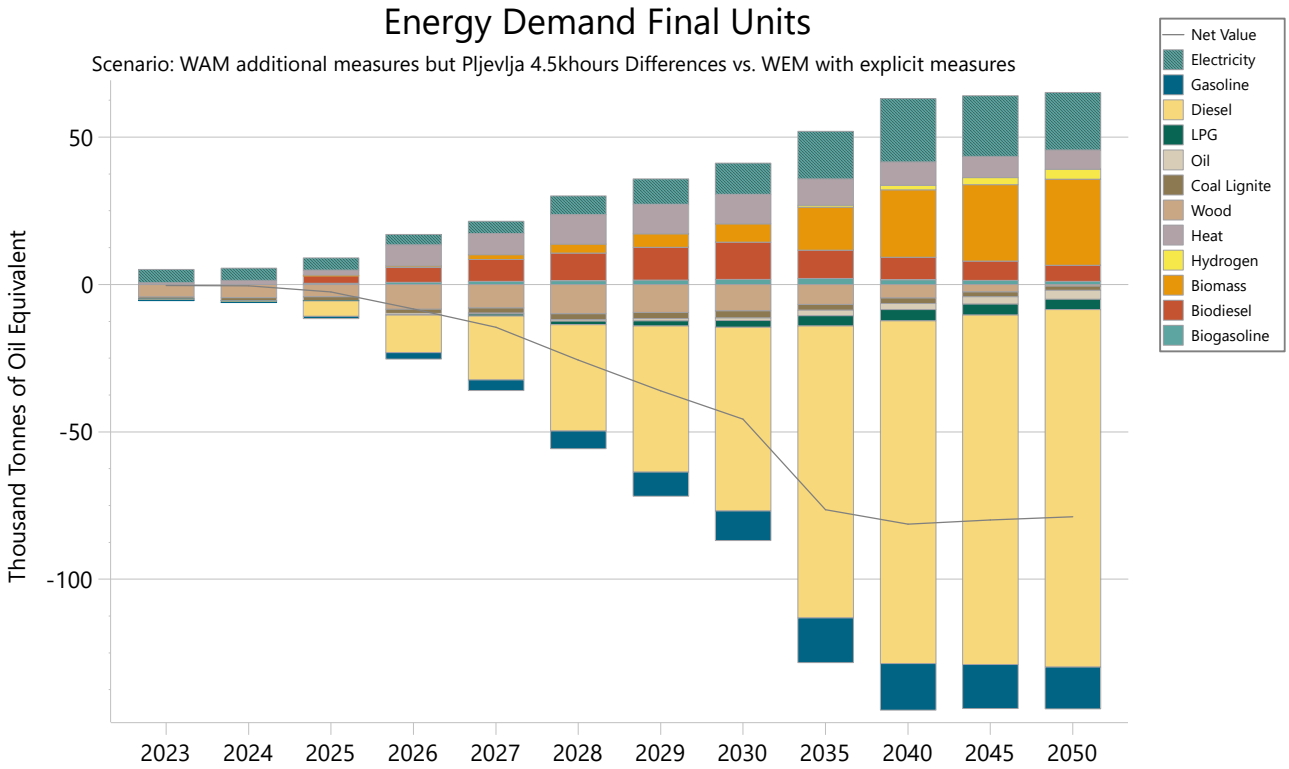



*Figure 74: Final energy consumption (ktoe) for all main demand sectors by fuel as projected until 2050, Differences between WAM and WEM broken down into subcategories.*

### 5.1.1.3 Dimension Energy Security

#### Electricity import shares

With regard to the energy security of the Montenegrin energy system, the power sector is of particular interest. Therefore, in the following, the development of electricity imports, generation and demand until 2050 is compared for the WAM and WEM scenarios. Figure 75 and Figure 76 combine this information in one graph for WAM and WEM scenario, respectively, and additionally show the import shares relative to the electricity generation each year. The respective numbers for selected historical years as well as the projected values are listed in Table 5.6. As these figures show, the WAM scenario reduces the import dependency for electricity as the installed capacity can supply the total demand.

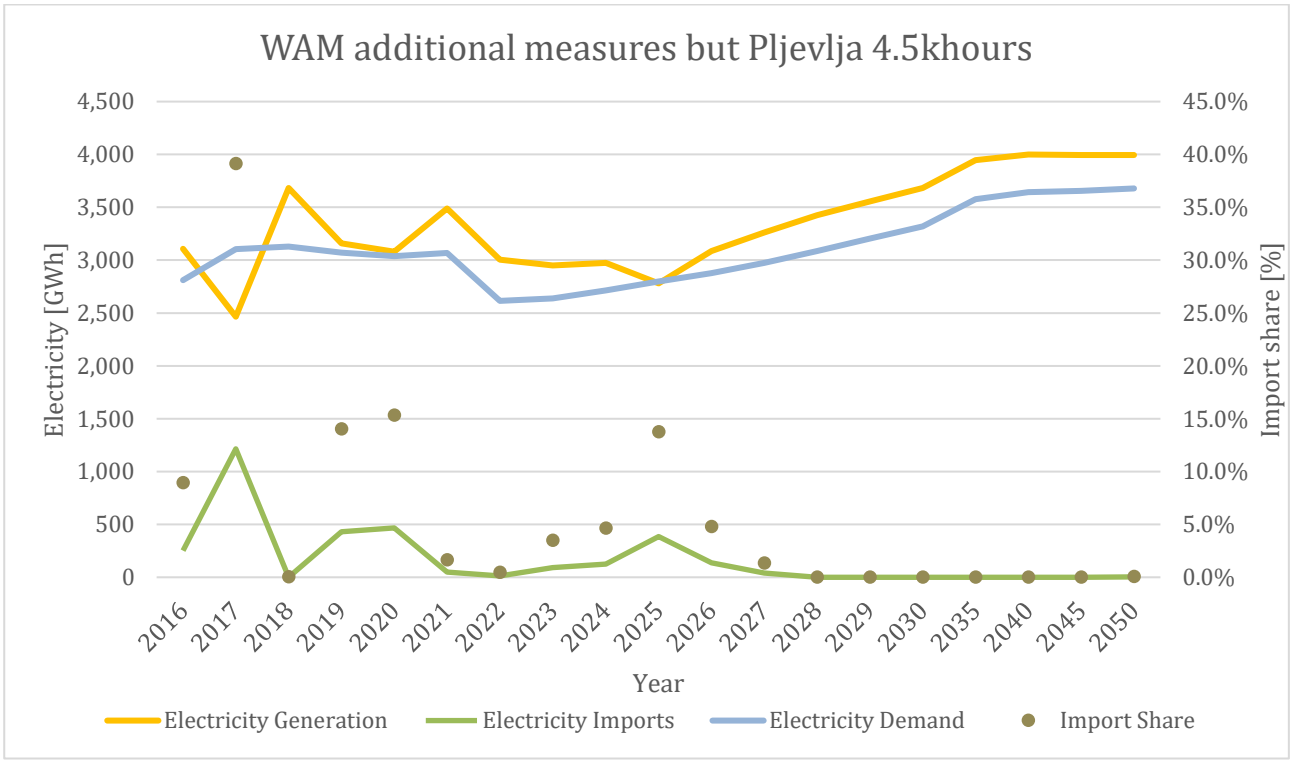



*Figure 75: Electricity generation, demand and imports in GWh as well as the import shares in % relative to the generation for the WAM scenario (projection 2023 - 2050)*

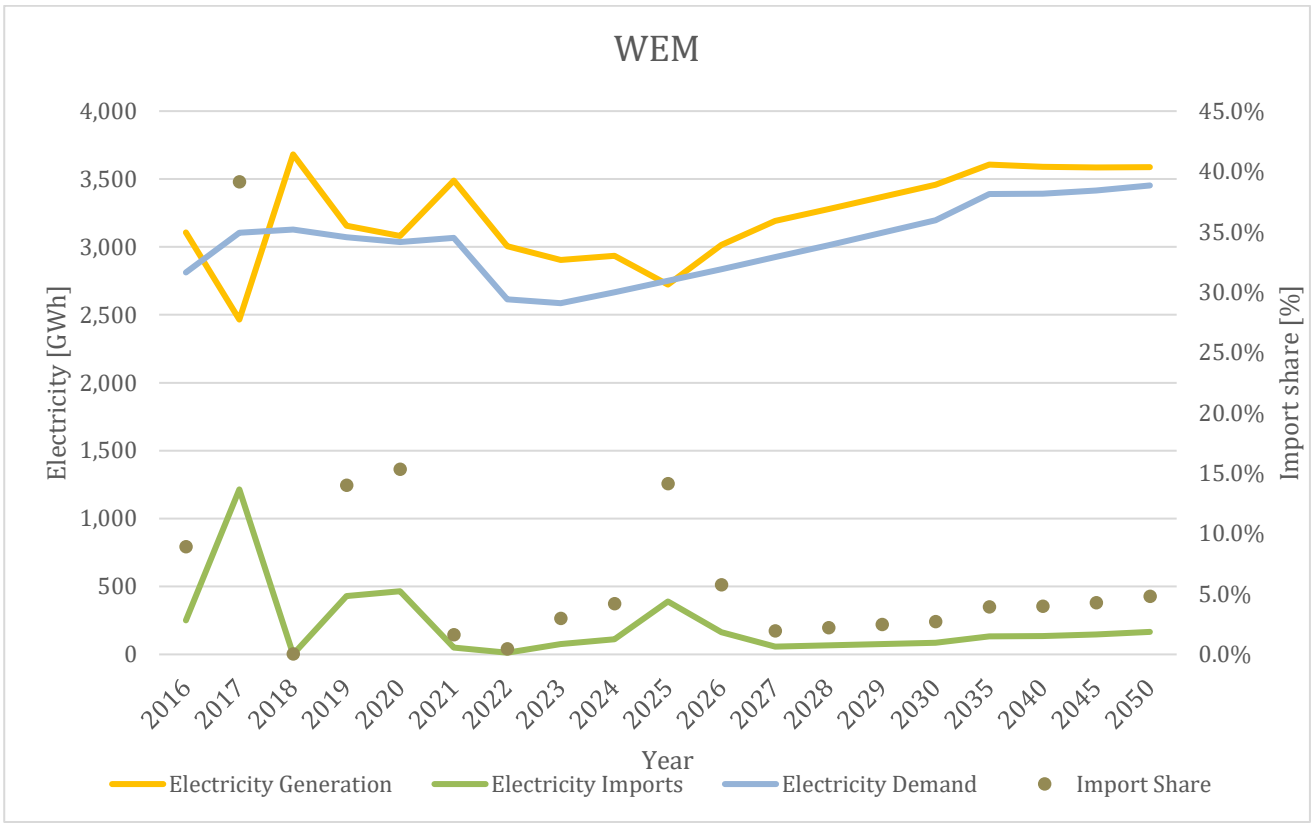



*Figure 76: Electricity generation, demand and imports in GWh as well as the import shares in % relative to the generation for the WEM scenario (projection 2023 - 2050)*

| | 2016 | 2018 | 2020 | 2022 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|---|---|
| **WEM** | | | | | | | | | | |
| **Electricity Demand (GWh)** | 2,811.1 | 3,128.7 | 3,036.7 | 2,614.7 | 2,750.0 | 3,195.2 | 3,389.1 | 3,392.8 | 3,416.2 | 3,452.6 |
| **Electricity Generation (GWh)** | 3,107.2 | 3,681.3 | 3,081.1 | 3,005.0 | 2,722.8 | 3,457.9 | 3,607.6 | 3,590.4 | 3,585.9 | 3,586.4 |
| **Electricity Imports (GWh)** | 251.0 | 1,214.8 | 465.6 | 12.2 | 389.0 | 86.8 | 132.9 | 135.1 | 146.2 | 166.4 |
| **Import Share (% of Gen.)** | 8.9% | 39.1% | 15.3% | 0.5% | 14.1% | 2.7% | 3.9% | 4.0% | 4.3% | 4.8% |
| **WAM** | | | | | | | | | | |
| **Electricity Demand (GWh)** | 2,811.1 | 3,128.7 | 3,036.7 | 2,614.7 | 2,798.3 | 3,318.8 | 3,576.2 | 3,642.2 | 3,655.9 | 3,678.4 |
| **Electricity Generation (GWh)** | 3,107.2 | 3,681.3 | 3,081.1 | 3,005.0 | 2,781.4 | 3,681.8 | 3,947.1 | 3,999.4 | 3,994.0 | 3,995.4 |
| **Electricity Imports (GWh)** | 251.0 | 1,214.8 | 465.6 | 12.2 | 385.2 | 0.0 | 0.0 | 0.0 | 0.0 | 2.9 |
| **Import Share (% of Gen.)** | 8.9% | 39.1% | 15.3% | 0.5% | 13.8% | 0.0% | 0.0% | 0.0% | 0.0% | 0.1% |

*Table 5.6: Electricity generation, demand and imports in GWh as well as the import shares in % relative to the generation for the WEM and WAM scenario (projection 2023 - 2050)*

#### *5.1.1.4 Discussion*

The following section discusses the most important points of the scenario analysis for the different sectors.

For the **residential** sector, the issue of energy efficiency is central to reducing overall energy demand and thus reversing the increase observed in recent years. The scenarios show that new construction of buildings with performance standards (EPBD) proves to be efficient in achieving a reduction in heating demand. Nevertheless, further changes in space heating technologies and fuel substitution need to be triggered to obtain further energy savings. In particular, the increased usage of heat pumps, the introduction of district heating, as well as the substitution of wood by pellets are worth mentioning.

Within the **service sector**, an increase in energy demand was observed until 2030 in the subsectors of trade, accommodation and food, as an effect of increased economic activity in these sectors. The question therefore arises as to how the energy savings that can be seen in public buildings can also be achieved in the private sector and in particular trade and hospitality.

As the demand for mobility (passenger and freight transport) is expected to increase further in the future, targeted measures are required in **the transport sector**. In the area of individual mobility, an ambitious introduction of electric vehicles, which are more energy efficient than internal combustion engines (ICE), is one of the focal points for reducing energy demand. The scenario modelling shows that in the WAM scenario, the deployment is ambitious enough to counteract the growing mobility demand for passenger transportation (which is the main consumer in the transportation sector). Other effective measure that is included (see Chapter 3) is a stronger focus on public transportation. As the current share of public transportation in Montenegro is below average for the area of western Balkan countries, the implementation of a bus network is considered. A final issue that represents an untapped source of decarbonization for both passenger and freight transport is the increased use of biofuels. In addition to CO2 reduction, this can be associated with the creation of a new local value chain.

In the **industrial sector**, the implementation of energy efficiency measures could be complemented by a possible fuel switch, as refurbishment for a fuel switch is also expected to lead to further efficiency gains. In addition to switching from fossil and emission-intensive fuels to electricity, solar heating could also be an interesting option for low-temperature heat in certain subsectors.

As has been discussed above, the transformation sector - i.e. energy supply - is a substantial source of emissions in Montenegro. Emissions from energy supply, which are considered in the model are only those stemming from the thermal plant of the power system, namely that in Pljevlja (referred to as TPP Pljevlja in the following) and is modelled accordingly. To highlight the importance of the TPP Pljevlja in the level of emissions and in the electricity supply in the country, the following figure shows the current energy generated in the form of electricity by the different power plants considered in the system. TPP Plevlja currently carries approximately 40% of the electricity supply (47.4% in 2022). In the scenario WAM, new power plants are considered, and the share of electricity which is supplied by TPP Pljevlja falls to 27.5% in 2030. TPP Pljevlja is put in cold reserve after 2040. The refurbishment of TPP Pljevlja is currently under way and is included in the WEM scenario.

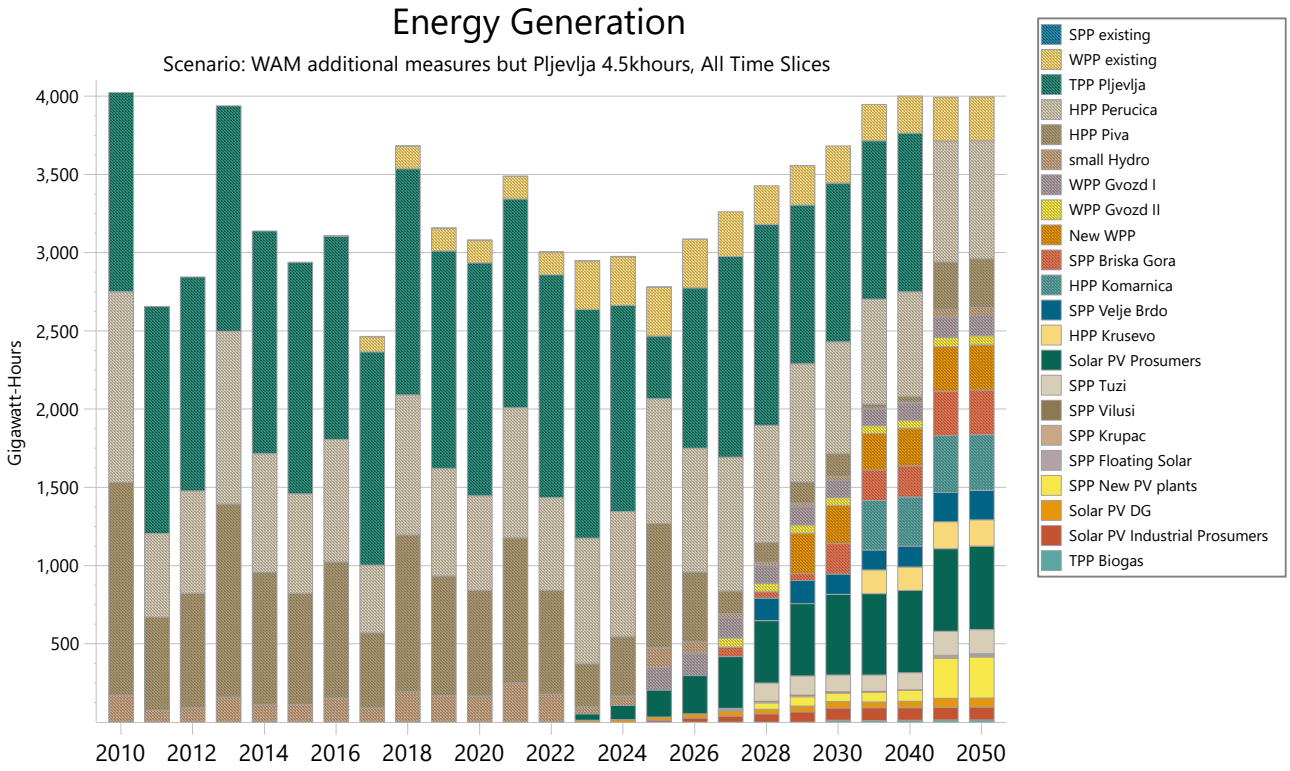



*Figure 77: Electricity generation from the different power plants considered in the model in the WAM scenario*

New hydro power plants (HPP) are considered in the WAM scenario (notably adding 171.9 MW capacity as HPP Komarnica in 2032 and 82 MW as HPP Krusevo in 2033). Furthermore, new solar photovoltaic installations are considered in the model for the time horizon to 2050 and an additional 200MW of wind plants.

In all cases, the model will match the electricity demand with the available capacities under the constraints of availabilities and seasonalities (see below). The following figure shows the development of electricity demand in different subsectors and the losses in the electricity grid which lead to slightly higher electricity generation than final demand. The model does not generate net exports of electricity.

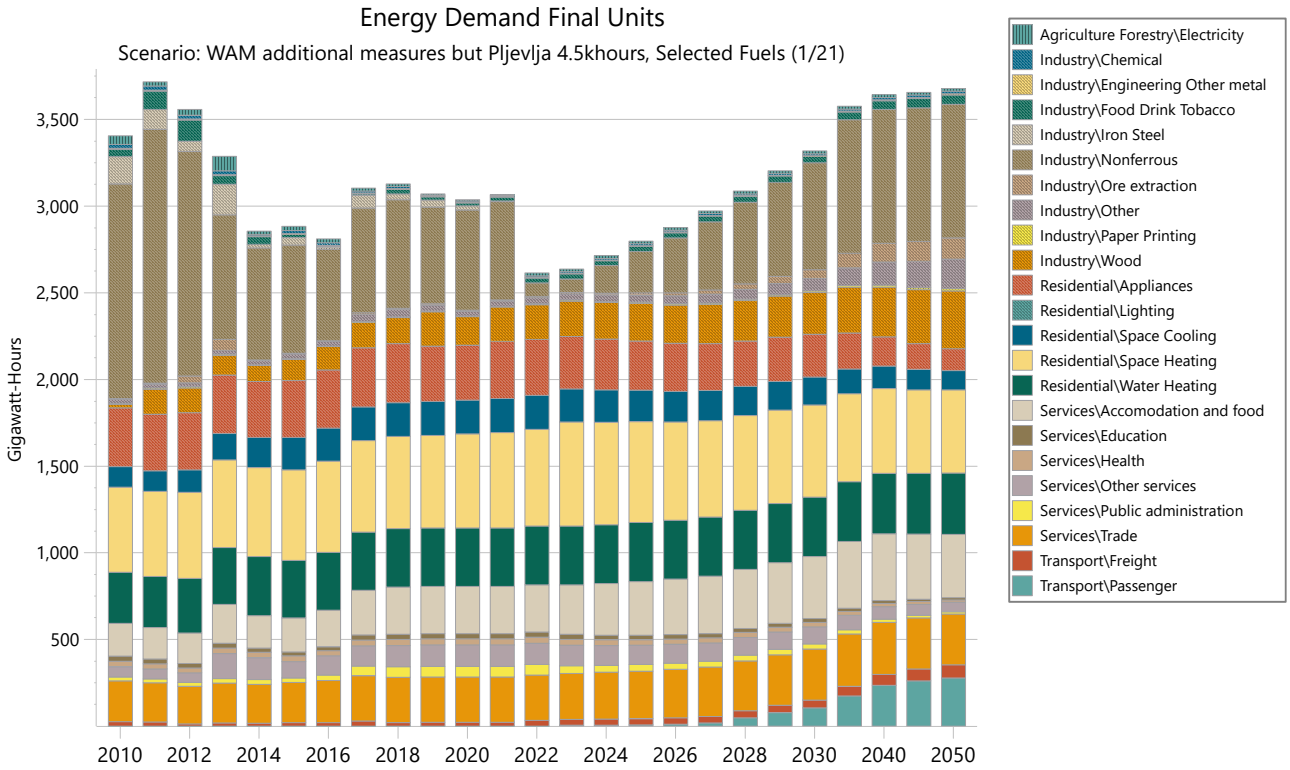



*Figure 78: Demand for electricity from different sectors as projected in WAM.*

In agriculture, the most important source of emissions is still from enteric fermentation. For N2O emissions, a better manure management could lead to significant emission reductions. Emissions from cropland cultivation could be further reduced by an increase of organic farming.

Within the LULUCF sector, the focus is on monitoring forest fires for GHG emissions. Emissions from biomass burning have a strong impact on the capacity of the forestry sink. In absolute terms, the latter can be considered the most important element of the GHG balance. In addition, emissions from land conversion to residential land are rising and should thus also be monitored.

The last sector to mention is the waste sector. Here, solid waste disposal requires target-oriented policies. In particular, the issue of a better waste management and higher recycling rates should be addressed.

#### *5.1.1.5 Technical notes on the scenarios*

##### *5.1.1.5.1 Seasonalities in electricity generation and demand*

In addition to the total demand for electricity, the model considers demand and availability of power plants in eight time slices through the year (four seasons and two periods of day) in all scenarios. Within these time slices, the dispatch order is the same, but some electricity demand sectors vary to reflect changing demands over seasons and times of day. The following figure shows this variation.

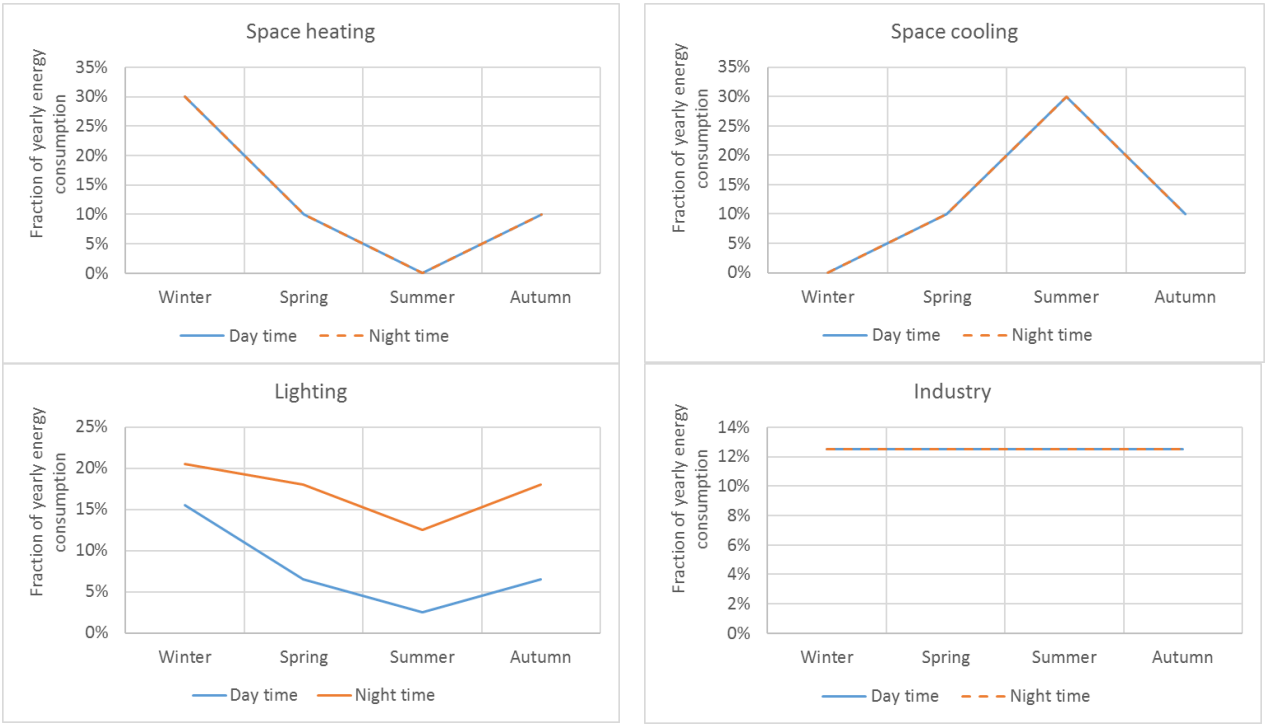



*Figure 79: Time slice variations of electricity demand. Note that the industry variation is used by all those branches that are not explicitly covered by one of the others, e.g. transport electricity*

In addition, the power plants also show seasonal and daily variations in their availability, as given in the following figure.

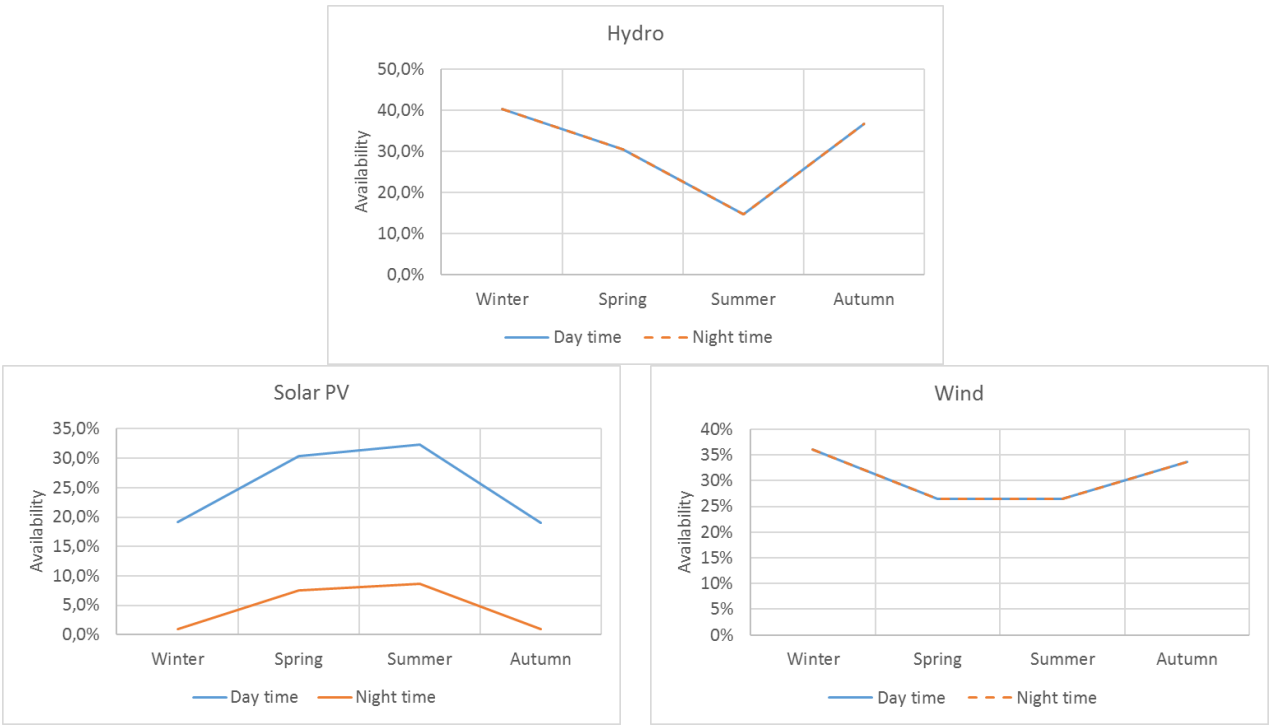



*Figure 80: Time slice variations of electricity supply from RES.*

## 5.2 Macroeconomic and, to the extent feasible, the health, environmental, employment and education, skills and social impacts, including just transition aspects (in terms of costs and benefits as well as cost-effectiveness) of the planned policies and measures described in section 3 at least until the last year of the period covered by the plan, including comparison to projections with existing policies and measures

This section will assess the non-energy impacts of energy and climate policies outlined in the NECP. While the environmental effects of policies promoting renewable energy (RE) and energy efficiency (EE) are well-documented, these measures also affect households, employment, businesses, and the public sector. Their impacts, ranging from macroeconomic effects to health and social outcomes, can be significant. This overview will focus on three key areas: 1) disposable household income, to assess fuel and energy poverty; 2) public budgets, to evaluate potential changes in revenue; and 3) employment, as these policies can create green jobs.

*Employment effects - Energy efficiency*

In terms of employment effects, PaMs focused on building renovation tend to have the largest impact. Most job creation occurs in the construction and manufacturing sectors.
PaMs related to building refurbishment are expected to significantly impact employment due to energy savings and the associated investments. These measures could create a few thousand full-time job equivalents from 2024 to 2030. Since public buildings make up a small portion of the total building stock, the majority of these employment gains will result from implementing energy performance standards for residential building renovations.

*Employment effects - Renewable energy*

The development of renewable energy power plants offers significant potential for job creation. While these plants will not be manufactured in Montenegro, the construction phase of renewable energy (RE) power plants will generate notable employment, although their operation is not labor-intensive. Most job creation is expected during the construction phase. Figure 81 provides an estimate of employment creation during the construction, operation, and maintenance phases of solar PV and wind power plants. This estimate uses normalized employment factors, converting person-years/MW into jobs/MW based on a 20-year project lifespan. The results are derived from the high-bound estimates by Cameron and van der Zwaan (2015)[20], who reviewed relevant peer-reviewed literature. Solar PV offers substantial potential for green job creation.

In the WEM scenario, around 318 MW of solar PV are added to the power system until 2030. This results in around 522 jobs in the installation phase, and 522 further jobs in the operation and maintenance phase, resulting in a total of 1045 solar PV related jobs until 2030. By a similar

[20] Lachlan Cameron and Bob van der Zwaan, *Employment factors for wind and solar energy technologies: A literature review*, Renewable and Sustainable Energy Reviews, 2015, vol. 45, issue C, pp 160-172.

metric, a total of around 57 jobs are created due to wind power plants, with a higher share (two thirds) attributed to the operation and maintenance phase.
The WAM scenario comprises a capacity addition of 1589 MW until 2030 for solar PV and 145 MW in the same timeframe for wind. This results in around 2610 jobs in each the installation and operation and maintenance phase for solar PV, or a total of 5220 jobs. As for wind, a total of around 150 jobs are created in the WAM scenario.

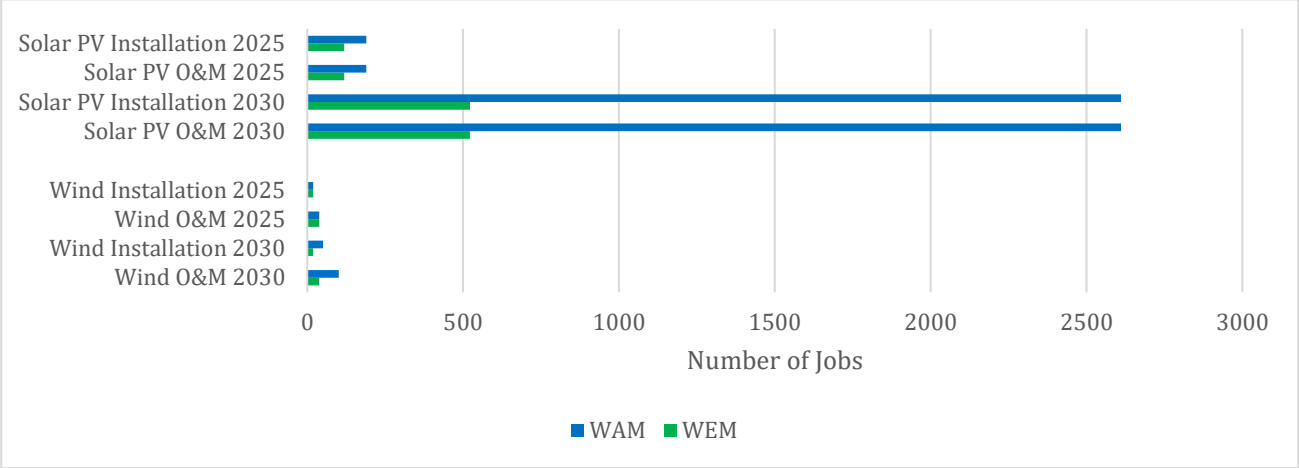



*Figure 81: Cumulative employment until 2025 and 2030 for solar PV and wind for the installation and O&M phases (own elaboration based on Cameron and van der Zwaan (2015)).*

## 5.3 Overview of investment needs

*i. existing investment flows and forward investment assumptions with regard to the planned policies and measures*

In the PaM description in chapter Chapter 3, the budget and investment are presented per PaM.

*i. sector or market risk factors or barriers in the national and regional context*

One risk that could hinder the growth of RES is the limitation of the state budget. Most new capacity would rely on support mechanisms such as FIT/CfD or net metering, which impact the state budget through national utilities and electricity prices.

*ii. analysis of additional public finance support or resources to fill identified gaps identified under point ii*

## 5.4 Impacts of planned policies and measures described in section 3 on other Member States and regional cooperation at least until the last year of the period covered by the plan, including comparison to projections with existing policies and measures

This section examines the impacts of the planned policies and measures outlined in Chapter 3 on neighbouring countries and regional cooperation, at least through the final year of the plan's coverage.

*i. Impacts on the energy system in neighbouring and other Member States in the region to the extent possible*

No impact is expected in the oil and gas sector of the region and the neighbouring countries. Furthermore, the projections of WAM in electricity sector show that there is on net imports or exports, which means that overall the effect in the region will be minimal.

*ii. Impacts on energy prices, utilities and energy market integration*

It is expected that the increase of renewable energy, combined with the rehabilitation of the lignite fired power plant and its eventual phase out, will lead to cheaper electricity prices.

*iii. Where relevant impacts on regional cooperation*

The projected regional interconnections are expected to enhance the integration with neighbouring countries energy systems, impacting positively regional cooperation.

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