

Low Carbon Development Strategy (LCDS) for Montenegro

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ECA



Contributors



Economic Consulting Associates Limited

41 Lonsdale Road, London NW6 6RA,
United Kingdom

tel: +44 20 7604 4546

fax: +44 20 7604 4547

www.eca-uk.com



EcoEnergy Consulting Doo

Marka Djukanovica 9, Podgorica
Montenegro

+38267567737

www.ecoenergy-consulting.com

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Abbreviations and acronyms

AFOLU	Agriculture, forestry, and other land use
BESS	Battery energy storage systems
BRS	Building renovation strategy
CfD	Contract for difference
CBAM	Carbon border adjustment mechanism
CGES	Crnogorski elektroprenosni sistem
COTEE	Crnogorski operator tržišta električne energije
ECA	Economic Consulting Associates
EE	Energy efficiency
EPC	Energy performance certificate
ESCO	Energy service companies
ETS	Emissions Trading Scheme
ETSDP	Electricity Transmission System Development Plan
EU	European Union
EV	Electric vehicles
GDP	Gross domestic product
HGV	Heavy goods vehicle
HPP	Hydro power plant
ICE	Internal combustion engine
IGCC	International Grid Control Cooperation
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial processes and product use
LCDS	Low Carbon Development Strategy
LEAP	Low Emission Analysis Platform
LPG	Liquid petroleum gas
LULUCF	Land use change, and forestry
M&V	Monitoring and verification
MDM	Metre data management
MRV	Monitoring, reporting, and verification
NDC	National Determined Contribution
NECP	National Energy and Climate Plan
NZEB	Nearly Zero Energy Buildings
PAM	Policies and measures

PMI	Partnership for Market Implementation
PPA	Power purchase agreement
SPP	Solar power plant
SSMS	Sustainable and Smart Mobility Strategy
UNIDO	United National Industrial Development Organisation
WPP	Wind power plant
VTMIS	Vessel Traffic Management Information System
WAM	With Additional Measures
WEM	With Existing Measures

Executive summary

Montenegro has achieved impressive economic development, however the energy system remains reliant on fossil fuels, leading to persistent greenhouse gas emissions.

Since independence in 2006, Montenegro has seen nominal incomes grow by on average 3% per year,¹ achieving upper middle income status and becoming the frontrunner candidate country for European Union accession. Despite this progress, the country's energy system remains reliant on greenhouse gas (GHG) emitting fossil fuels. Coal fired thermal power plant (TPP) Pljevlja remains essential for security of supply of the electricity network; while petroleum fuels remain to primary energy source for transport, industry and manufacturing. Ongoing fossil fuel use results in persistent GHG emissions from the country despite a vulnerability to the adverse impacts of climate change. Montenegro has particular exposure to droughts, floods, forest fires and heatwaves with the water, forestry and agriculture sectors all vulnerable to its effects.² Contributing to global decarbonisation goals is therefore a key political target with the long-run objective of climate neutrality by 2050. Furthermore, investing in decarbonisation can deliver significant benefits, not only related to health and environmental outcomes, but by stimulating green industry, reducing dependence on imported fuels, and enabling export of renewable electricity.

Montenegro's Low Carbon Development strategy sets a pathway to achieve long term emissions' targets.

In December 2025 Montenegro adopted the "Law on Climate Change". The law provides the enabling provisions for the development and implementation of core policies to support Montenegro to achieve its domestic targets and international obligations in relation to climate change and emissions reduction, including through the development of the Low Carbon Development Strategy (LCDS) and the Climate Change Adaptation Plan.³ Targets include a long-term emission reduction target of climate neutrality by 2050 established in the Law and an intermediate target of a 55% reduction in net, economy-wide emissions by 2030 (compared to 1990) as expressed in Montenegro's Updated Nationally Determined Contribution (NDC).⁴ Montenegro's extensive forests provides a substantial but uncertain carbon sink. The LCDS therefore provides a pathway to meet these targets with increased confidence by focusing on the minimisation of gross emissions at the sectoral level while proposing further activity in the land use, land use change, and forestry (LULUCF) sector. The LCDS is led by the Ministry of Ecology, Sustainable Development and Northern Region Development but supported by cross-cutting engagement with other state and public entities.

¹ World Bank. World Bank Databank. [GDP per capita \(constant LCU\) – Montenegro](#). Accessed: 21 December 2025.

² Government of Montenegro. 2024. [Fourth national Communication and the First Biennial Transparency Report of Montenegro to the UNFCCC](#)

³ Government of Montenegro. 2025. [Climate Change Adaptation Plan for period 2025-2035 with action plan for period 2025-2027](#)

⁴ Government of Montenegro. 2025. [Update of the NDC of Montenegro \(3.0 NDC\)](#)

To ensure alignment across energy and climate planning, the LCDS uses Montenegro's National Climate and Energy Plan (NECP) as a basis.

Montenegro has recently adopted its NECP in fulfilment of the country's requirements as a signatory to the Energy Community Treaty. The LCDS proposes additional policies and measures (PAMs) to those included in the NECP that can increase the ambition level for emission reductions. The LCDS has been developed as a long-term enhancement of the NECP, and while the NECP focuses on the period to 2035, the LCDS emphasises long term opportunities to 2050. Together the two documents provide three scenarios of low carbon development for Montenegro:

- The NECP With Existing Measures (WEM) scenario (lowest ambition).
- The NECP With Additional Measures (WAM) scenario (medium ambition).
- The LCDS scenario (highest ambition).

As with the NECP, the LCDS is action oriented and is structured around a set of PAMs Montenegro can implement to deliver decarbonisation objectives.

The LCDS scenario assumes all climate related PAMs outlined in the NECP are implemented. In addition, the LCDS defines further PAMs targeting reducing emissions from each of the major emitting sectors as close to zero as possible based on available technologies and their expected evolution. PAMs are arranged by emissions sector, with emissions sectors defined based on reporting sectors as required by the UNFCCC.

LCDS scenario PAMs

LCDS PAMs
Energy Power generation (PG).
LCDS PAM PG.1: Alignment of the carbon price with the European Union (EU) Emissions Trading System (ETS) price by 2028.
LCDS PAM PG.2: Retirement of TPP Pljevlja by 2035.
LCDS PAM PG.3: Full deployment of the renewable energy generation projects included in the electricity transmission system development plan (ETSDP) and not deployed under the NECP.
Energy Transport (T).
LCDS PAM T.1: Develop and publish a transport decarbonisation strategy, including formalising targets included in the LCDS.
LCDS PAM T.2: Reduce car kilometres by 25% by 2035.
LCDS PAM T.3: 100% electrification of rail infrastructure by 2040.
LCDS PAM T.4: 90% of road transport vehicles zero emissions by 2050.
Energy Manufacturing and industrial energy use (IM).
Industry and manufacturing LCDS PAM IM.1: 95% of industrial and manufacturing fossil fuel use to be replaced with electricity.
Energy Buildings (B).

LCDS PAMs
LCDS PAM B.1: Implementation of Montenegro's Building Renovation Strategy (BRS).
Industrial processes and product use (IPPU).
LCDS PAM IPPU.1: Development and implementation of plans for Phases II, III and IV for reduction of hydrofluorocarbon (HFC) use in line with the Kigali Amendment.
Agriculture (AG).
LCDS PAM AG1: Assignment of responsibility within the Ministry of Agriculture, Forestry and Water Management to monitor international developments in agricultural mitigation technologies.
Waste (W).
LCDS PAM W1: Assignment of responsibility within the Ministry of Ecology, Sustainable Development and Northern Development to monitor international developments in waste management technologies and processes.
Land use, land use change, and forestry (LULUCF).
LCDS PAM LULUCF1: Conversion of coppice to high forests.
LCDS PAM LULUCF2: Consider inclusion of carbon removals from soils for Forst Land, Cropland and Grassland for the LULUCF sector.

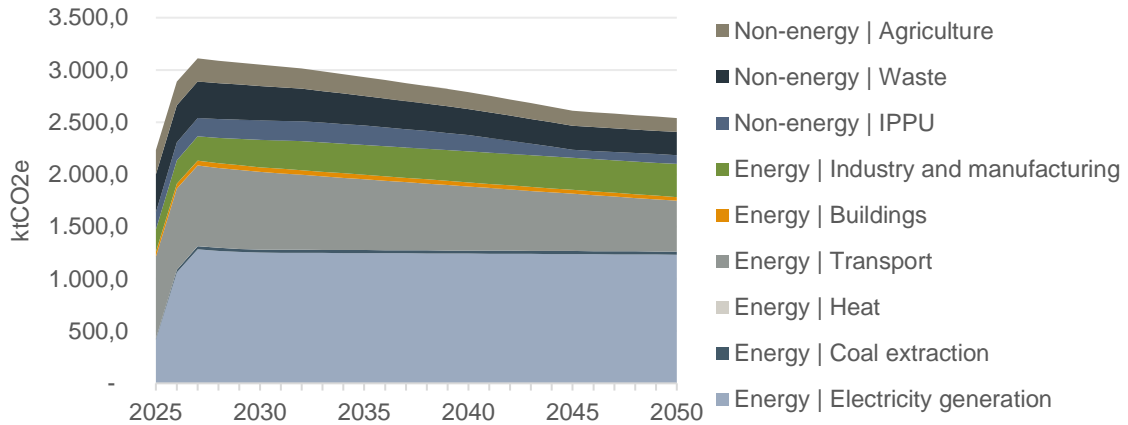
Development of the LCDS has been a participatory process and has incorporated feedback from wide ranging stakeholders.

Preparation of the strategy began in 2023 and has included four rounds of stakeholder workshops to inform stakeholders on approach and progress. Stakeholders from government, industry, civil society, and academia have provided critical input on the process for development, PAMs included in the strategy, and technical inputs to the underpinning model.

The NECP WEM scenario represents the case where only measures already being implemented are taken.

This scenario does not include the retirement of TPP Pljevlja, and does not foresee sufficient capacity of greenfield renewable energy generation to reduce the utilisation of TPP Pljevlja before 2050. As a result, emissions from power generation are not reduced by 2050. While emissions from transport, waste, agriculture, IPPU, and buildings all fall; progress is overall limited as PAMs targeting electrification are not implemented.

Forecast emissions by sector in NECP WEM scenario.



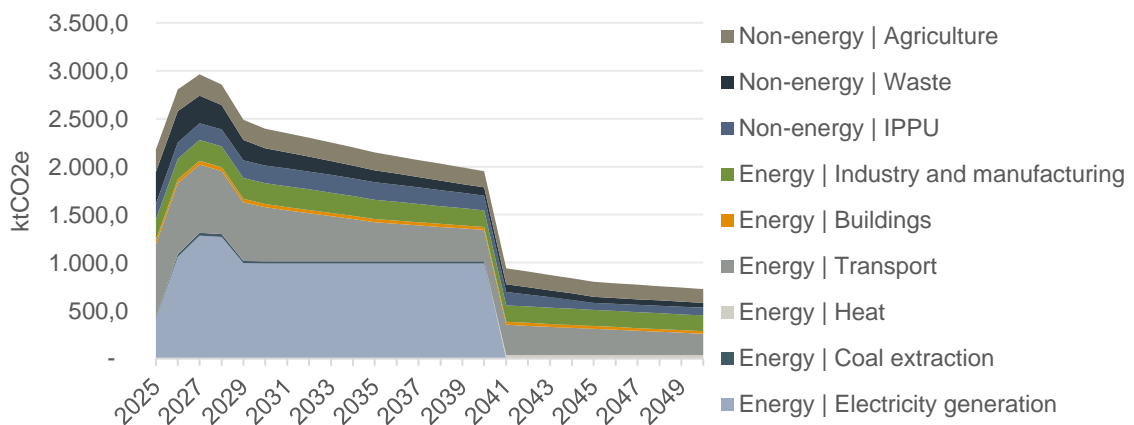
Source: Economic Consulting Associates based on NECP data.

The NECP WAM scenario includes additional PAMs to those included in the WEM scenario with a focus on the period to 2035.

Meaningful additional PAMs implemented in the WAM scenario include significant additional uptake of renewable energy power generation, uptake of electric mobility and modal shifting in transport, electrification of machinery, and implementation of major improvements in waste management. The result of these measures is a significant reduction of total emissions relative to the WEM scenario.

A first wave of renewable energy generation capacity is expected to come online around 2029 in the WAM scenario, facilitating a fall in utilisation for TPP Pljevlja, and a resulting fall in emissions. TPP Pljevlja is expected to come offline in 2041 in this scenario, leading to complete elimination of greenhouse gas (GHG) emissions from the power generation sector.

Forecast emissions by sector in NECP WAM scenario.



Source: Economic Consulting Associates based on NECP data.

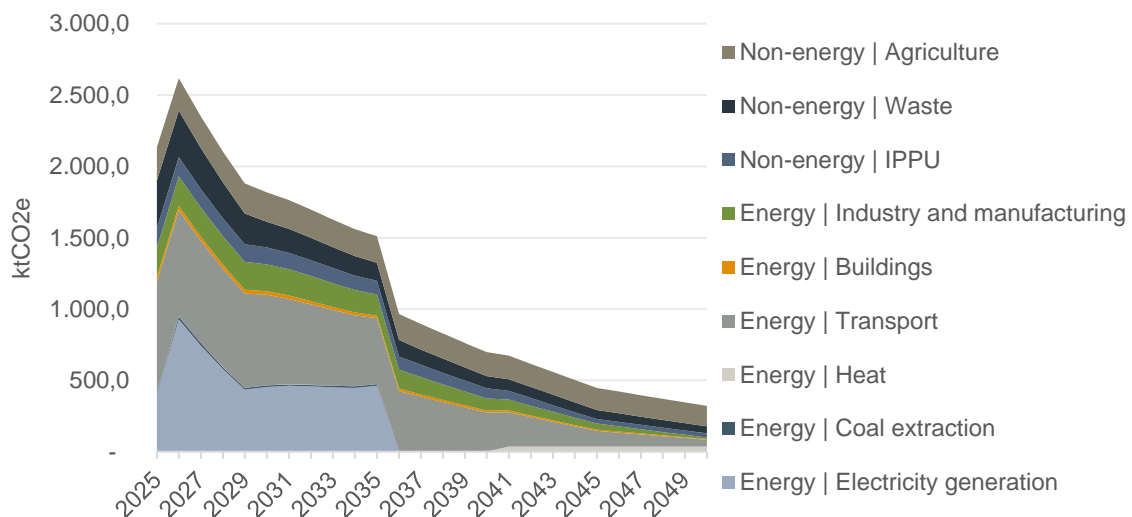
The LCDS scenario represents increased ambition for emissions reduction with a focus on the period to 2050.

Compared to the NECP WAM scenario, the LCDS scenario sees:

- additional installed renewable energy generation capacity,
- increased ambition in the electrification of transport and modal shift to more efficient transport modes,
- increased ambition in the electrification of industry,
- implementation of a comprehensive building renovation programme, and
- reduction of hydrofluorocarbons (HFCs) in line with the requirements of the Kigali Amendment to the Montreal Protocol.

The cumulative effect of these PAMs is an accelerated reduction of emissions from non-power sector sources starting from 2030. By 2050 in the LCDS scenario, total gross GHG emissions fall to 322 ktCO₂e, corresponding to 9% of reported 2022 emissions. Agriculture contributes by far the largest share of residual emissions.

Forecast emissions by sector in LCDS scenario.



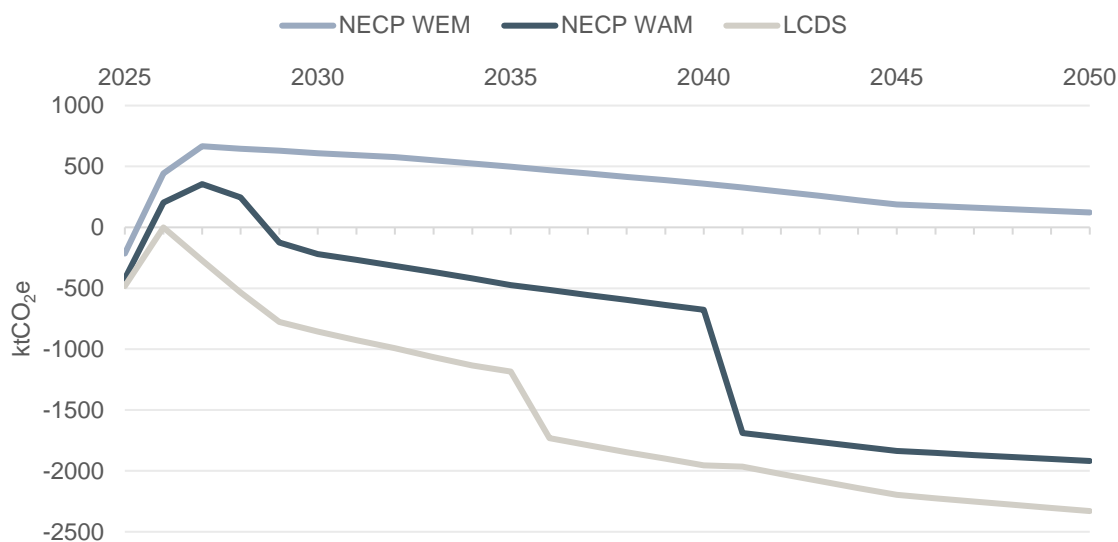
Source: Economic Consulting Associates based on NECP data.

Both the NECP WAM and LCDS scenario achieve net zero emissions between 2030 and 2035.

While gross emissions excluding LULUCF per the above chart do not reach zero at any point, net zero emissions are possible because of the negative emissions from the carbon sink associated with Montenegro's forests. For both the WAM and LCDS scenarios, net zero territorial emissions is achieved when development of new build renewable power generation facilitates a reduction in the utilisation of TPP Pljevlja. This occurs in 2027 in the LCDS scenario, and 2029 in the NECP WAM scenario (see below chart). In the NECP WEM scenario, utilisation of TPP Pljevlja does not fall at any stage and the impact of other mitigation PAMs is relatively small, as a result this scenario does not achieve net zero emissions at any point. These estimates are based on a central forecast of negative emissions from LULUCF

which are subject to significant year-to-year variability due to the unpredictable nature of forest fires and droughts. EU accounting constraints may also impact such calculations and hence the forecasts for net emissions should be taken as illustrative approximations rather than firm predictions.

Net GHG emissions across scenarios



Source: Economic Consulting Associates based on NECP data.

While the forest carbon sink means Montenegro can achieve net zero well ahead of the 2050 target, there is further potential for to reduce gross emissions.

At a sectoral level, there are several critical opportunities for major emissions reductions that will also deliver wider benefits:

- In the electricity generation sector, reducing capacity of or shutting down the Pljevlja thermal power plant will reduce or remove the primary source of national emissions. This may be supported by accelerated construction of capacities for electricity generation from renewable sources, which can also provide additional economic benefits through increased electricity exports. **Modal shift and electrification of transport** will be key actions to eliminating emissions from this sector. Simultaneously, modal shift will increase efficiency and lower cost, while electrification will reduce dependence on imported fossil fuels. Additionally, **electrification of manufacturing and industrial processes** can eliminate emissions while leveraging synergies from electrification of transport.
- **Successful delivery of existing plans and strategies for buildings, use of hydrofluorocarbons (HFCs), and the waste sector** can deliver decarbonisation of those sectors. Implementation of the BRS will bring additional benefits of reduced energy bills and improve health outcomes, particularly for households at risk of energy poverty. Similarly, implementation of planned improvements in the waste sector will deliver wider environmental benefits.

Early and decisive climate action can deliver net zero emissions while supporting Montenegro’s economic, social, and political ambitions.

Successful implementation of this LCDS will surpass Montenegro’s target of net zero emissions and deliver impressive reduction in emissions across all major sources. Beyond reducing emissions, decarbonisation can provide an economic stimulus by creating a renewable energy export industry, improving energy efficiency for businesses and households, and reducing dependence on imported fossil fuels. Action is also an essential requirement of Montenegro’s ambition to accede to the European Union by 2028, by which time the alignment with EU energy and climate policy and acquis will be required, including alignment with the net zero 2050 target.

1 Introduction

1.1 Objective of document

Climate change presents a critical challenge to the international community with rising temperatures threatening extensive negative environmental, economic, and social impacts. Montenegro has particular exposure to droughts, floods, forest fires and heatwaves with the water, forestry and agriculture sectors all vulnerable to its effects.⁵ Contributing to global decarbonisation goals is therefore a key political target with the long-run objective of climate neutrality by 2050.

In December 2025 Montenegro adopted the “Law on Climate Change”. The law provides the enabling provisions for the development and implementation of core policies to support Montenegro achieve its domestic targets and international obligations in relation to climate change and emissions reduction. The law aims to give the basis for Montenegro to reach the climate neutrality by 2050 target through the permitting, tracking, and registering of greenhouse gas emissions, the creation of an Emissions Trading Scheme (ETS) for alignment and integration with that of the European Union (EU), and the related monitoring, verification and reporting (MRV) processes and infrastructure.⁶

The law also mandates the development of a Low Carbon Development Strategy (LCDS). The LCDS establishes a pathway with supporting policy measures to achieve the long-term emission reduction target of climate neutrality by 2050 as established in the law. An intermediate target of a 55% reduction in net emissions by 2030 was expressed in Montenegro’s Updated Nationally Determined Contribution (NDC).⁷ Montenegro’s extensive forestry provides a significant but uncertain (due to account approach and year-to-year volatility) carbon sink which has a major impact on any estimate of net emissions. The LCDS pathway help give greater confidence to the achievement of this goal by minimising gross emissions across all sectors, while also taking additional action in the land use, land use change, and forestry (LULUCF) sector. The LCDS is led by the Ministry of Ecology, Sustainable Development and Northern Region Development but supported by cross-cutting engagement with other state and public entities. This document constitutes the LCDS and is structured as follows:

- **Section 1** introduces the objectives of the LCDS, how it fits within the legal and policy framework for climate change action in Montenegro, and its role in meeting international obligations for the country.
- **Section 2** provides sector-by-sector assessments, drawing from relevant sectoral strategy and planning documents to identify details on mitigation and adaptation policy measures in relation to emission reduction as well as governance, social,

⁵ Government of Montenegro. 2024. [Fourth national Communication and the First Biennial Transparency Report of Montenegro to the UNFCCC](#)

⁶ Covering the support information technologies (IT) systems, calculation methodologies, and their interaction with institutional and regulatory structures

⁷ Government of Montenegro. 2025. [Update of the NDC of Montenegro](#)

and international dimensions. These are split into “energy” and “non-energy” sectors.

- **Section 3** uses the findings of the sector-specific assessments to develop a set of emission reduction pathways under different policy scenarios to identify a credible LCDS pathway that seeks to meet net zero and further minimise gross sectoral emissions across the economy.

The LCDS has been prepared developed by a consultancy team of Economic Consulting Associates (ECA) of the United Kingdom and EcoEnergy Doo of Montenegro through the World Bank’s Partnership for Market Implementation (PMI).

Development of the LCDS has included phased stakeholder engagement process with four consultative workshops held to discuss approach, modelling assumptions, policies and measures (PAMs) included in the strategy, and modelling assumptions with stakeholders at key development milestones. Workshops have been attended by representatives from across Montenegrin society including national government, local government, businesses, industry bodies, non-governmental organisations (NGOs), international organisations, civil society, and academia. When specific topics have been identified as needing additional consultation in workshop, bilateral follow up meetings have been held with relevant stakeholders.

1.2 International context

Montenegro is a signatory or contracting party to a number of international agreements that impose a series of obligations on the country regarding the reduction of greenhouse gas emissions and policies to support this.

Paris Agreement.

Montenegro is a signatory to the Paris Agreement adopted at COP21 in 2015 and entered into force on 4 November 2016.⁸ Under the agreement Montenegro is required every five years to prepare a NDC outlining a short to medium-term plan for achieving emissions reductions and related targets. Montenegro’s updated NDC set a target of a 55% reduction in total national GHG emissions (including LULUCF) by 2030 compared to 1990 (base year).

In addition, signatories are invited to submit NDC-aligned long-term low emissions development strategies (LT-LEDS) that provide just transitions to net zero emissions by or around 2050, taking into account national circumstances.⁹ Montenegro’s LCDS fulfils this requirement.

Energy Community.

Montenegro is a Contracting Party to the Energy Community and thereby bound by the Energy Community acquis that transposes climate and energy legislation of the EU subject to agreed amendments. The latest legal framework is Edition 5.0 of 2023 and contains the transposition

⁸ UNFCCC. Accessed 2025. [The Paris Agreement](#).

⁹ UNFCCC. Accessed 2025. [Long-term strategies portal](#).

of the Governance Regulation (EU) 2018/1999, which requires the periodic development of National Energy and Climate Plans (NECPs). Set across five dimensions NECPs include planned PAMs for climate change mitigation, as well as corresponding emissions trajectories. They include an assessment of how such additional planned measures may see an increased level of ambition and emissions reduction. Montenegro has recently adopted its NECP with such details and two emissions reduction trajectories, termed as “With Existing Measures” (WEM) and “With Additional Measures” (WAM) respectively. As encouraged by Article 8 of the Governance Regulation, Montenegro’s draft NECP considers the longer-term perspective of the proposed measures out to 2050 although does not include consideration of new or strengthened measures beyond 2035.

European Union (EU).

Montenegro holds Candidate Status for EU accession with an ongoing negotiation process for meeting the full requirements of the EU acquis, and a political commitment to complete accession negotiations by the end of 2026 and achieve EU membership by 2028.¹⁰ Chapter 27 of the acquis on Environment and Climate Change, which must be met in full, covers related matters concerning greenhouse gas emission reduction targets, climate neutrality by 2050, and the associated EU legislation for achieving this. This includes harmonisation and integration with the EU ETS and associated need for facilitating carbon pricing in the Montenegrin economy. The National Strategy with Action Plan for transposition, implementation, and enforcement of the EU acquis on Environment and Climate Change 2016-2020 (NEAS) was developed as the guiding document for establishing the necessary actions to meet the EU’s climate change requirements as well as providing a benchmark against which progress can be measured.

1.3 Domestic context

Energy use is the largest source of greenhouse gas (GHG) emissions in Montenegro. Energy industries, which includes power generation, is the largest single source. Emissions from energy industries come almost entirely from the 43 year old 225 MW TPP Pljevlja lignite coal power station, the only large thermal power station in Montenegro. TPP Pljevlja supplies 30 to 40% of Montenegro’s electricity demand annually, but at times when water levels at hydro reservoirs are low can supply 100%.¹² Construction of new hydro generation, which could lower the dependency on TPP Pljevlja, faces public opposition and requires regional cooperation to manage water resources in the Drina River Basin.

Transport is the other major contributor to energy emissions, with the transport sector dominated by individual use of internal combustion engine (ICE) personal vehicles.

¹⁰ Government of Montenegro. 2025. [Ibrahimović attends Bled Strategic Forum: EU perspective essential for regional stability; Montenegro determined to complete accession negotiations and join the EU by 2028](#). Accessed: 23 October 2025.

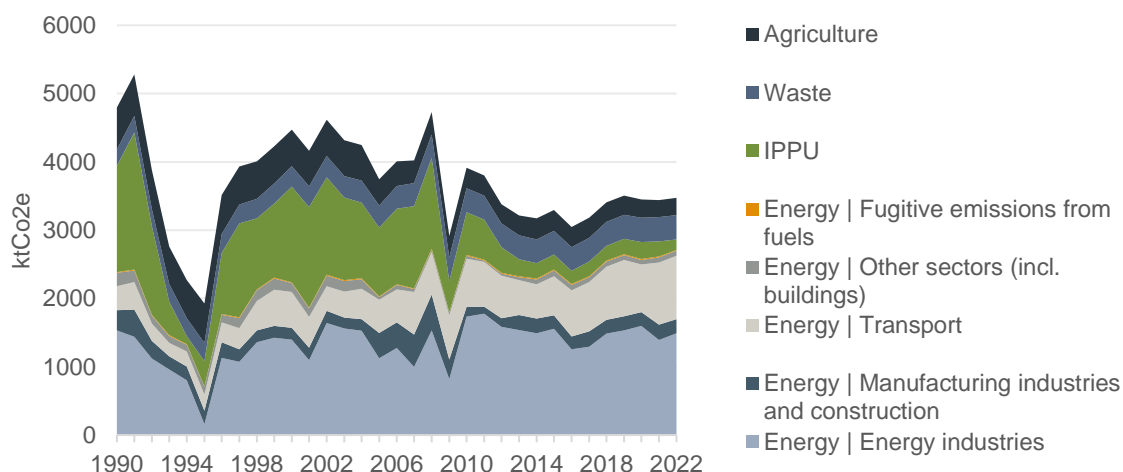
¹¹ Ministry of Sustainable Development and Tourism. 2016. [National Strategy with Action Plan for transposition, implementation and enforcement of the EU acquis on Environment and Climate Change 2016-2020](#)

¹² World Bank Group. 2024. [Western Balkans 6. Montenegro Country Compendium. Country Climate and Development Report](#).

Furthermore, the vehicle fleet is old and inefficient. The average age of passenger cars in Montenegro was 16.6 years in 2020, compared with an EU average of 11.5 years.¹³

Non-energy sources agriculture, waste, and industrial processes and product use (IPPU) all contribute meaningful shares of emissions. IPPU emissions have fallen significantly since 2010 due to reduced production of steel and aluminium.

Figure 1 Historic emissions by Intergovernmental Panel on Climate Change (IPCC) sector

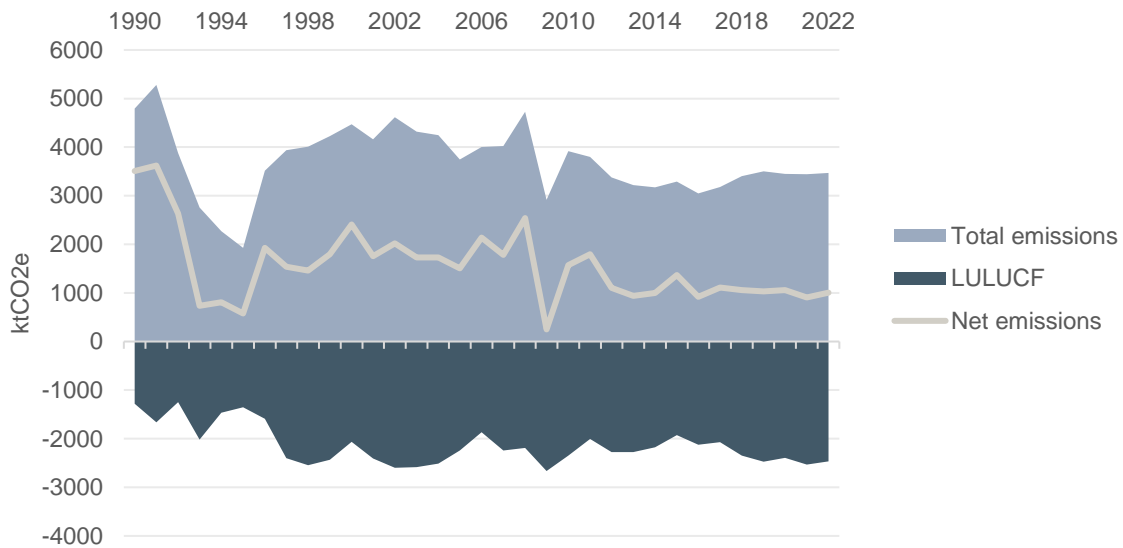


Source: Environmental Protection Agency of Montenegro. 2024. [National Inventory Document 2024 of Montenegro](#).

69% of Montenegro’s land area is covered with forests, and as a result forests provide a significant carbon sink. As such, LULUCF sector removals offset 70% of emissions in 2020. Removals from LULUCF have shown significant variation year on year, largely driven by forest fires.

¹³ Ministry of Capital Investments. 2022. Roadmap. Transport Decarbonisation Montenegro.

Figure 2 Net GHG emissions



Source: Environmental Protection Agency of Montenegro. 2024. [National Inventory Document 2024 of Montenegro](#).

1.4 Approach to developing the LCDS scenario

To ensure alignment across energy and climate planning, the LCDS uses the NECP as a basis, and then proposes additional PAMs that can further emission reduction ambition. As such, analysis in the LCDS is based around three scenarios:

- NECP WEM scenario (the lowest ambition scenario).
- NECP WAM scenario (medium ambition scenarios).
- LCDS scenario (highest ambition scenario).

These scenarios have been developed bottom up and are nested. Scenarios are defined based on specific PAMs that are intended to be implemented within each. Higher ambition scenarios include all PAMs already included in the lower ambition scenarios (e.g. the LCDS scenario includes the implementation of all NECP WEM and WAM PAMs).

The sectoral assessments outlined in Section 2 outline the complete sets of PAMs included in the LCDS scenario. Summaries of the NECP WEM and WAM PAMs are provided, ahead of outlines of the additional LCDS PAMs.

As much as possible, LCDS PAMs have been defined based on existing sectoral strategies and plans. A summary of relevant plans is provided in each sectoral assessment.

Emissions reductions targets outlined in the sectoral assessments are based on the LCDS scenario. Comparison of expected emissions reductions in the NECP WEM, NECP WAM, and LCDS scenarios are provided in Section 3. Expected emissions reductions have been modelled using the Low Emission Analysis Platform (LEAP) software, with details of the model

and modelling process provided in Annex A1. The LEAP model used is an expanded version of the model developed for the preparation of the NECP scenario, ensuring baseline assumptions are fully aligned between the two models.

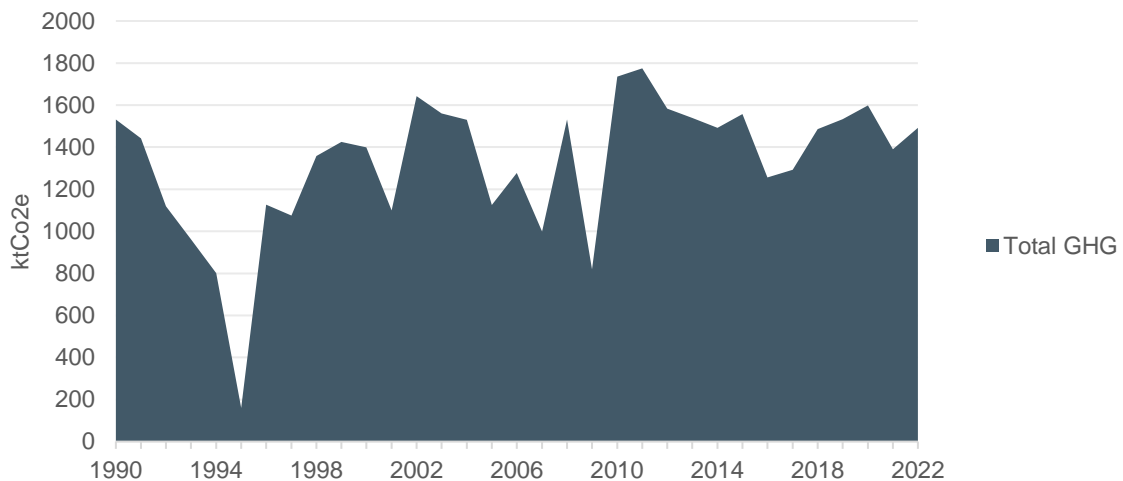
2 Sectoral assessments

2.1 Energy | Power generation

2.1.1 Description and context

Power generation is the largest GHG emitting sector in Montenegro, contributing 43% of emissions in 2022. Power sector emissions come almost entirely from the lignite coal-fuelled TPP Pljevlja power station, which typically generates between 42-55%¹⁴ of Montenegro's electricity requirement.

Figure 3 Historic emissions from power generation



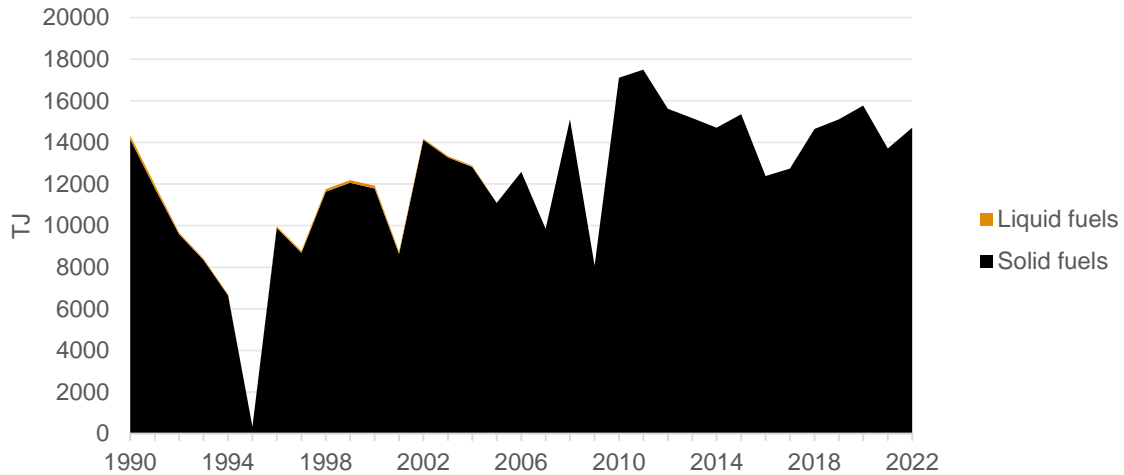
Source: Environmental Protection Agency of Montenegro. 2024. [National Inventory Document 2024 of Montenegro](#).

Outside of coal, liquid fuels have historically been a minor fuel source for power generation. However, use of liquid fossil fuels for generation has not been recorded in the national GHG inventory since 2004.¹⁵

¹⁴ EPCG.

¹⁵ While this implies generation from liquid fuels no longer provides commercial grid supplied electricity, there is ongoing use of liquid fuel powered power generators for self consumption. This fuel use and associated emissions will be captured in emissions in the industrial and manufacturing and buildings sectors dependent on energy end use.

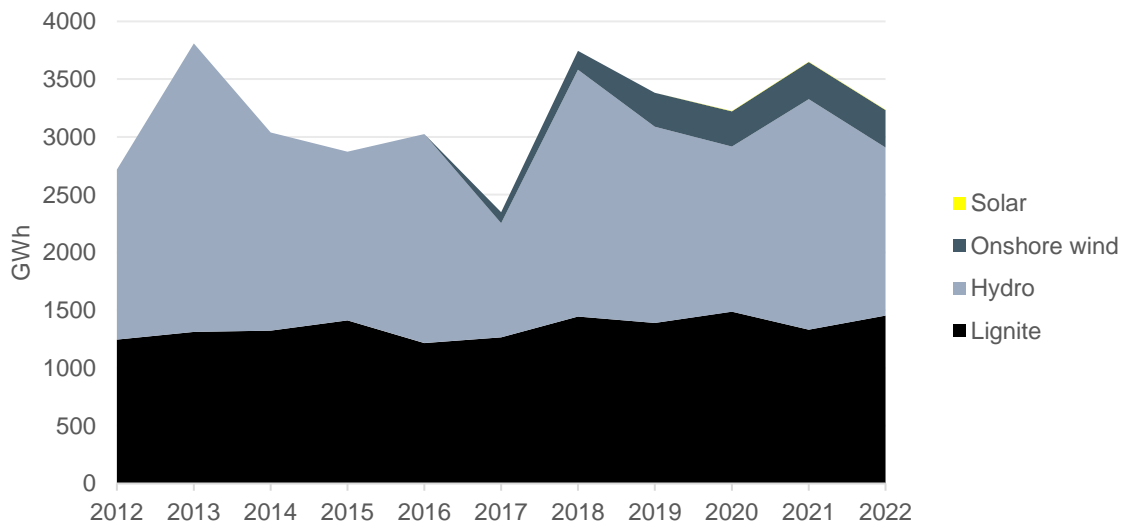
Figure 4 Historic fuel use in power generation



Source: Environmental Protection Agency of Montenegro. 2024. [National Inventory Document 2024 of Montenegro](#).

Outside of fossil production, hydro power constitutes the majority of remaining generation with the exact contribution varying dependent on the hydrological situation each year. Wind and solar have been part of the generation mix since 2017 and 2019 respectively.

Figure 5 Historic power generation by technology

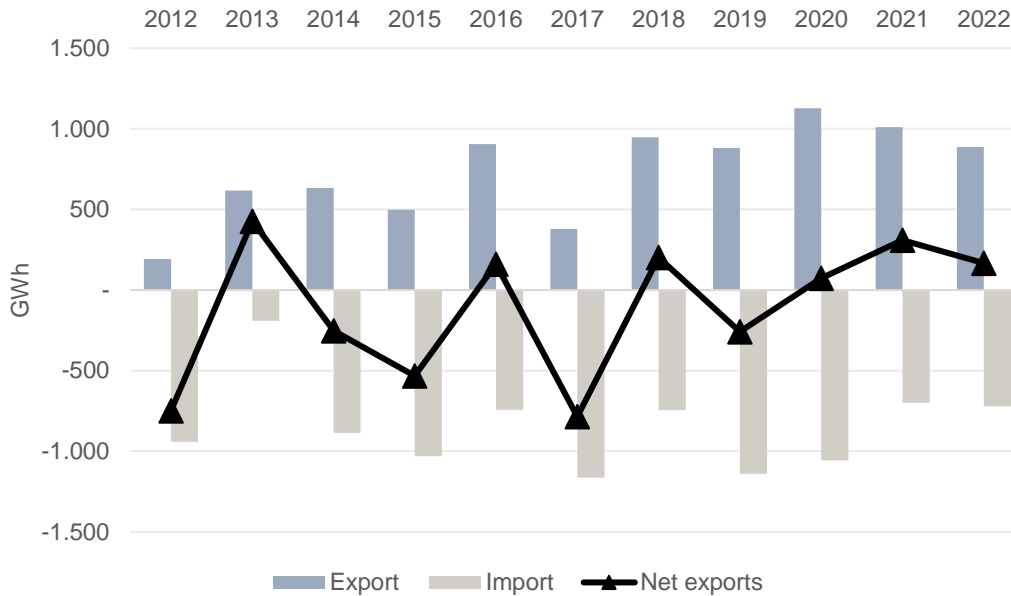


Source: EPCG.

Montenegro’s electricity system is interconnected across land borders with Bosnia and Herzegovina, Serbia, Kosovo, and Albania; as well as via an undersea cable to Italy. Imports are used to make up for shortfalls in generation as demonstrated by 2017 where low water availability and high opportunity cost of hydro generation drove lower than usual hydro generation and therefore leading to low exports and high imports. Imports and exports of electricity are lower than actual flows across the interconnectors because these flows also include electricity generated in one neighbour and consumed in another but transmitted

through Montenegro. Such flows are managed by CGES. Figure 6 shows imports purchased and exports sold (not including other transboundary flow of power transmitted through Montenegro).

Figure 6 Net exports of electricity by EPCG



Source: EPCG.

Montenegro's power markets are liberalised and open to competition. Power generation is owned by both the private (approximately 12% of large scale generation capacity¹⁶) and public sector (approximately 88% of large scale generation capacity¹⁷), with Elektroprivreda Crne Gore AD Nikšić (EPCG) remaining the dominant supplier of electricity. Transmission and system balancing are managed by Crnogorski Elektroprenosni Sistem (CGES), and distribution is managed by Crnogorski Elektrodistributivni Sistem (CEDIS). While supply is open to competition, EPCG remain the de facto supplier of electricity for most customers.

Going forward, investment in renewable energy generation is to be supported through renewable energy subsidy auctions, as enabled by the 2024 Renewable Energy Law. The first of these auctions has been undertaken in late 2025, with subsidies being provided in the form of a two-way contract for difference (CfD). The auction allocated subsidies to a targeted 250 MW of generation capacity.

2.1.2 Strategy and planning documents

Key planning documents for Montenegro's power system are:

¹⁶ Private sector owner operators manage the 72 MW Krnovo Green Energy and 46 MW Mozura Wind Park.

¹⁷ EPCG own and operate the 225 MW TPP Pljevlja coal fired power station, 307 MW HPP Perucica, and 342 MW HPP Piva.

- The National Energy and Climate Plan (NECP).
- The Electricity Transmission System Development Plan (ETSDP) prepared by CGES.
- The Spatial Plan of Montenegro Until 2040.
- Green Hydrogen Development Programme with the Action Plan for the period 2026-2028.

These documents are explored in more detail below.

Having a liberalised electricity market, Montenegro has moved away from centralised electricity generation planning. However, planned or under-development power generation projects have been outlined in the NECP, these projects are considered to have moderate to high probability of being realised. In addition, all new generation projects under development must make a grid connection plan with CGES. Power generation projects for which a connection request has been received and for which the relevant technical connection analysis has been performed are listed in the ETSDP.

National Energy and Climate Plan

Specific power generation projects listed as planned to be developed in the draft NECP are summarised in Table 1 below. As noted above, this list is considered to have a high probability of being realised although does not include distributed generation located at the point of consumption as planned to be implemented under the NECP. A total of 110 MW of distribution network connected solar PV capacity is foreseen across the WEM and WAM scenarios in the NECP.

Table 1 Power generation projects listed as planned in the draft NECP

Project name	Technology	Capacity (MW)
Wind power plant (WPP) Gvozd	Wind	54.6
Hydro power plant (HPP) Komarnica	Hydro	171.9
HPP Perućica	Hydro (capacity expansion)	58.5
Small hydro power plant (SHPP) Otilovići	Small hydro	3.2
HPP Kruševo	Hydro	82
Solar power plant (SPP) Vilusi I	Solar	30
SPP Dragalij/Vilusi II	Solar	80
SPP Čevo	Solar	100
SPP Slano	Solar	40
SE Kapino polje L1 i L2	Solar	10
SE Zeljezara	Solar	25

Project name	Technology	Capacity (MW)
Kapino polje B1	Solar	10
Kapino polje B2	Solar	40
SE Krupac	Solar	40
SE Stedim	Solar	120

Source: Ministry of Ecology, Spatial Planning and Urbanism. 2024. Draft of the NECP of Montenegro.

Electricity Transmission System Development Plan (ESTDP)

The purpose of the ETSDP is to outline a plan for development of the electricity transmission network based on trends in demand and planned power generation development. Having liberalised electricity markets, Montenegro no longer undertakes centralised power generation planning. However, the ETSDP provides the most comprehensive overview of potential projects.

Power generation projects for which a connection request has been received by CGES and the relevant technical connection analysis has been performed are listed in Table 2 below. This list includes very extensive development of solar generation in particular. Realisation of such projects will be dependent on numerous factors, in particular demand from either within Montenegro or export markets for the power generated.

It is likely that some of the projects listed in Table 1 and Table 2 will participate in the 2025 renewable energy subsidy auction. In order to be eligible for participation in the auctions, projects must not benefit from other forms of RE subsidy support, construction works must not have commenced, and funds for construction must not yet have been secured.

Table 2 Power generation projects listed in the draft ETSDP

Project name	Technology	Capacity (MW)
M Energy	Solar	385.00
MONTEČEVO	Solar	400.00
Prediš	Solar	215.00
SOLAR POWER	Solar	170.00
Korita	Solar	240.00
Dubrovsko Phase I	Solar	40.00
Dubrovsko Phase II	Solar	155.00
RES MONTENEGRO	Solar	506.00
Vračenovići	Solar	87.50
Bijela	Wind	118.80
QAIR MONTENEGRO-RUDINE	Solar	50.13
EPCG (A8)	Hydro	58.50
“Nebojša” (Bobovo)	Wind	120.00

Project name	Technology	Capacity (MW)
Bogetići	Solar	18.00
Sinjajevina I	Wind	118.80
Vuča	Solar	122.00
Permonite	Solar	100.00
Rudine energy park	Solar	140.00
Šipačno II	Solar	164.00
Velestovo	Solar	50.00
Krupac (Stuba)	Solar	49.96
New Age Energy III	Solar	68.00
Vjetro park Korita	Wind	72.60
Lika	Solar	12.00
Krstac (Muževica)	Solar	80.00
Sinjajevina II	Wind	290.40
Petrovići	Solar	50.00
Somina (Samsol)	Solar	180.00
Tupan	Solar	70.00

Source: CGES. 2025. Electricity Transmission System Development Plan.

Spatial Plan of Montenegro Until 2040.

In order for a project to be developed, the land the project is planned to be developed on must be allocated to use for power generation facilities in the Spatial Plan of Montenegro of Montenegro Until 2040. Project developers must be aware of the need for a project to be included in the development plan and take account for the advanced planning needed to have their projects included to prevent delays due to non-inclusion. Lists of hydro, solar, and wind projects for which urban planning permission has been granted by the Ministry of Spatial Planning, Urbanism and State Property is included in the Spatial Plan of Montenegro of Montenegro Until 2040, these are summarised in Table 3 below.

Table 3 Power generation projects for which urban planning permission has been granted per the Spatial Plan of Montenegro of Montenegro Until 2040

Project name	Technology	Capacity (MW)	Area (ha)	Location
HPP Komarnica ¹⁸	Hydro	171.9	N/A	Šavnik and Plužine
SUNRISE EUROPE d.o.o Kotor	Solar	220.00	276.00	Šavnik
M Energy d.o.o. Cetinje	Solar	385.00	1,300.00	Cetinje
EE KORITA d.o.o Bijelo Polje	Solar	240.00	505.00	Bijelo Polje

¹⁸ The environmental impact assessment (EIA) submitted to the Environmental Protection Agency (EPA) for HPP Komarnica has been withdrawn by EPCG in mid-2025, however the project remains included in the Spatial Plan.

Project name	Technology	Capacity (MW)	Area (ha)	Location
Montenegro Investment & holdings d.o.o Kotor	Solar	12.50	19.00	Podgorica
Obnovljivi izvori energije d.o.o Podgorica	Solar	225.00	440.00	Cetinje
RES Montenegro group d.o.o Podgorica	Solar	506.00	769.00	Cetinje
Cetinje - Velestovo	Soalr	60.00	60.00	Cetinje
SOLAR POWER d.o.o Podgorica	Solar	150.00	130.00	Cetinje
SOMSOL d.o.o Podgorica	Solar	240.00	485.00	Nikšić
Sun Horizon d.o.o Podgorica	Solar	400.00	521.00	Cetinje
UNIPAN GREEN d.o.o Podgorica	Solar	100.00	27.00	Podgorica
BSD MONT d.o.o. Podgorica	Solar	123.00	196.00	Rožaje
AGENOS Energy d.o.o Podgorica	Solar	100.00	125.00	Nikšić
Rudine Energy park d.o.o. Podgorica	Solar	186.00	131.00	Nikšić
Qair Montenegro d.o.o. Podgorica	Solar	50.00	71.00	Nikšić
NEW AGE ENERGY TRI d.o.o. Nikšić	Solar	68.00	69.80	Nikšić
GREEN ENERGY PROVIDER d.o.o. Podgorica	Solar	80.00	108.00	Nikšić
GREEN ENERGY INVESTMENT d.o.o. Podgorica	Solar	160.00	228.00	Nikšić
EPCG A.D. Nikšić	Solar	47.00	150.00	Nikšić
PHYLLON d.o.o. Tuzi	Solar	10.00	15.00	Tuzi
PERMONTE d.o.o. Podgorica	Solar	100.00	101.00	Cetinje
S2P ELECTRIC GMBH Švajcarska	Solar	90.00	147.00	Nikšić
ROAMING MONTENEGRO d.o.o. Nikšić	Solar	449.00	700.00	Nikšić
KOSANICA SOLAR d.o.o Pljevlja	Solar	120.00	121.00	Pljevlja
Nikšić	Solar	192.00	22.00	Nikšić
Danilovgrad/Slap	Solar	50.00	63.00	Danilovgrad
NEW AGE ENERGY TRI d.o.o. Nikšić	Solar	70.00	100.00	Nikšić
A101 d.o.o Nikšić	Solar	74.00	37.00	Nikšić
SOLAR GLOBAL d.o.o. Tivat	Solar	200.00	119.00	Cetinje
QAIR MONTENEGRO d.o.o Podgorica	Solar	50.00	50.00	Nikšić
BSD MONT d.o.o. Podgorica	Solar	84.00		Rožaje

Project name	Technology	Capacity (MW)	Area (ha)	Location
UNIPAN GREEN d.o.o. Podgorica	Solar	34.00		Podgorica, Zeta
UNIPAN GREEN d.o.o. Podgorica	Solar	13.00		Podgorica, Zeta
SOLUNO d.o.o. Podgorica	Solar	13.00		Podgorica, Zeta
TM INVEST d.o.o.	Solar	67.00	100.00	Nikšić
ELEKTROPRIVREDA CRNE GORE a.d. Nikšić	Solar	11.00	16.00	Nikšić
ELEKTROPRIVREDA CRNE GORE a.d. Nikšić	Solar	38.00	46.00	Nikšić
ELEKTROPRIVREDA CRNE GORE a.d. Nikšić	Solar	115.00	250.00	Nikšić
Pljevlja	Wind	120.00	167.00	Pljevlja
VJETRO PARK BIJELA d.o.o. Podgorica	Wind	119.00	205.00	Šavnik
ENERGY 2 d.o.o. Podgorica	Wind	112.00	279.00	Kolašin
N1 d.o.o Podgorica, SISTEMMNE, d.o.o. Podgorica I PerMonte d.o.o. Podgorica	Wind	290.00	350.00	Kolašin and Šavnik
VJETRO PARK KORITA d.o.o Podgorica, SISTEM – MNE d.o.o. Podgorica, PerMonte d.o.o. Podgorica	Wind	73.00	162.00	Bijelo Polje
BSD MONT d.o.o. Podgorica	Wind	84.00		Rožaje
VJETROPARK BRAJIĆI	Wind	108.80		Budva and Bar

Source: Ministry of Spatial Planning, Urbanism and State Property. 2025. [Spatial Plan of Montenegro of Montenegro Until 2040](#).

While projects listed in the Spatial Plan of Montenegro of Montenegro Until 2040 do not map one to one with projects listed in the ETSDP, the total capacities of both wind and solar that have been given spatial planning permission are larger than the corresponding capacities for which a grid connection request has been made. It is therefore unlikely that allocation of spatial planning permission is to be a major barrier to development of RE generation, and the list of RE projects included in the ETSDP by CGES is treated as the master list project pipeline for the purposes of the LCDS.

In addition to consented renewable energy projects, the Spatial Plan of Montenegro Until 2040 outlines plans for cogeneration of heat from TPP Pljevlja. After the completion of the ecological reconstruction of TPP Pljevlja, a primary head pipe will be constructed to enable use of the steam from the power station to supply 10 MW of heat capacity to supply heating to households in Pljevlja. The Spatial Plan of Montenegro Until 2040 notes that the cessation of operation of TPP Pljevlja between 2035 and 2040 is also being considered.

Green Hydrogen Development Programme with the Action Plan for the period 2026-2028..

Green hydrogen production has the potential to provide a demand source for renewable energy projects. Produced hydrogen can be utilised as a low carbon fuel to support decarbonisation of the transport and industrial sectors, as well as provide an export product.

The Programme, adopted in December 2025, sets a long-term goal of 9% to 15% of available electricity generated by renewable sources to be used for green hydrogen production by 2050. Based on these targets, two scenarios for development of green hydrogen production capacity have been developed, these are presented in Table 4 below. In the lower uptake moderate hydrogen economy implementation scenario, installed electrolyser capacity reaches 105 MW by 2050, while in the higher uptake ambitious hydrogen economy scenario installed capacity reaches 175 MW.

Table 4 Total electrolyser capacity under different uptake scenarios

Scenario	2030	2035	2040	2050
	MW	MW	MW	MW
Moderate hydrogen economy implementation in Montenegro	1.00	17.51	58.36	105.04
Ambitious hydrogen economy implementation in Montenegro	3.00	35.01	93.37	175.07

Source: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. 2024. Technical and Methodological Support of the Green Hydrogen Strategy of Montenegro.

2.1.3 Policy measures

NECP measures.

The NECP PAMs span regulatory, financial and technical measures that support increased deployment of renewable energy generation and more efficient delivery of power to consumers.

Regulatory improvements can enable significant growth in renewable energy generation. In particular, market coupling will enable free trade with the European energy market easing cross-border trading and thereby the commercial viability of projects. Auctions can also support via providing a transparent process for procurement of RE while providing commercial developers with secure and adequate forward revenue.

Technical improvements to the transmission and distribution networks can lower risks for renewable energy developers, while development of new dispatchable generation options including hydroelectric power stations and BESS can help to manage intermittency of variable renewable energy generation.

Ecological refurbishment of TPP Pljevlja.

NECP scenario	WEM scenario
Description	Ecological refurbishment of TPP Pljevlja aims to address non-compliance with air quality standards and extend the lifespan of the power plant
Actions for delivery	<ul style="list-style-type: none"> • Installation of equipment for reducing pollutants from emissions. • Construction of a heating station connected to the power station.
Relevance for the LCDS	<p>The NECP includes a target to retire TPP Pljevlja by 2040, however ecological refurbishment will reduce emissions from operation ahead of retirement.</p> <p>The heat facility will use otherwise wasted excess heat from the power station to supply district heating in Pljevlja town. Once the power station is retired it is foreseen that district heating will continue in Pljevlja town, powered by biomass.</p>

Development of decentralised energy generation by producer – consumers (prosumers).

NECP scenario	WEM scenario
Description	Development of decentralised renewable energy generation facilitated by EPCG through on-bill financing.
Actions for delivery	<ul style="list-style-type: none"> • Implementation is already underway. More than 26,000 consumers have expressed interest. • 70 MW of associated capacity has been installed, with total anticipated capacity supported of 250 MW.
Relevance for the LCDS	Early development of additional renewable energy generation capacity will facilitate decarbonisation of other sectors switching to electricity as a fuel source as well as the retirement of TPP Pljevlja.

New renewable power plants.

NECP scenario	WEM scenario
Description	<p>Deployment of EPCG lead renewable energy power projects with the highest probability of realisation:</p> <ul style="list-style-type: none"> • Extension of HPP Perućica. • SHPP Otilovići. • WPP Gvozd. • SPP Krupac. • SPP Slano.
Actions for delivery	<ul style="list-style-type: none"> • Outstanding activities for project development. • No financial support is expected to be provided by the government.
Relevance for the LCDS	Early development of additional renewable energy generation capacity will facilitate decarbonisation of other sectors switching to electricity as a fuel source as well as the retirement of TPP Pljevlja.

Additional renewable power plants.

NECP scenario	WEM scenario
Description	Deployment of renewable power plants considered to be at a lower level of preparation to those in the PAM entitled “New renewable power plants” because all necessary technical documentation has not been prepared, financing is not confirmed, or some aspects of environmental impact assessment are complete. This includes: <ul style="list-style-type: none"> • 145 MW of new wind generation capacity. • 746 MW of new solar generation capacity. • Development of the HPP Kruševo and HPP Komarnica hydro power stations.
Actions for delivery	<ul style="list-style-type: none"> • Auctions for procurement of renewable energy are to be implemented by EPCG. • Outstanding activities for project development.
Relevance for the LCDS	Early development of additional renewable energy generation capacity will facilitate decarbonisation of other sectors switching to electricity as a fuel source as well as the retirement of TPP Pljevlja.

Refurbishment of small hydro power plants.

NECP scenario	WEM scenario
Description	Refurbishment of EPCG owned small hydro power plants past their operating life and not yet refurbished.
Actions for delivery	<ul style="list-style-type: none"> • Implementation of power plant refurbishment.
Relevance for the LCDS	Early development of additional renewable energy generation capacity will facilitate decarbonisation of other sectors switching to electricity as a fuel source as well as the retirement of TPP Pljevlja.

Development of decentralised energy generation (distribution medium voltage connection).

NECP scenario	WEM scenario
Description	Connection of medium sized RES (up to 5 MW) to the distribution network with the aim to connect additional capacity of 25 MW by 2030.
Actions for delivery	<ul style="list-style-type: none"> • Outstanding activities for project development.
Relevance for the LCDS	Early development of additional renewable energy generation capacity will facilitate decarbonisation of other sectors switching to electricity as a fuel source as well as the retirement of TPP Pljevlja.

Additional development of decentralised energy generation (distribution medium voltage connection).

NECP scenario	WEM scenario
Description	Introduction of a power purchase agreement (PPA) auction for distributed generation (up to 5 MW) to facilitate connection of an additional capacity of 25 MW by 2030.
Actions for delivery	<ul style="list-style-type: none"> • Implementation of auction for procurement of distributed generation by EPCG. • Outstanding activities for project development.
Relevance for the LCDS	Early development of additional renewable energy generation capacity will facilitate decarbonisation of other sectors switching to electricity as a fuel source as well as the retirement of TPP Pljevlja.

Development of electricity transmission power network.

NECP scenario	WEM scenario
Description	Implementation of the ETSDP with the objective of reducing losses in the electricity transmission network.
Actions for delivery	<ul style="list-style-type: none"> • Adoption and implementation of the ETSDP.
Relevance for the LCDS	<p>A reduction in losses will reduce the demand for power generation and associated emissions.</p> <p>Transmission network development and improved operation will facilitate integration of renewable energy and the commercial viability of projects under development.</p>

Reduction of losses in the electricity distribution power network & Development of electricity distribution power network.

NECP scenario	WEM scenario
Description	Implementation of the distribution system development plan with the objective of reducing losses in the electricity transmission network.
Actions for delivery	<ul style="list-style-type: none"> • Adoption and implementation of the distribution system development plan.
Relevance for the LCDS	Improved operation of the distribution network will improve the viability of distribution renewable generation projects under development.

Development of the Just Transition Plan for the Pljevlja Coal Region.

NECP scenario	WAM scenario
Description	Provide a comprehensive response to the challenges arising from the transition of the Pljevlja region from a coal-based economy to sustainable

	low-carbon development. The plan will outline a strategic and operational framework for investment and support during the 2027-2035 period.
Actions for delivery	<ul style="list-style-type: none"> • Development and drafting of the plan during 2026.
Relevance for the LCDS	The LCDS proposes a more ambitious timeline for the closure of the TPP Pljevlja coal fired power station than the NECP, development of this strategy must therefore account for the possibility of closure during 2035 and outline proposed support accordingly.

Additional development of decentralised energy generation by producer - customers (prosumer).

NECP scenario	WAM scenario
Description	Extension of the above PAM, targeting additional prosumer capacity with solar generation supported by battery storage.
Actions for delivery	<ul style="list-style-type: none"> • Tender for equipment. • Make public calls for interested prosumer customers. • Total anticipated capacity supported of 140 MW.
Relevance for the LCDS	Early development of additional renewable energy generation capacity will facilitate decarbonisation of other sectors switching to electricity as a fuel source as well as the retirement of TPP Pljevlja.

Prosumers in industry.

NECP scenario	WAM scenario
Description	Development of decentralised renewable energy generation facilitated by EPCG through on-bill financing for industrial customers.
Actions for delivery	<ul style="list-style-type: none"> • Tender for equipment. • Make public calls for interested prosumer customers. • Total anticipated capacity supported of 60 MW.
Relevance for the LCDS	Early development of additional renewable energy generation capacity will facilitate decarbonisation of other sectors switching to electricity as a fuel source as well as the retirement of TPP Pljevlja.

Developing battery energy storage systems (BESS).

NECP scenario	WAM scenario
Description	Installation of BESS at several sites identified by EPCG, totalling 240 MW (240 MWh).
Actions for delivery	<ul style="list-style-type: none"> • Activities for project development.
Relevance for the LCDS	Development of BESS can improve grid stability and help manage variable renewable energy generation thereby increasing the potential capacity of renewable energy that can be connected to the grid.

Risk Preparedness Plan.

NECP scenario	WAM scenario
Description	Development of a Risk Preparedness Plan, outlining the rules on how to prevent, prepare for, and manage an electricity crisis.
Actions for delivery	<ul style="list-style-type: none"> • Identification of electricity crisis scenarios. • Preparation of the plan.
Relevance for the LCDS	The LCDS foresees significant increase in wind and solar generation capacity and transborder trade of power generated by those facilities. New risks will be imposed on the power system as a result of these changes which will have to be carefully assessed and managed.

Operationalisation of the Security Coordination Region.

NECP scenario	WAM scenario
Description	A decision will be made on which energy security region Montenegro will belong to within the EU framework during 2026. Once this decision has been made, work will have to be undertaken to operationalise the region, which will have to be done in close coordination with other associated countries.
Actions for delivery	<ul style="list-style-type: none"> • Preparation and approval of methodologies for operational security coordination. • Application of methodologies by transmission system operator.
Relevance for the LCDS	Improved management of regional power systems will support increased regional trade in renewable energy.

Market coupling.

NECP scenario	WAM scenario
Description	Market coupling with the single European market for the single day-ahead and intraday power markets, facilitated by the interconnector with Italy.
Actions for delivery	<ul style="list-style-type: none"> • Finalise regulatory framework. • Finalise interconnector capacity calculation methodologies.
Relevance for the LCDS	Market coupling will enable free trade with the EU power market, enabling the potential for new renewable energy generation projects to secure offtake agreement with Italian power purchasers, thereby improving the commercial viability of renewable energy generation projects.

Implementation of European Balancing Platforms.

NECP scenario	WAM scenario
Description	Montenegro's connection to European power system balancing platforms managed by ENTSO-E to integrate balancing markets and procure balancing services.

Actions for delivery	<ul style="list-style-type: none"> • Preparation of technical specifications. • Harmonisation of regulations.
Relevance for the LCDS	Improvement of balancing processes can improve system stability and facilitate increased connection of variable renewable generation to the network.

Demand response.

NECP scenario	WAM scenario
Description	Creation of the regulatory framework for consumers to actively participate in electricity markets through demand response by adjusting their consumption behaviour.
Actions for delivery	<ul style="list-style-type: none"> • Adoption of required laws and regulations. • Implementation of laws and regulations.
Relevance for the LCDS	Demand response provides an additional option for managing system stability and help manage intermittency as renewable generation capacity continues to grow.

Pilot project for improving the “visibility” of the low-voltage network.

NECP scenario	WAM scenario
Description	Instillation of advanced metering devices and sensors in the low-voltage network, and implementation of the metre data management (MDM) system. Improved collection of data will enable better network development planning and facilitation assessment of potential for connecting new small solar PV systems to the network.
Actions for delivery	<ul style="list-style-type: none"> • Feasibility study. • Installation of new equipment and implementation of new systems.
Relevance for the LCDS	This measure will facilitate the development of distribution network connected solar generation capacity included in the NECP PAMs. Additional distribution network connected solar is not included in the LCDS as a specific PAM, however organic growth of prosumer generation is likely beyond the NECP targets.

Operationalisation of the Capacity Calculation Region.

NECP scenario	WAM scenario
Description	The EU has capacity calculation regions to support transborder electricity trade. With the adoption by the EU Clean Energy Package by the Energy Community, power trade at Montenegro's borders will enter several of these regions. CGES will be required to develop and operationalise associated methodologies for capacity calculation, redispatch, and counter trading.

Actions for delivery	<ul style="list-style-type: none"> • Develop and implemented appropriate methodologies.
Relevance for the LCDS	Improved management of regional power systems will support increased regional trade in renewable energy and therefore facilitate the growth in export oriented RE foreseen in the LCDS.

Establishment of renewable energy communities.

NECP scenario	WAM scenario
Description	Development of community solar generation projects including on public institutions, households, and vulnerable consumer groups. The purpose of this PAM is to undertake preparatory activities for the implementation of a pilot renewable energy community.
Actions for delivery	<ul style="list-style-type: none"> • Preparation of a feasibility study for the development of a renewable energy community project.
Relevance for the LCDS	This measure will facilitate the development of the small scale and distribution network connected solar generation capacity included in the NECP PAMs. Additional distribution network connected solar is not included in the LCDS as a specific PAM, however organic growth of prosumer generation is likely beyond the NECP targets.

Establishment of a dynamic electricity pricing model.

NECP scenario	WAM scenario
Description	Facilitating actions to help electricity suppliers implement a dynamic electricity pricing model for retail electricity. Introduction of dynamic electricity pricing models is expected to be increase competition amongst power suppliers and help consumers optimise consumption patterns.
Actions for delivery	<ul style="list-style-type: none"> • Installation of advanced metering infrastructure. • Development of an application for comparing supplier offers.
Relevance for the LCDS	Dynamic pricing can help improve efficient use of energy in buildings, as well as shift demand to align better with generation profiles of variable renewable energy generation.

Improvement of network access procedures for citizen energy.

NECP scenario	WAM scenario
Description	Improving grid connection procedures for small scale renewable energy installed by prosumers primarily for self generation. Improvement of procedures is expected to include the creation of standardised application forms and to develop and digital information portal.
Actions for delivery	<ul style="list-style-type: none"> • Capacity building. • Develop standardised application forms. • Development of digital platform. • Make amendments to secondary legislation as needed.

Relevance for the LCDS	This measure will facilitate the development of the small scale and distribution network connected solar generation capacity included in the NECP PAMs. Additional distribution network connected solar is not included in the LCDS as a specific PAM, however organic growth of prosumer generation is likely beyond the NECP targets.
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Green Hydrogen Development Plan with an Action Plan for the period 2026–2028.

NECP scenario	WAM scenario
Description	Preparation and adoption of a Green Hydrogen Development Plan to enable the development of green hydrogen in Montenegro through the establishment of a regulatory, infrastructural, and market framework, as well as the integration of hydrogen into the industry, transport, heating, and energy storage sectors.
Actions for delivery	<ul style="list-style-type: none"> Preparation and drafting of the Green Hydrogen Development Plan and Action Plan.
Relevance for the LCDS	A national green hydrogen development plan will set targets for the development of a green hydrogen industry in Montenegro, determine strategic objectives for the industry including intended use cases (eg transport, industry, export), and outline the actions needed to achieve targets and strategic objectives. This will support decarbonisation in the transport sector, which is foreseen to be a consumer of green hydrogen in the LCDS.

LCDS PAMs.

LCDS PAMs for the power sector set bold ambition through aligning the carbon price paid in the Montenegro ETS with the EU ETS price by 2028, in time for planned EU accession, and a commitment to retire the TPP Pljevlja coal fired power station by 2035. While the NECP highlights 2041 as the potential coal phase-out date, accession to the EU and participation in the EU ETS would make ongoing use of TPP Pljevlja uneconomic¹⁹, implying a need to plan for earlier phase-out. In addition, planned further growth in RE generation capacity seeks to leverage the regulatory and technical measures included in the NECP to accelerate deployment of renewable energy.

Power generation LCDS PAM PG.1: Alignment of the carbon price with the EU Emissions Trading System price by 2028.

Description	Increase the carbon price established by the Montenegro ETS to reach alignment with the EU ETS by 2028 as will be necessary to achieve EU accession by that date.
Actions for delivery	Update relevant regulation as necessary to increase the price of emissions units. Considering TPP Pljevlja is likely to remain the only regulated entity covered by the scheme, the best approach will continue to

¹⁹ Economic Consulting Associates. 2024. Carbon pricing impact assessment for Montenegro. Task 2. Assessment of the interactions of carbon pricing and power sector generation planning. Final report.

	set a regulated price for emissions units until accession is achieved and integration with the EU ETS is required.
Included in existing strategy	Increasing the carbon price is a new measure.
Investment need	No associated investment.
Energy and climate change dimension	<ul style="list-style-type: none"> Increasing the carbon price can help incentivise the retirement of TPP Pljevlja ahead of the target retirement date of 2035. If Montenegro has not achieved EU Accession by 2028, alignment of the carbon price with the EU ETS price will remove complex power trade requirements associated with the EU carbon border adjustment mechanism (CBAM) and therefore facilitate development of new renewable energy generation intended to supply the export market.
Governance dimension	<ul style="list-style-type: none"> Management of the Montenegro ETS will continue to be the responsibility of the Ministry of Ecology, Sustainable Development and Northern Region Development. The Eco Fund will continue to manage the use of funds collected through the ETS.
Social dimension	<ul style="list-style-type: none"> Phased alignment of the Montenegro ETS price with the EU ETS price balances economic, health, and environmental impacts.²⁰ Increasing the carbon price will have a small adverse impact on economic growth in the short term. However, the impact on consumers can be mitigated through a share of carbon price revenues being made available to support low-income households. Support will also be needed to help transition coal workers to new employment once TPP Pljevlja has been retired. On the other hand, closure of TPP Pljevlja will deliver health benefits to the surrounding area through reduced air pollution. Should EU accession be assured and Montenegro become fully integrated into the EU ETS, as a lower income EU MS Montenegro would be eligible for support to mitigate social and competitiveness impacts of the ETS through various channels. These might include: the Modernisation Fund, the Social Climate Fund, Article 10c of the EU ETS Directive allowing free allocation of allowances to electricity production to support investment in modernising the energy sector, and through receiving additional EU ETS allowances through the 10% allocated to lower income member states. Details of access to these support channels would be determined through prevailing EU rules at the time of accession and negotiation with the European Commission during the accession process.
International dimension	<ul style="list-style-type: none"> Alignment of the carbon price with the EU ETS will remove restrictions on power exports to the EU associated with the EU CBAM. Phased price alignment will also facilitate the process of entering the EU ETS which will be required for EU accession.

Power generation LCDS PAM PG.2: Retirement of TPP Pljevlja by 2035.

Description	Set a policy target for the retirement of TPP Pljevlja by 2035. ²¹
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²⁰ Economic Consulting Associates. 2024. Carbon Pricing Impact Assessment for Montenegro. Task 1. Analysis of the implications of carbon pricing.

²¹ For the purposes of the LCDS LEAP model, retirement by 2035 has been interpreted as by end 2035, and therefore TPP Pljevlja continues to supply electricity during 2035 in the model.

Actions for delivery	<p>Predicated on implementation of PCDS PAM PG.1 to align the carbon price with the EU ETS price thus providing the economic incentive to cease operations at TPP Pljevlja. With full alignment the price of generation at TPP Pljevlja becomes uncompetitive with renewable generation thus accelerating the transition.</p> <p>Formally include the retirement of TPP Pljevlja in national plans and strategies.</p> <p>Prepare a just transition plan for Pljevlja region detailing the social, economic, environmental, and financial considerations for retirement of TPP Pljevlja. Development of such a plan is included as a measure in the NECP. While the NECP does not include a target to close TPP Pljevlja by 2035, the just transition plan must be developed with this as a possible option.</p>
Included in existing strategy	Set a policy target for the retirement of TPP Pljevlja by 2035 is a new measure.
Investment need	No associated investment. Budget may be allocated towards management supporting a just transition, budget requirements should be identified as part of the development of the just transition plan.
Energy and climate change dimension	<ul style="list-style-type: none"> Retirement of TPP Pljevlja will eliminate all remaining GHG emissions from the power sector. Installation of alternative sources of dispatchable generation may be needed for security of supply.
Governance dimension	<ul style="list-style-type: none"> The Government of Montenegro is responsible for setting a policy target date for the closure of TPP Pljevlja, supporting by the National Council for Just Transition and the Ministry of Ecology, Sustainable Development and Northern Region Development. The Ministry will have to work in close cooperation with EPCG and CGES to facilitate closure at that date.
Social dimension	<ul style="list-style-type: none"> Closure of TPP Pljevlja will have implications for individuals in the Pljevlja region. Support finding alternative employment for coal sector works will be necessary to ensure a just transition. Closure of TPP Pljevlja by 2035 is not expected to result in a noticeable increase in the cost of electricity relative to a scenarios where TPP Pljevlja continues to operate but is required to pay an EU ETS aligned carbon price.²²
International dimension	<ul style="list-style-type: none"> Phase out of coal generation has been identified in the EU Green Deal as essential for achieving EU climate targets. However, considering each country within the EU has different circumstances, no fixed date has been set for phase out across the EU. Phase out by 2035 is therefore likely to be in line with EU requirements and Montenegro's accession plans.²³ Phase out will lower exposure of electricity prices to the EU ETS price while in the even accession to the EU is not obtained beforehand, likewise reduce exposure to the CBAM price.

²² Economic Consulting Associates. 2024. Carbon pricing impact assessment for Montenegro. Task 2. Assessment of the interactions of carbon pricing and power sector generation planning. Final report.

²³ European Court of Auditors. 2022. [EU support to coal regions. Limited focus on socio-economic and energy transition.](#)

Power generation LCDS PAM PG.3: Full deployment of the renewable energy generation projects included in ETSDP and not deployed under the NECP.

Description	Deployment of all planned renewable energy projects who have made a grid connection request to CGES and are included in the ETSDP.
Actions for delivery	<ul style="list-style-type: none"> • Actions to achieve market coupling with the EU and improve grid strength overcome major barriers to deployment of additional generation. For such significant growth in capacity to occur, it is likely that financial viability will be determined by ability of developers to secure transborder PPAs. • Additional capacity auctions to those proposed under the NECP may be considered. Assessment of the success of those auctions, and any forecast shortfalls in supply for EPCG should be assessed in 2030 to evaluate if further auctions are necessary and justified.
Included in existing strategy	Generation projects under development are included in the ETSDP developed by CGES.
Investment need	<p>At current prices, development of all solar projects included in the ETSDP would require total capital investment of € 3.3 billion to € 4.6 billion.</p> <p>At current prices, development of all wind projects included in the ETSDP would require total capital investment of € 1.2 billion to € 1.4 billion.²⁴</p>
Energy and climate change dimension	<ul style="list-style-type: none"> • Realisation of all “under development” capacity can meet Montenegro’s annual electricity demand and facilitate the retirement of TPP Pljevlja in 2035, eliminating emissions from the sector.
Governance dimension	<ul style="list-style-type: none"> • CGES is responsible for connection of renewable energy projects to the grid, and for facilitating trans-border transmission of power. • Crnogorski operator tržišta električne energije (COTEE) will be responsible for any renewable energy auctions to be undertaken. • Ministry of Spatial Planning, Urbanism and State Property will be responsible for ensuring new projects are efficiently added to the Montenegro spatial plan to prevent planning permissions creating a bottleneck in the development process.
Social dimension	<ul style="list-style-type: none"> • Development of new renewable energy can create significant job opportunities and a driver of economic growth.
International dimension	<ul style="list-style-type: none"> • Development of renewable generation intended for export to the EU can strengthen electricity market integration.

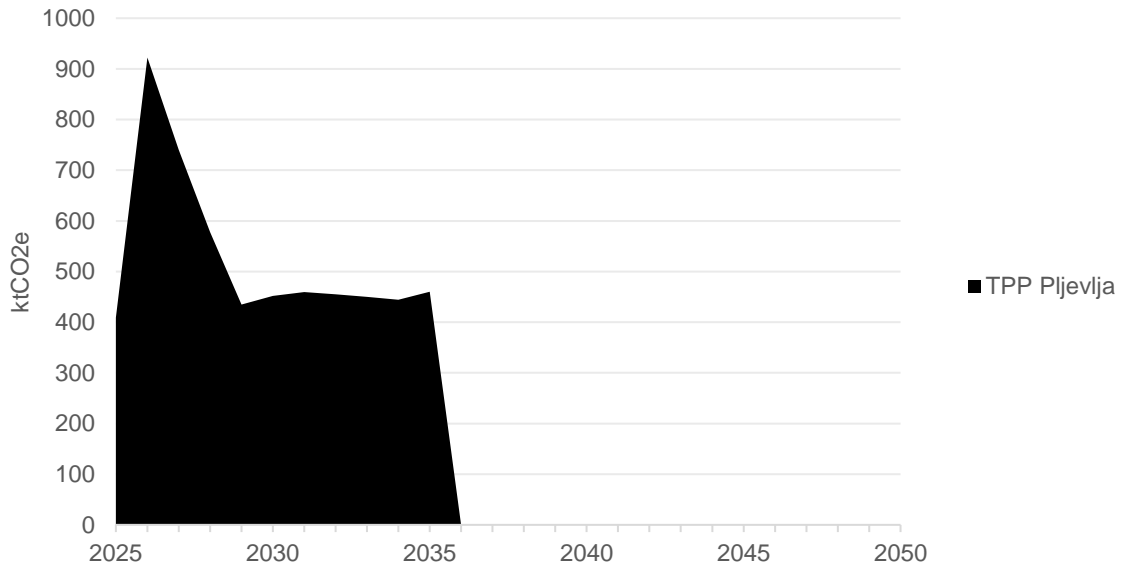
2.1.4 Emission reduction targets

Implementation of the LCDS and NECP PAMs implies territorial GHG emissions from the power sector significantly reduce by 2030 and fall to zero in 2036 when TPP Pljevlja retires. Falling emissions ahead of 2030 are caused by a significant increase in renewable generation capacity, based on expected deployment in the NECP and projects having applied for grid connection with CGES, enabling TPP Pljevlja to be operated with lower utilisation. Technical minimum utilisation requirements of TPP Pljevlja prevent emissions from falling further ahead

²⁴ Current capital cost estimates taken from Lazard. 2025. [Lazard levelized cost of energy. June 2025.](#)

of the full retirement of the power station. Low emissions in 2025 are due to TPP Pljevlja being partially offline during the ecological refurbishment.

Figure 7 Forecast power generation emissions in LCDS scenario

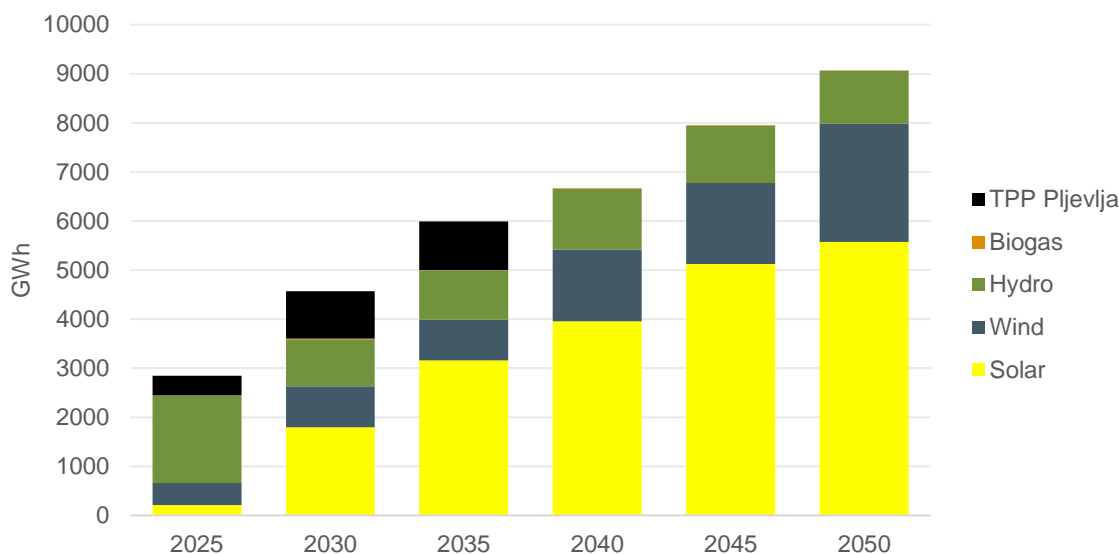


Source: Economic Consulting Associates based on NECP data.

Power generation is forecast to increase to meet growth in demand caused by electrification of energy demand from transport, industry, and manufacturing; and steadily growing power exports. Solar is the dominant technology, with strong growth also in wind energy.

Coal generation is low in 2025 due to the ecological refurbishment of Pljevlja and per Figure 7 above is then expected to rebound before declining again by 2030. The modelling suggests very high hydro generation in 2025 to substitute for Pljevlja although this is dependent on water availability which in reality may instead need to be substituted in a large part from imports from neighbouring countries.

Figure 8 Forecast power generation for by technology in LCDS scenario



Source: Economic Consulting Associates based on NECP data.

Implementation of the NECP and LCDS PAMs imply an enormous increase in wind and solar generation capacities. Hydro is also expected to experience some limited growth in capacity. It is assumed in the LCDS scenario that the HPP Kruševo and HPP Komarnica power plants are developed. At present there is uncertainty as to whether these projects will be implemented because of the potential adverse environmental impacts associated hydro dam reservoirs. However, with the retirement of TPP Pljevlja, development of new dispatchable generation technology will be essential to provide security of supply.^{25,26}

There is also uncertainty with regards to potential barriers to such a level of renewable energy development. These include the potential need for grid reinforcement within Montenegro, other system operation considerations, permitting requirements, relative competitiveness with similar developments in neighbouring countries (and by extension offtake and financing risk), and general social acceptance for larger wind and solar developments. This is therefore a key sensitivity explored in Annex A1 to this report.

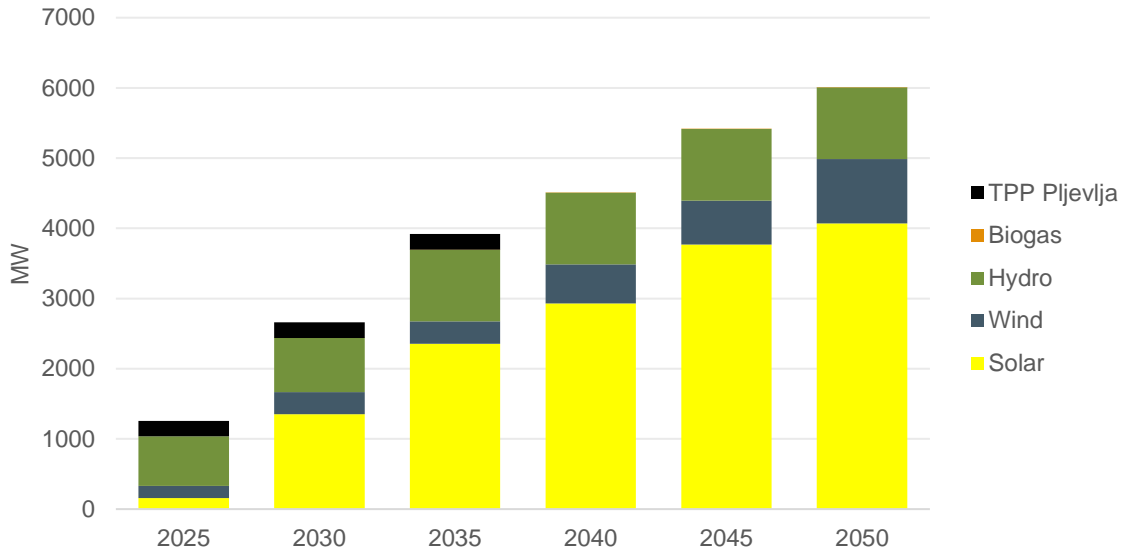
Based off a previous assessment of the impact of increasing the Montenegro ETS price on Montenegro's power system, it has been assumed that development of additional hydro capacity and use of imports will be sufficient to facilitate adequate domestic reserve provisions to achieve security of supply criteria.²⁷ As such, no further battery capacity that that included in the NECP is assumed to be developed.

²⁵ Economic Consulting Associates. 2024. Carbon pricing impact assessment for Montenegro. Task 2. Assessment of the interactions of carbon pricing and power sector generation planning. Final report.

²⁶ A sensitivity scenario has been estimated to analyse the impact on the energy system if HPP Kruševo, HPP Komarnica, and other potential renewables are not developed. Results are presented in Annex A2.

²⁷ Economic Consulting Associates. 2024. Carbon pricing impact assessment for Montenegro. Task 2. Assessment of the interactions of carbon pricing and power sector generation planning. Final report.

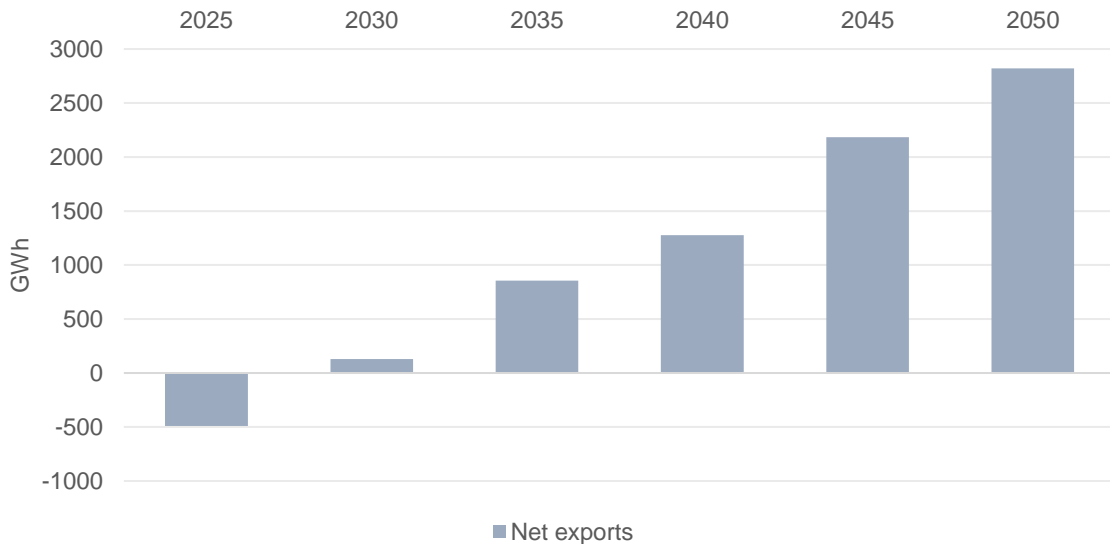
Figure 9 Forecast power generation capacity by technology in LCDS scenario



Source: Economic Consulting Associates based on NECP data.

By 2030, growth in wind and solar capacity means that Montenegro becomes a net exporter of electricity. Exports grow steadily towards 2050 reaching 20% of total power generated by 2040 and 30% in 2050. Relatively high imports are modelled in 2025 to offset the reduced capacity of TPP Pljevlja during ecological refurbishment.

Figure 10 Forecast net exports of electricity in the LCDS scenario



Source: Economic Consulting Associates based on NECP data.

Based on estimates produced in the Technical and methodological Support of the Green Hydrogen Strategy of Montenegro report, it is estimated that 105 MW of green hydrogen

electrolyser capacity is installed by 2050.²⁸ Produced fuel is used for domestic goods transport and export. The majority, 80 to 90% per year, is exported after 2035.

2.1.5 Sectoral SWOT

Major development of renewable energy generation can be an enabler of decarbonisation for other sectors and a driver for economic growth. However, environmental and technical risks will have to be managed.

Table 5 Strengths, weaknesses, opportunities, and threats of transport decarbonisation in Montenegro.

Strengths	Weaknesses
<ul style="list-style-type: none"> • A combination of variable renewable generation, hydroelectric generation, and more integrated power trading can provide secure domestic power supply and enable net export of electricity. • Increased renewable electricity generation enables decarbonisation of other sectors. 	<ul style="list-style-type: none"> • Transition for the Pljevlja region will have to be carefully managed and adverse impacts of coal retirement mitigated. • An increased carbon price could lead to higher near term power prices ahead of retirement of TPP Pljevlja. • Montenegro's competitive advantage to enable renewable generation exports is not well established.
Opportunities	Threats
<ul style="list-style-type: none"> • Export of power and green hydrogen to the EU can support economic growth. • Potential for job growth in the renewable energy and green hydrogen sectors. • Encouraging distributed generation from prosumers can leverage investment from private sources outside the power industry. 	<ul style="list-style-type: none"> • Delays in achieving market coupling with the EU will present a risk to renewable energy developers. • Grid strengthening will have to be successfully deployed to ensure the grid can accept growth in renewable generation. • Additional hydroelectric capacity may not be feasible if non-climate environmental impacts are determined to be significant. • Despite strong ambition, uncertainty remains about the future size of the European green hydrogen market.

²⁸ 105 MW is based off the more conservative Moderate Hydrogen Economy Implementation scenario.

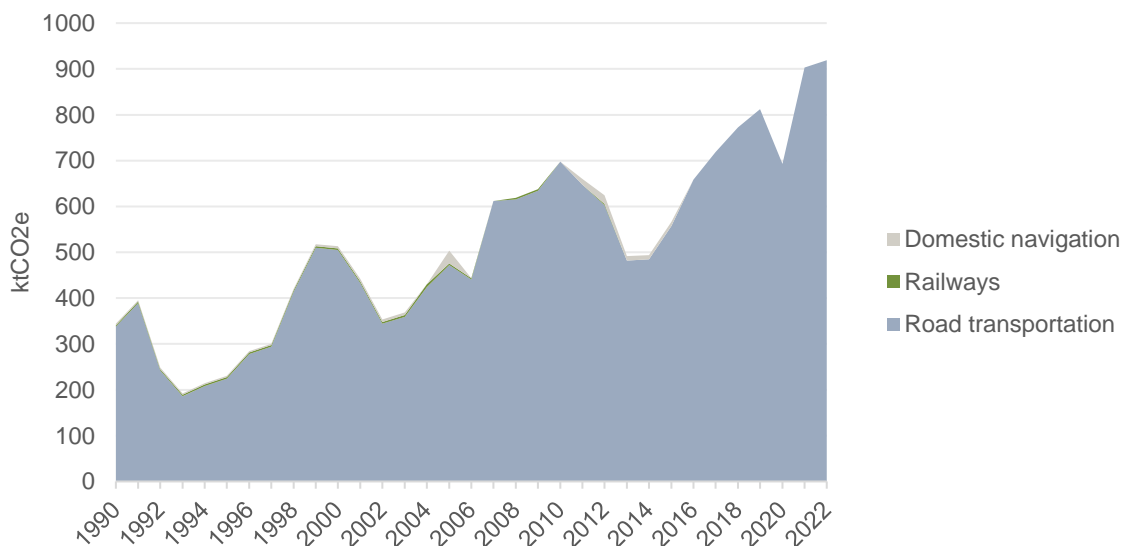
2.2 Energy | Transport

2.2.1 Description and context

Historic emissions.

Transport is a major contributor of emissions in Montenegro, accounting for 27% of total emissions and 34% of energy sector emissions in 2022. Road transport generates the vast majority of transport emissions. Rail transport is mostly electrified and therefore contributes a very small amount of emissions. Domestic marine navigation²⁹ has historically contributed a small share of emissions, however in recent years this has not been estimated in GHG inventories and is considered to be very small.

Figure 11 Historic emissions from transport by mode

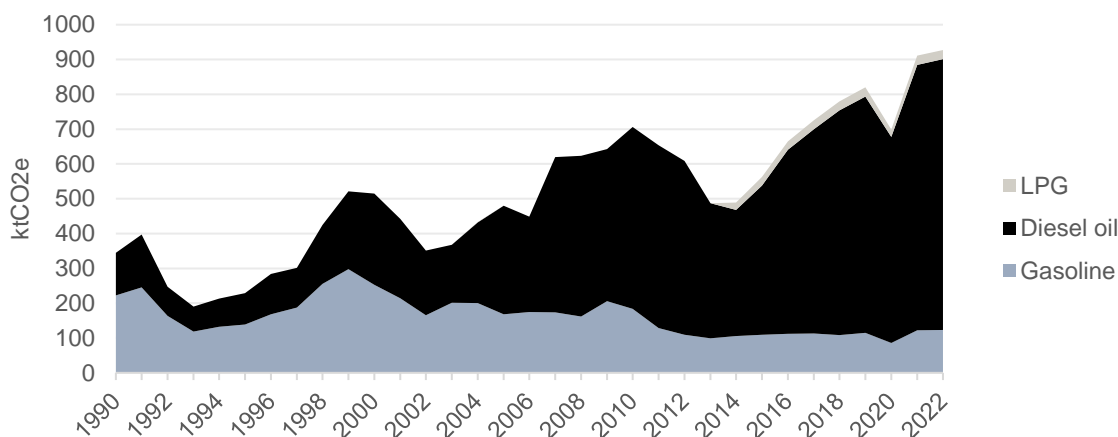


Source: Environmental Protection Agency of Montenegro. 2024. [National Inventory Document 2024 of Montenegro](#).

Road transport emissions come predominantly from diesel fuel, with petrol and liquid petroleum gas (LPG) providing minority shares. Diesel is the main fossil fuel used in freight road transport, public road passenger transport (buses), and private passenger road.³⁰

²⁹ Domestic navigation includes any maritime travel within a single countries waters, including oceans, seas, and navigable lakes and rivers.

³⁰ Ministry of Capital Investments. 2022. Roadmap Transport Decarbonisation Montenegro. Towards clean, safe, accessible and affordable mobility. Final version. May 2022.

Figure 12 Historic emissions from road transport by fuel


Source: Environmental Protection Agency of Montenegro. 2024. [National Inventory Document 2024 of Montenegro](#).

Passenger transport.

Passenger transport in Montenegro is dominated by use of private vehicles, with more than 90% of travel done by private car. Less than 10% of passenger transport is done by buses and coaches, and rail transport makes up slightly more than 1% of passenger transport.

The private vehicle fleet is relatively old and inefficient by EU standards. As of 2020, the average age of passenger cars in Montenegro was 17 years, compared with an EU average of 12.³¹

Bus and coach transport is supplied by private sector contractors. Multiple providers serve both the urban (Podgorica) and inter-city markets. Current contracting arrangements mean that provision of public bus services is inefficient and average bus utilisation is only 20%.

Similar to private passenger vehicles, the age the bus fleet is old by EU standards. The average age of intercity passenger bus fleet is 19 years, compared with an EU average of 12 years.³²

Rail transport uptake has been hampered by scheduling issues. Train schedules have not been regularly updated, and do not necessarily align with passenger needs and journey times. Furthermore, increasing the schedule of trans is limited by the number of available trains.³³

Freight transport.

The share of rail in freight transport is relatively high in Montenegro at 62%, with the remaining 38% provided by road transport. Across the EU, the rail transport contributes approximately

³¹ Ministry of Capital Investments. 2022. Roadmap Transport Decarbonisation Montenegro. Towards clean, safe, accessible and affordable mobility. Final version. May 2022.

³² Ministry of Capital Investments. 2022. Roadmap Transport Decarbonisation Montenegro. Towards clean, safe, accessible and affordable mobility. Final version. May 2022.

³³ Ministry of Capital Investments. 2022. Roadmap Transport Decarbonisation Montenegro. Towards clean, safe, accessible and affordable mobility. Final version. May 2022.

just 18% of freight transport. Nevertheless, projections indicate that there is potential to further increase the share of rail in freight transport.

2.2.2 Strategy and planning documents

Key strategy and planning documents for the transport sector in Montenegro are:

- Roadmap Transport Decarbonisation Montenegro (not formally published, but prepared by the Ministry of Capital Investments in 2022).
- Transport Development Strategy – Montenegro 2019-2035.
- Spatial Plan of Montenegro Until 2040.
- Green Hydrogen Development Programme with the Action Plan for the period 2026–2028.

Roadmap Transport Decarbonisation Montenegro.

While not formally adopted, the Roadmap Transport Decarbonisation Montenegro, prepared for the Ministry of Capital Investments, outlines a comprehensive set of actions needed to reduce emissions in the transport sector. The actions outlined in the Roadmap have formed the core of the policy measures for the transport sector included in the LCDS.

The Roadmap defines a set of five policy objectives to deliver decarbonisation in the road transport sector:

- Modal shift from cars to bus, trains, boats and other forms of environmentally friendly transport.
- Renewal of cars and buses.
- Modal shift from road to rail in freight transport.
- Decarbonisation of vehicles used in freight transport.
- Efficiency improvement of the road transport industry.

Detailed recommendations for the implementation of these objectives and the estimated impact on emissions are outlined within the Roadmap document.

Transport Development Strategy – Montenegro 2019-2035.

The transport development strategy outlines plans for the development and management of transport infrastructure, primarily roads, rail networks, airports and ports. While the strategy does not directly target transport decarbonisation, implementation will improve efficiency of the transport sector and facilitate modal shift from private road to rail transport, thereby supporting transport decarbonisation.

Included in the Transport Development Strategy is the Single Project Pipeline, a list of priority transport projects. The SPP is summarised in Table 6 below.

Table 6 Single Project Pipeline

No.	Project title	Subsector	Estimated cost
1	Reconstruction and modernisation of the railway line "Vrbnica-Bar", state border with Serbia	Rail	€ 246,500,000
2	Construction of Bar-Boljare highway, section Mateševo – Andrijevića	Road	€ 294,840,000
3	Adriatic-Ionian expressway coastal variant along Montenegro's coast	Road	€ 1,013,001,000
4	Highway Bar-Boljare, bypass Podgorica, section Smokovac – Tološi - Farmaci	Road	€ 233,122,000
5	Highway Bar-Boljare, section Đurmani - Farmaci	Road	€ 440,640,000
6	Highway Bar-Boljare, section Andrijevića – Boljare	Road	€ 731,160,000
7	Reconstruction and modernisation of the railway line Podgorica - Tuzi – across the border with Albania	Rail	€ 35,000,000
8	Vessel Traffic Management Information System (VTMIS) response to maritime pollution incidents - PHASE II	Maritime	€ 4,200,000
9	Development of the Podgorica Airport	Air	€ 94,842,387
10	Development of the Tivat Airport	Air	€ 55,000,000
11	Reconstruction of the Šćepan Polje-Plužine highway (border crossing with Bosnia and Hercegovina)	Road	€ 60,000,000
12	Construction of the railway Nikšić- border with BiH-Trebinje-Čapljina	Rail	€ 179,597,190
Total			€ 3.3 billion

Source: Ministry of Transport and Maritime Affairs of Montenegro. 2019.

Spatial Plan of Montenegro Until 2040.

While the spatial plan does not include actions specifically targeting emissions reduction in the transport sector, needs identified in the plan will help enable transport decarbonisation. These needs include:

- Develop public urban, suburban and intercity transport.
- Increase the level of services in all aspects of transport infrastructure.
- Increase the share of rail and maritime transport in the overall system.

- Increase the share of air transport in the transport system.

Development of electric vehicle charging infrastructure is not explicitly included in the plan, however the need for electricity network planning to consider development of this infrastructure is noted.

Green Hydrogen Development Programme with the Action Plan for the period 2026–2028.

Green Hydrogen Development Programme with the Action Plan for the period 2026–2028 outlines a plan for the development of a renewable hydrogen industry in Montenegro. Transport is identified in the document as one of the main domestic demand sources for green hydrogen should such an industry develop. Coastal and short-distance maritime public transport and cargo transport are the sub-sectors where hydrogen is expected to be utilised.

2.2.3 Transport sector PAMs

NECP PAMs.

Montenegro's draft NECP includes five PAMs specifically targeting the transport sector. These PAMs target energy efficiency improvement, uptake of low carbon transport, and transport modal shift. As such these PAMs provide the bases for the LCDS and provide a starting point for the enhanced transport decarbonisation ambition proposed in the LCDS. The five draft NECP PAMs are summarised below.

Promotion of e-mobility.

NECP scenario	WAM scenario
Description	Support the uptake of electric vehicles, targeting at least 35,000 passenger cars within the total vehicle stock by 2030.
Actions for delivery	<ul style="list-style-type: none"> ● Financial incentives for purchase of electric vehicles (EVs). ● Financial support for the roll out of EV chargers.
Relevance for the LCDS	Feeds directly into NECP PAM T4 by facilitating early-stage uptake of EVs in Montenegro. NECP PAM T4 will strengthen ambition for rollout of EVs and other zero carbon vehicles.

Introduction of a mandatory share of biofuels in the fuel supply.

NECP scenario	WAM scenario
Description	Introduction of a mandatory share of biofuel blending into diesel and petrol to amounts 6% of diesel by 2030 and 10% of petrol by 2034.
Actions for delivery	Legally mandate blend shares.

Relevance for the LCDS	This is seen as a transition measure, and while biofuel blending is expected to continue while petroleum fuels remain in use, it is not considered a priority to increase the share of biofuel blending.
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Ban on import of old vehicles (Euro 4 or lower standard).

NECP scenario	WAM scenario
Description	Ban on the import of vehicles older than 15 years to improve fuel efficiency in the sector.
Actions for delivery	<ul style="list-style-type: none"> Regulatory ban, this has already been introduced.
Relevance for the LCDS	<ul style="list-style-type: none"> Regular review and update of vehicle standards can facilitate efficient upgrading of the vehicle stock, including supporting the transition to EVs and other low carbon vehicles. While not explicitly included in the LCDS PAMs, update of vehicles standards could be used as an implementation tool for LCDS PAM T4.

Passenger transport modal shift to public bus transport.

NECP scenario	WAM scenario
Description	Increase the share of bus public transport in total passenger transport to the EU average of 7% of transport kilometres by 2030.
Actions for delivery	<ul style="list-style-type: none"> Provide financial support for the purchase of 100 new buses for municipalities outside of Podgorica.
Relevance for the LCDS	<ul style="list-style-type: none"> This PAM will lead into LCDS PAM T1 through starting the process of passenger transport modal shift.

Passenger and freight modal shift to rail.

NECP scenario	WAM scenario
Description	Increase the share of rail passenger transport from less than 1% to 7% by 2030 and the share of rail freight transport from 61% to 60%.
Actions for delivery	<ul style="list-style-type: none"> A grant of € 112 million has been made available for technical and financial support to solve issues currently preventing higher uptake of rail transport.
Relevance for the LCDS	<ul style="list-style-type: none"> This PAM will lead into LCDS PAM T2 through starting the process of freight transport modal shift.

LCDS PAMs.

Five critical PAMs have been defined to support decarbonisation of the transport sector through to 2050. PAMs have been defined in terms of targets for key metrics in transport sector decarbonisation, with possible corresponding actions for implementation outlined for each; alongside a PAM to prepare an overarching strategy document formalising those targets within the sector. Actions for implementation include both financial support for early stages of low carbon transport adoption, and regulatory reform to enable more efficient public transport.

PAMs have been defined in terms of high-level targets because flexibility will be needed when they are implemented. There remains particular uncertainty about both the forward costs of electric mobility, and the availability of alternative low carbon technologies including hydrogen fuel cell vehicles. Actions will need to be implemented and adopted as understanding improves and better information becomes available.

Montenegro has an advantage in this regard as a relatively small country located close to larger EU Member States (MS). As MS adopt new technologies, Montenegro can take learnings from successes and failures and take advantage of associated technological innovations.

Transport LCDS PAM T.1: Develop and publish a transport decarbonisation strategy, including formalising targets included in the LCDS.

Description	<p>A national transport decarbonisation strategy will set targets for modal shifting, energy efficiency improvements, and fuel switching in the transport sector; and outline the actions needed to achieve targets and strategic objectives.</p> <p>This strategy could build on the existing but not formally adopted Roadmap Transport Decarbonisation Montenegro previously prepared by Ministry of Capital Investments.</p>
Actions for delivery	<p>Prepare and adopt the transport decarbonisation strategy. The NECP and LCDS both propose targets for transport decarbonisation and actions that can support achievement of those targets, these could form the bases of a sectoral strategy prepared and endorsed by the appropriate government agency.</p>
Included in existing strategy	<p>Preparation and adoption of a national transport decarbonisation strategy is a new measure.</p>
Investment need	<p>Estimates of the investment need for various actions that are likely to be included in a transport decarbonisation strategy have been provided under those actions, for example LCDS PAM T.3, LCDS PAM T.4, and LCDS PAM T.5. More detailed estimates of investment requirements could be prepared as part of the strategy.</p>
Energy and climate change dimension	<ul style="list-style-type: none"> A national transport decarbonisation strategy will be the coordinating document to deliver the energy and climate change dimension outcomes detailed under LCDS PAM T.2, LCDS PAM T.3, LCDS PAM T.4, and LCDS PAM T.5.
Governance dimension	<ul style="list-style-type: none"> The Ministry of Transport is responsible for development of a transport decarbonisation roadmap.

	<ul style="list-style-type: none"> Increased cooperation with the Ministry of Energy and mining will be required due to the interdependencies with the power sector associated with electrification of the transport sector. Cross ministerial cooperation will be necessary for successful development of a low carbon transport sector with actions likely needed from: Ministry of Ecology, Sustainable Development and Northern Region Development; Ministry of Public Works; Ministry of Spatial Planning, Urbanism and State Property; and the Ministry of Energy and Mining. Establishment of a coordination body including relevant ministries, the Eco-Fund, EPCG, and CEDIS to comprehensively map suitable locations for installing EV chargers would help support coherent planning.
Social dimension	<ul style="list-style-type: none"> Transport represents an essential good for much of the population of Montenegro. The objectives of access, safety, and affordability must be balanced against decarbonisation targets.
International dimension	<ul style="list-style-type: none"> Montenegro's transport decarbonisation strategy should align with the EU Sustainable and Smart Mobility Strategy (SSMS).³⁴

Transport LCDS PAM T.2 Reduce car kilometres by 25% by 2035.

Description	Set a target to reduce the reduce car kilometres by 25%. 36% of reduced passenger miles are intended to shift to rail transport, and a remaining 64% are intended to shift to bus transport.
Actions for delivery	<p>Actions to be taken are likely to focus on an ongoing overhaul of the public transport system to incentivise public transport providers to provide efficient service that meet users' needs:</p> <ul style="list-style-type: none"> Improvement of urban public bus transport. Improve network and scheduling of intercity public bus transport and improve contracts with private operators to better incentivise efficient provision. Revision of time schedule of rail transport services, based on user demand. <p>Many of the necessary actions will likely be taken in the NECP PAM Passenger transport modal shift to public bus transport. As such, at 2030 once that PAM has been implemented, a review should be undertaken to identify additional actions that may need to be undertaken.</p>
Included in existing strategy	Target and proposed actions for delivery have been informed by Policy objective 1: modal shift in passenger transport, included in the Roadmap Transport Decarbonisation Montenegro.
Investment need	Requirements should be assessed during review recommended to be undertaken in 2030 assessing success of NECP PAM Passenger transport modal shift to public bus transport.
Energy and climate change dimension	<p>Reducing car kilometres will reduce energy consumption and GHG emissions through several channels:</p> <ul style="list-style-type: none"> Modal shift to more energy efficient mass transit (buses and trains) will reduce energy consumption.

³⁴ European Commission. 2020. [Sustainable and Smart Mobility Strategy – putting European transport on track for the future.](#)

	<ul style="list-style-type: none"> • A reduction in energy consumption will lead to lower consumption of fossil fuels, and therefore associated emissions. • Emissions reduction will be further enhanced if modal shift also implies a shift to low carbon transport fuels, eg electricity or hydrogen. At present buses in Montenegro are predominantly diesel, however other PAMs aim to increase use of low carbon fuels in buses. The rail network is mostly powered by electricity, the carbon intensity of which will be determined by the renewable share of power generation, which is targeted to increase through complimentary PAMs.
Governance dimension	<ul style="list-style-type: none"> • The Ministry of Transport will be responsible for delivery of reduced car kilometres. • MoT must coordinate with existing bus and rail operators.
Social dimension	<ul style="list-style-type: none"> • Improved provision of bus and rail services can have a significant positive impact on disadvantaged groups who may lack access to a private vehicle, including people unable to drive due to a disability. • Survey evidence indicates women are more dependent on public transport than men, and therefore improved provision of bus and rail can provide significant benefits to women.
International dimension	<ul style="list-style-type: none"> • The EU commission's SSMS identifies making interurban and urban mobility more sustainable and healthier as a flagship initiative, this includes advocacy for development of high-speed rail and boosting attractiveness of rail to customers. • The TEN-T regulation by the European Parliament sets urban mobility targets for cities including those in the Western Balkans, mandating all urban nodes must by 2030 adopt sustainable urban mobility plans and development of multimodal passenger hubs to improve access to improve access to public transport infrastructure. • The <i>Transport Community's</i> progress report on the SSMS in the Western Balkans notes re-establishment of rail passenger connections is a priority for the region.

Transport LCDS PAM T.3: Increase rail share of freight transport.

Description	Increase rail share of freight from 61% to 73% in 2040 and 87% in 2050.
Actions for delivery	<ul style="list-style-type: none"> • Establishment of multimodal terminals to facilitate the transfer of goods between transport modes. • Implementation of the Transport Development Strategy.
Included in existing strategy	<ul style="list-style-type: none"> • Modal shift as a policy objective, and the actions for delivery have been informed by Policy Objective 3: modal shift in freight transport, included in the Roadmap Transport Decarbonisation Montenegro. • The proposed targets for modal shift by 2040 and 2050 have been informed by a regional study on smart and sustainable mobility in the Western Balkans funded by the EU.³⁵
Investment need	<ul style="list-style-type: none"> • Development of two intermodal transport stations (at Podgorica and Bijelo Polje) are estimated in the Transport Development Strategy to cost a total of €6 million.

³⁵ Connecta Consortium. 2023. Technical Assistance to connectivity in the Western Balkans. Impact scenarios of the Sustainable and Smart Mobility Strategy (SSMS) for the Western Balkans.

	<ul style="list-style-type: none"> The total cost of all improvements to the rail network included in the Transport Development Strategy is estimated to be €459 million.
Energy and climate change dimension	<p>Increasing rail share of freight transport will reduce energy consumption and GHG emissions through several channels:</p> <ul style="list-style-type: none"> Modal shift to more energy efficient rail freight will reduce energy consumption. A reduction in energy consumption will lead to lower consumption of fossil fuels combusted in road freight, and therefore associated emissions. Rail freight is already almost fully electrified, the carbon intensity of which will be determined by the renewables share of generation, which is targeted to increase through complimentary PAMs.
Governance dimension	<ul style="list-style-type: none"> The Ministry of Transport will be responsible for delivering an increased share of rail freight transport, including the development of intermodal transport stations.
Social dimension	<ul style="list-style-type: none"> Reduction of road freight can have several co-benefits including reduced air and noise pollution, reduced road congestion, and reduced road trauma.
International dimension	<ul style="list-style-type: none"> The EU commission's SSMS calls for a substantial part of the 75% inland freight today carried by road to be shifted to rail and inland waterways. To deliver upon this aim the SSMS cites the development of multimodal logistics to be a key part of this transformation, allowing flexibility between freight transport modes. The <i>Transport Community Western Balkans SSMS progress report</i> proposes actions include delivering upon a rail corridor initiative such that the Western Balkans can join Rail Freight Corridors.³⁶

Transport LCDS PAM T.4: 100% electrification of rail infrastructure by 2040.

Description	100% of railway lines electrified by 2040. Currently 225 km of 250 km of railway track is electrified.
Actions for delivery	<ul style="list-style-type: none"> Electrification of the remaining 25 km of not yet electrified track from Podgorica to Tuzi on the Albanian border.
Included in existing strategy	<ul style="list-style-type: none"> Reconstruction and modernisation of the Podgorica to Tuzi line has been included in the single project pipeline included in the Transport Development Strategy 2019 – 2035.
Investment need	<ul style="list-style-type: none"> Reconstruction and modernisation of the Podgorica to Tuzi railway line is estimated to cost €35 million.
Energy and climate change dimension	<ul style="list-style-type: none"> Electrification of the remaining railway track will reduce direct fossil fuel consumption by diesel locomotives and therefore lead to a reduction in corresponding carbon emissions. The carbon intensity of electric rail transport will be determined by the renewables share of generation, which is targeted to increase through complimentary PAMs.

³⁶ The current network of the Rail Freight Corridors can be seen [here](#)

Governance dimension	<ul style="list-style-type: none"> The Ministry of Transport will be responsible for delivery of the single pipeline project included in the Transport Development Strategy 2019 – 2035.
Social dimension	<ul style="list-style-type: none"> Reduction of diesel fuel use in railways can have several co-benefits including reduced air and noise pollution.
International dimension	<ul style="list-style-type: none"> The EU parliament and council have adopted guidelines for Trans Europe train network to be fully electrified by 2030.

Transport LCDS PAM T.5: 90% of road transport vehicles zero emissions by 2050.

Description	50% of on road vehicles to be zero emissions by 2040, and 90% to become zero emissions by 2050. Zero emissions cars are all expected to be electric. Zero emissions buses and heavy goods vehicles expected to be a combination of electric (50% of vehicles) and hydrogen fuel cell vehicles (40% of vehicles).
Actions for delivery	<ul style="list-style-type: none"> Achievement of this PAM will be facilitated by successful implementation of NECP PAM Promotion of e-mobility. NECP PAM Promotion of e-mobility include both financial incentives for the purchase of EVs and for the installation of EV charging infrastructure. By 2030, if NECP PAM Promotion of e-mobility has been implemented, it is expected that the EV market in Montenegro will have reached scale and EVs will be cost competitive with ICE vehicles, therefore financial incentives for purchase of EVs will no longer be necessary. Ongoing support should focus on roll out of EV charging infrastructure. Continue rollout of EV charging infrastructure, assuming the same ratio of slow and fast charges per EV are rolled out as per NECP PAM Promotion of e-mobility, it is estimated approximately 2,950 additional slow chargers and 270 additional fast chargers will be needed. In addition, support may be needed in the roll out of hydrogen fuelling infrastructure.
Included in existing strategy	<ul style="list-style-type: none"> Promotion of e-mobility is included in the NECP, this PAM represents an extension of the NECP ambition through to 2050. Targets for vehicle electrification and hydrogen use have been informed by a regional study on smart and sustainable mobility in the Western Balkans funded by the EU.³⁷
Investment need	<ul style="list-style-type: none"> Total investment need for new EV charging infrastructure is estimated to be approximately € 5.5 million based on the estimated need for additional chargers and the unit cost of fast and slow chargers provided in the draft NECP.³⁸ Additional investment will be required in hydrogen fuelling infrastructure, however given the hydrogen transport industry remains nascent, cost forecasts are highly uncertain.

³⁷ Connecta Consortium. 2023. Technical Assistance to connectivity in the Western Balkans. Impact scenarios of the Sustainable and Smart Mobility Strategy (SSMS) for the Western Balkans.

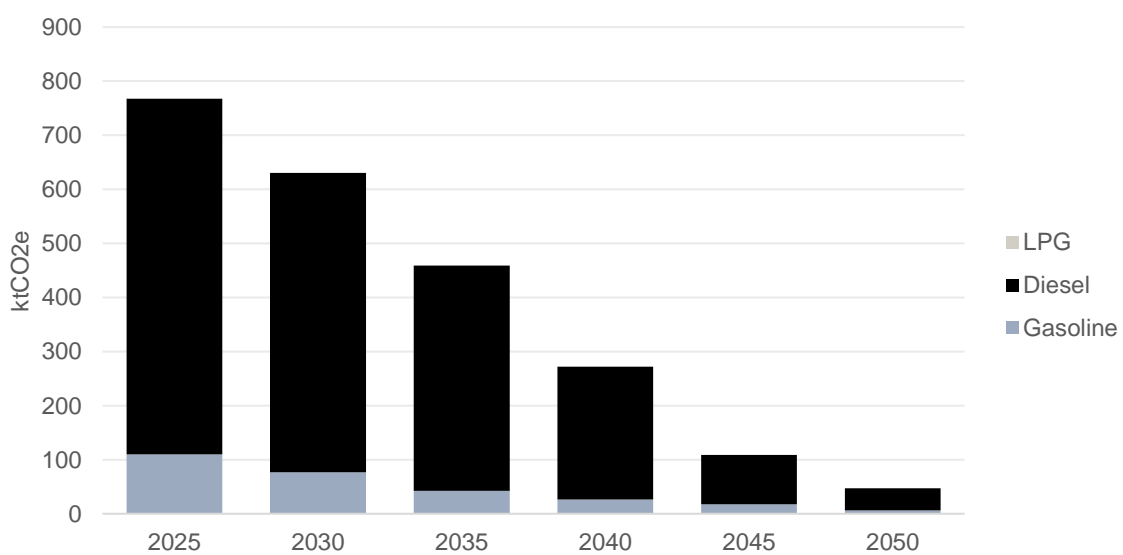
³⁸ The draft NECP includes a unit cost of € 1,500 per slow charger, and € 5,000 per fast charger.

Energy and climate change dimension	<ul style="list-style-type: none"> • Electrification and use of hydrogen in road transport will reduce direct fossil fuel consumption by ICE vehicles and therefore lead to a reduction in corresponding carbon emissions. • The carbon intensity of electric road transport will be determined by the renewables share of generation, which is targeted to increase through complimentary PAMs. • Similarly, the carbon intensity of domestically produced hydrogen via electrolysis will be determined by the renewables share of generation, which is targeted to increase through complimentary PAMs.
Governance dimension	<ul style="list-style-type: none"> • The Ministry of Transport will be responsible for overseeing the rollout of EV charging infrastructure and hydrogen vehicle fuelling infrastructure.
Social dimension	<ul style="list-style-type: none"> • Reduction of ICE vehicle use can have several co-benefits including reduced air and noise pollution.
International dimension	<ul style="list-style-type: none"> • The EU SSMS advocates for boosting the uptake of zero-emission vehicles as a flagship initiative. • The <i>Transport Community</i> SSMS progress report describes the transition to zero-emission vehicles as a key priority across the Western Balkans but cites disparities in charging infrastructure across the region a key challenge.

2.2.4 Emission reduction targets

Implementation of all PAMs included in the LCDS leads to a reduction in direct emissions from transport of 94% by 2050 relative to 2025. Outstanding emissions are estimated to total 47 ktCO_{2e}. 41 ktCO_{2e} come from ongoing use of diesel fuel and 6 ktCO_{2e} come from ongoing use of petroleum fuel.

Figure 13 Forecast transport emissions by fuel in LCDS scenario

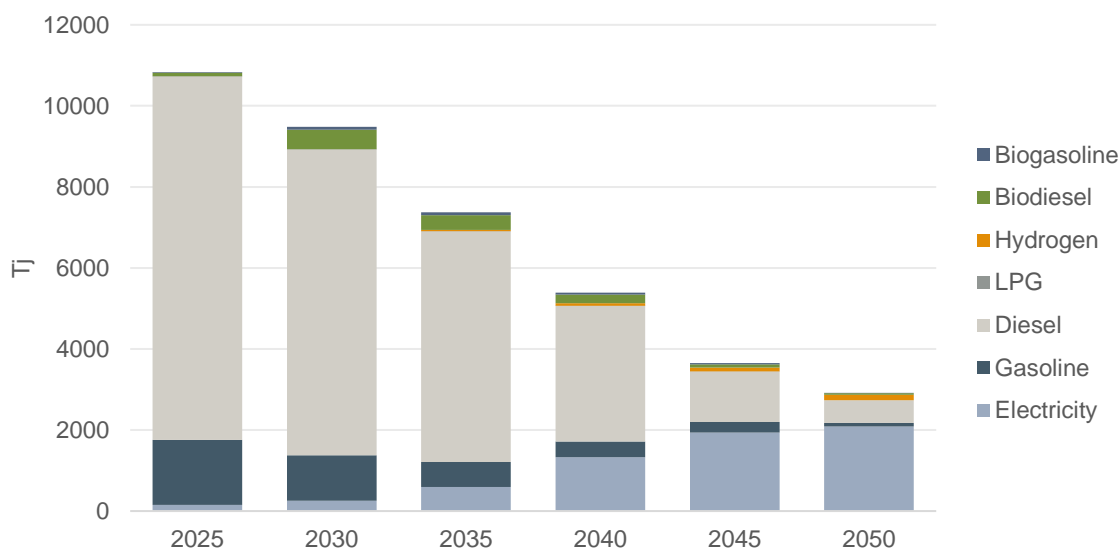


Source: Economic Consulting Associates based on NECP data.

Emissions reductions are caused by a combination of reduced final energy demand and fuel switching. Final energy demand from transport falls because of improved vehicle efficiency (EVs are significantly more efficient at the point of consumption than ICE vehicles³⁹) and mode switching from road to rail and personal vehicle use to public transit. As a result of improved efficiency, final energy demand from transport is estimated to fall by 73% in 2050 relative to 2025.

PAM T2 fully phases out direct fossil fuel use in rail transport by 2040. PAMs T3 and T4 reduce fossil fuel use to 10% of road transport by 2050, diesel continues to make up a much larger share of transport fossil fuel use than petroleum. Blending of biofuels into fossil fuels continues at the same proportion as is required in the NECP. Considering the long-term focus on phasing out fossil fuel use, it was not considered necessary to target increased use of biofuels in the LCDS.

Figure 14 Forecast transport final energy demand by fuel in LCDS scenario



Source: Economic Consulting Associates based on NECP data.

2.2.5 Sectoral SWOT

Electrification of transport provides a strong opportunity to lower the overall cost of transport for many people in Montenegro, while providing possible sources of demand for new RE development and a possible green hydrogen industry. Vehicle cost reductions required to reduce upfront costs and enable cost savings on a per km basis do however rely on uptake of vehicles in other markets.

Possible uptake of hydrogen vehicles is more uncertain. Hydrogen fuel cell vehicles are beginning to see increased uptake, however production of green hydrogen fuel remains

³⁹ EVs convert approximately 87-91% of electrical energy stored in the battery into motion, while gasoline ICE vehicles convert only 16-25% of the energy stored in gasoline into movement. Source: United States Environmental Protection Agency. [Electric Vehicle Myths](#). Accessed: 22 December 2025.

nascent and the cost of production relatively high. Significant cost reductions via electrolysis, facilitated by global uptake, will be required in order for uptake targets to be realised.

Table 7 Strengths, weaknesses, opportunities, and threats of transport decarbonisation in Montenegro.

Strengths	Weaknesses
<ul style="list-style-type: none"> • EVs can be phased in as existing vehicle fleet reaches end of life • Uptake of EVs across the EU will establish market maturity and lead to reduced costs, including providing a robust second hand market • Electrification of transport may lower the total cost of transport in the long run • Synergies with electrification and uptake of hydrogen as a fuel of industrial machinery 	<ul style="list-style-type: none"> • Up front cost of electricity charging infrastructure and fleet renewal may be high • EVs currently do not have equivalent range to ICE vehicles, and charging takes longer
Opportunities	Threats
<ul style="list-style-type: none"> • Electrification of transport will reduce dependence on imported diesel and petrol, and can improve balance of trade • RE potential implies Montenegro could be a hydrogen exporter (although this is highly uncertain), domestic transport offtake could provide anchor demand while growing exports 	<ul style="list-style-type: none"> • Successful implementation contingent on development of renewable electricity generation capacity and having sufficient grid capacity • Uptake of EVs across the EU is likely to create surplus supply of second hand ICE vehicles, Montenegro needs to avoid becoming a major sales market for these second hand vehicles leading to carbon lock in • Reliant on improvement in EV technologies • Use of hydrogen for heavy goods vehicles (HGVs) and buses reliant on improvements in vehicle technologies and availability of affordable fuel

2.3 Energy | Manufacturing and industrial energy use

2.3.1 Description and context

Energy use in the manufacturing sectors contributed a small but not insignificant 6% of GHG total emissions (corresponding to 7.5% of total energy emissions). The majority of these emissions come from liquid fuels including diesel oil, fuel oil, and LNG.

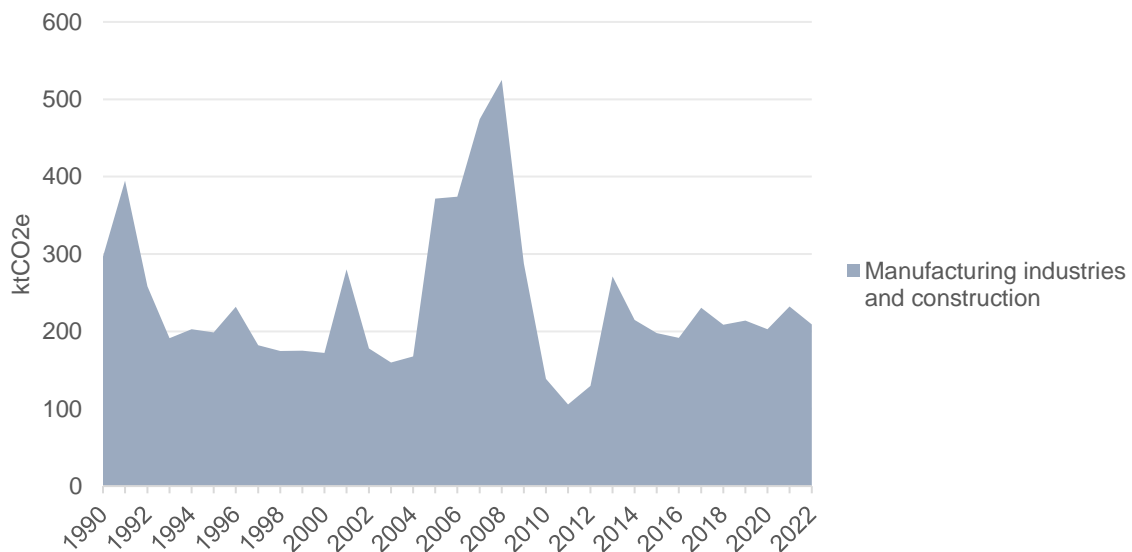
Historically, iron and steel production has been a notable contributor to manufacturing and industrial energy use emissions, however production stopped in Montenegro in 2022. Similarly, aluminium production (non-ferrous metals) was previously the largest contributor to manufacturing and industrial energy use emissions, however production of primary aluminium stopped in 2009 and subsequently emissions from this sub-sector have fallen close to zero.

Processing of imported primary aluminium and secondary aluminium into aluminium alloys and billets is ongoing with production capacity for each process of:

- Aluminium alloys plant (silumin) – capacity 30,000 tonnes per year.
- Aluminium extrusions plant (billets) – capacity 70,000 tonnes per year.

The winding down of iron and steel production and primary aluminium production is a major factor behind emissions from manufacturing and industrial energy use currently being significantly below the peak level of 2009.

Figure 15 Historic emissions from manufacturing industries and construction



Source: Environmental Protection Agency of Montenegro. 2024. [National Inventory Document 2024 of Montenegro](#).

Emissions from manufacturing industries and construction come from 11 subsectors. Key contributors are food processing, beverages, and tobacco, mining and quarrying (which includes the coal mine in Pljevlja), wood and wood products, and construction (included in “other” in the most recent GHG inventory).

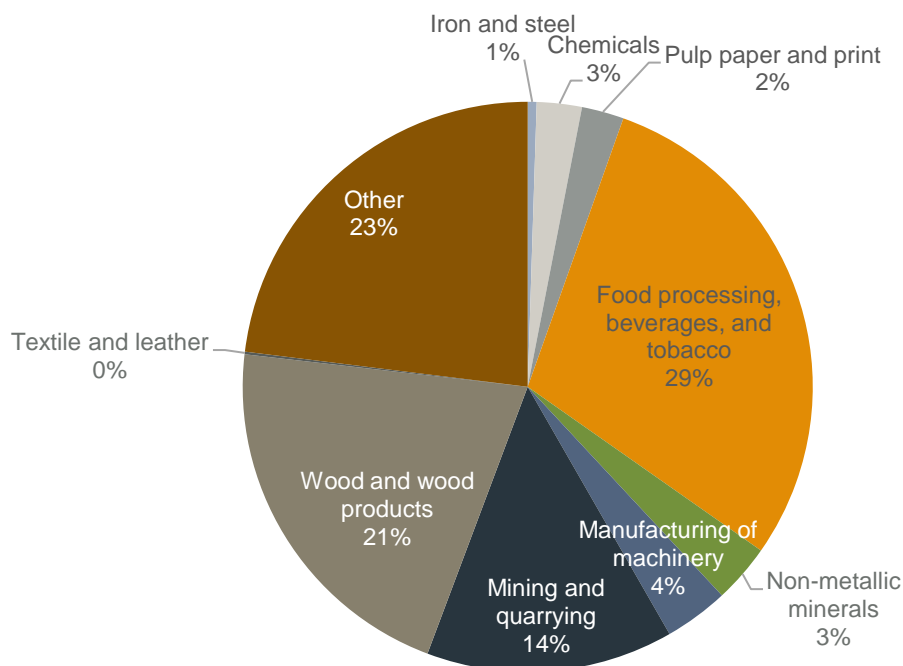
A detailed breakdown of fuel use within these subsectors is not available. It is however, assumed that the majority of this usage comes from non-road mobile machinery and other special working machinery⁴⁰. Fossil fuel usage in industrial machinery can be replaced by a combination of electrification and other zero carbon fuels such as hydrogen.

Montenegro has not yet prepared a national industrial decarbonisation strategy, or completed a detailed study of decarbonisation options, for industrial machinery. Electrification and low carbon fuel use targets for the sector included in the LCDS have therefore been set using a recent study on non-road mobile machinery prepared for the United Kingdom.⁴¹

⁴⁰ Montenegro’s draft NECP indicates that fuel usage in the industrial sector is primarily driven by these machines.

⁴¹ ERM. 2023. [Industrial Non-Road Mobile Machinery Options: Techno-Economic Feasibility Study](#).

Figure 16 Share of manufacturing industries and construction emission by sub-sector (2022)



Source: Environmental Protection Agency of Montenegro. 2024. [National Inventory Document 2024 of Montenegro](#).

Note: In the 2022 National Inventory, emissions from construction are included under Other.

2.3.2 Strategy and planning documents

While Montenegro has not prepared a national industrial decarbonisation strategy, the country has published the Industrial Policy 2024-2028.⁴² This policy document has been prepared to be in line with the EU Industrial Policy package and outlines a pathway for the sustainable development of Montenegro's industrial sector. The Industrial Policy focuses on growth and improved competitiveness in manufacturing industries, including outlining how industry can be supported towards achieving climate neutrality.

Operational objective 2.2 Supporting industry towards climate neutrality of the policy outlines a high-level approach to reducing emissions in the sector. Financial incentives and subsidies are planned for transitioning to energy efficient industrial processes and innovative technologies that use renewable energy sources. Planned interventions outlined in the policy are:

- Implementation of a subsidy programme for the purchase and installation of photovoltaic systems, electrical and hybrid vehicles, as well as electric vehicle charging stations.

⁴² Ministry of Economic Development. 2024. Industrial Policy of Montenegro 2024-2028.

- Implementation of a programme to encourage innovation in the function of energy efficiency in the processing industry to improve energy efficiency and increase the use of renewable energy.
- Implementation of financial incentives under IPARD III for the food industry sector with investments in wastewater treatment and renewable energy.

For the purposes of the LCDS, growth in renewable energy supply⁴³ and uptake of EVs are addressed in the power generation and transport sections respectively. This chapter therefore focuses on the use of renewable energy in industrial and manufacturing processes. As outlined in Section 2.3.1, this largely corresponds to transitioning to electrified and other zero carbon fuel powered machinery.

2.3.3 PAMs

NECP PAMs.

Transitioning to electrified machinery is the cornerstone of emissions reduction in the manufacturing and industrial sectors in the LCDS. The PAMs to be implemented in Montenegro's NECP provide the start point for this process via incentives for early-stage adoption of these technologies. In addition, the NECP sets the trajectory for the mid-term by establishing biodiesel as a transition fuel.

In 2030, assessment of progress achieved by the NECP PAMs must be undertaken to help determine the details of ongoing support needed to achieve strengthened policy targets set in the LCDS.

The NECP includes two measures associated with the reintroduction primary aluminium production at the Uniprom KAP electrolysis plant. Considering primary aluminium production is not currently occurring at the Uniprom KAP facility, the increase in energy consumption associated with any restart is not included in the LCDS scenario. Energy demand from secondary aluminium production, including potential growth, is included in the scenario. Should this situation change then the corresponding impact on energy demand and emissions reduction efforts will need to be accommodated in any update to this strategy..

Uniprom KAP: electrolysis cells replacement and overhauling.

NECP scenario	WEM scenario
Description	Upgrade and increased production processes of KAP aluminium plant, in line with the EU Industrial Emissions Directive.
Actions for delivery	<ul style="list-style-type: none"> ● Investment by plant owner, Uniprom KAP.
Relevance for the LCDS	This is considered to be one off plant specific action and therefore follow on actions are not considered in the LCDS. Any associated changes in power demand and process emissions as a result of the investment will be accounted for the LCDS scenario modelling.

⁴³ This includes the NECP PAM *Prosumers in Industry* which is included in the power generation chapter of the LCDS.

Uniprom KAP: Cell hibernation.

NECP scenario	WAM scenario.
Description	Improvement of production processes to eliminate Perfluorocarbon (PFC) emissions in line with the EU Industrial Emissions Directive.
Actions for delivery	<ul style="list-style-type: none"> Investment by plant owner, Uniprom KAP.
Relevance for the LCDS	This is considered to be one off plant specific action and therefore follow on actions are not considered in the LCDS. Any associated changes in process emissions as a result of the investment will be accounted for the LCDS scenario modelling.

Biofuels in industry.

NECP scenario	WAM scenario
Description	Require 25% blending of biodiesel into diesel used for industrial processes by 2030.
Actions for delivery	<ul style="list-style-type: none"> Implementation of a regulation requiring biodiesel blending, with blending to start from 2026 and reaching 25% by 2030.
Relevance for the LCDS	The LCDS focuses on electrification of electrical machinery, biodiesel is considered to be a transition fuel, with usage initially increasing before falling over time.

Financial incentives for introduction of hybrid special working machines in industry sector.

NECP scenario	WAM scenario
Description	Grant funding to support the purchase of hybrid heavy machinery to replace diesel machinery.
Actions for delivery	<ul style="list-style-type: none"> A subsidy of 15% when purchasing hybrid heavy machinery, to address the estimated 10% to 30% higher purchase price of the machinery.
Relevance for the LCDS	Transitioning to electrified machinery is the cornerstone of emissions reduction in the manufacturing and industrial sectors in the LCDS. Therefore this PAM provides a start point for that transition. Assessment of the success of this PAM should be taken in 2030, focusing the degree of electrification already achieved and whether further incentives are required.

Programme for the promotion of innovation and energy efficiency services in industry.

NECP scenario	WEM scenario
Description	Provide future rounds of funding to the Programme for the Promotion of Innovation and Energy Efficiency Services in Industry, implemented through the Innovation Fund of Montenegro, targeting increased energy efficiency and the use of renewable energy by micro, small, and medium sized enterprises (MSMEs) in manufacturing and industry.
Actions for delivery	<ul style="list-style-type: none"> Allocation of funding for future rounds.
Relevance for the LCDS	Projects demonstrating first of a kind uptake of energy efficiency and renewable energy processes and technologies in Montenegro can help start the process of improving energy efficiency and transitioning away from fossil fuels in industry and manufacturing.

LCDS PAMs.

The LCDS focuses on ongoing electrification of machinery to reduce emissions from industry and manufacturing. This strategy builds on NECP PAMs which aim to start the process of electrification of machinery. A flexible approach is needed, and the exact actions needed to implement targets set in the LCDS should be determined once an assessment of progress delivered by the NECP PAMs has been undertaken.

LCDS PAM PG.1: Alignment of the carbon price with the EU Emissions Trading System price by 2028 has been included in section 2.1 Energy | Power generation rather than here because at present only the TPP Pljevlja is covered by the Montenegro ETS. Previously iron and steel production and primary aluminium production were included in the Montenegro ETS, however these production processes are not currently occurring within the country. If iron and steel production or primary aluminium production restart, then these will most likely be covered by the ETS. Should other industrial and manufacturing production increase in scale in the future it is possible that some facilities may become large enough to be required to participate in the ETS, however at this stage no facilities meet scale thresholds. Industry and manufacturing LCDS PAM IM.1: 95% of industrial and manufacturing fossil fuel use to be replaced with electricity.

Description	LCDS PAM
Actions for delivery	<ul style="list-style-type: none"> Introduce a policy target pathway for replacement of fossil fuel use in electricity by 2050. Proposed target pathway is: 25% at 2035, 50% at 2040, 75% at 2045, 95% at 2050. Delivering this target will likely require a range of policy actions and incentives. Assessment should be undertaken to identify the most appropriate actions for delivery, which may include, but not necessarily be limited to:

	<ul style="list-style-type: none"> • Establishment of a fund for industrial electrification. Such a fund could follow a structure similar to the auction for subsidies to support innovative projects that electrify industrial process heat being implemented in the EU via the Innovation Fund and funded by revenues from the EU ETS.⁴⁴ • Improvement of energy efficiency standards for industrial processes. Montenegro has already adopted the EU Ecodesign for Sustainable Products Regulation⁴⁵ which establishes requirements for industrial energy efficiency. Assessment should consider whether these are fit for purpose to deliver the industrial electrification targets, or whether strengthening is required. • A supportive regulatory framework for renewable energy PPAs between RE developers and industrial producers. Existing regulatory and market arrangements should be reviewed to identify barriers to PPAs, and measures identified that can help stimulate a PPA market. • Provide training, capacity building, and other education on industrial electrification to build awareness and support uptake. • Additional financial incentives to those recommended by the NECP may be necessary and justified dependent on the extent to which uptake of electricity in industry manufacturing has been achieved in Montenegro by 2030 and considering how the global cost curve of electric heavy machinery has changed. An assessment of these two criteria should be undertaken in 2030 to determine whether further financial incentives are justified.
Included in existing strategy	<ul style="list-style-type: none"> • Electrification of heavy machinery is included as a measure in the Industrial Policy, however specific targets and instruments for implementation are not provided. • Early uptake of electrified heavy machinery is proposed to be incentivised in the NECP.
Investment need	<ul style="list-style-type: none"> • Investment will be undertaken by the private sector and can be done as current machinery reaches end of life and requires replacement. Investment support may be required in the near term if the cost of electric machinery remains above the cost of fossil fuel powered machinery. Once the cost of electric machinery falls to the point where there is no cost differential then investment subsidies should not be necessary on an ongoing basis, and the electrification targets can be assumed to impose no additional investment costs on industry relative to business as usual.
Energy and climate change dimension	<ul style="list-style-type: none"> • Electrification of machinery will reduce direct fossil fuel consumption and therefore lead to a reduction in corresponding GHG emissions. • The carbon intensity of electric machinery will be determined by the renewables share of generation, which is targeted to increase through complimentary PAMs.
Governance dimension	<ul style="list-style-type: none"> • Primary responsibility for implementation of electrification of machinery will sit with the Ministry of Energy and Mining. • The Chamber of Commerce should support the Ministry of Energy and Mining in coordinating with relevant private sector energy users.

⁴⁴ European Commission. Directorate General Climate Action. 2025. [Innovation Fund IF25 Heat Auction. Terms and Conditions.](#)

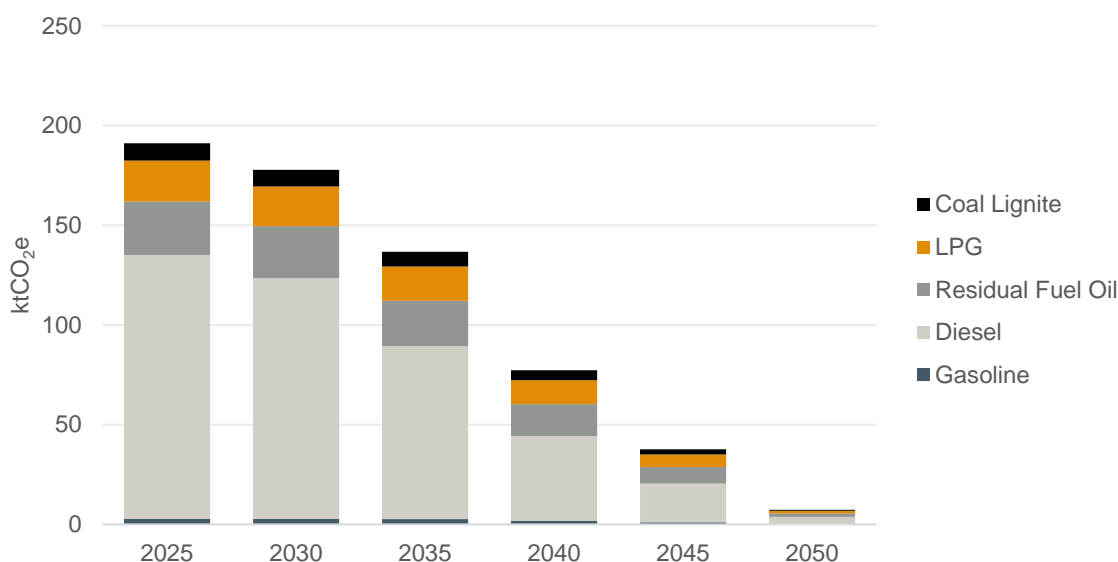
⁴⁵ Official Journal of the European Union. 2024. [Regulation \(EU\) 2024/1781 establishing a framework for the setting of ecodesign requirements for sustainable products.](#)

Social dimension	<ul style="list-style-type: none"> Reduction of fossil fuel use can have several co-benefits including reduced air and noise pollution.
International dimension	<ul style="list-style-type: none"> Electrification of machinery is in line with the EU Industrial Clean Deal which promotes transitioning to domestically produced clean energy.

2.3.4 Emission reduction targets

Achievement of 90% electrification of industrial and manufacturing energy use can result in emissions from industrial fuel use falling to 7.3 ktCO₂e by 2050, a 96% reduction relative to emissions in 2022.⁴⁶

Figure 17 Forecast industry and manufacturing emissions by fuel in LCDS scenario



Source: Economic Consulting Associates based on NECP data.

Emissions reductions are achieved despite an increase in energy demand from manufacturing and industry to 2050. Energy demand from the sector is expected to grow over time in line with average growth of the Montenegro economy.

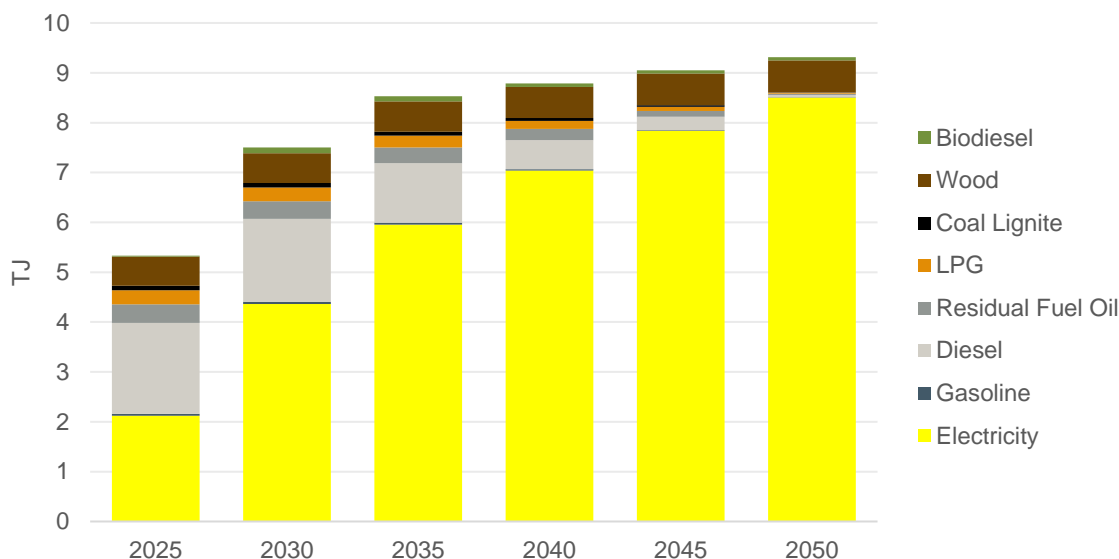
Biodiesel use is assumed to continue at the level achieved by 2030 through the relevant PAM in the NECP. Biodiesel is considered a transitional fuel, and therefore the LCDS does not include measures to continue to promote the use of biodiesel in the long term. However, while some use of fossil fuels remain, ongoing use of biodiesel blending can continue to reduce the associated emissions.

Wood use is used in manufacturing and industry in processes where electrification is more difficult than in areas where fossil fuels are currently used. Therefore, use of wood is assumed

⁴⁶ Environmental Protection Agency of Montenegro. 2024. [National Inventory Document 2024 of Montenegro](#).

to continue at current levels. So long as forests are sustainably managed, wood can be a low or zero-emission fuel.

Figure 18 Forecast industry and manufacturing final energy demand by fuel in LCDS scenario



Source: Economic Consulting Associates based on NECP data.

2.3.5 Sectoral SWOT

Electrification of machinery can be done with minimal additional investment cost relative to a business-as-usual situation by phasing in electric machines over time as existing machinery reaches end of life. However, the scale of additional cost will depend on cost of electric machines falling, which is reliant on significant international uptake.

Table 8 Strengths, weaknesses, opportunities, and threats of industry and manufacturing decarbonisation in Montenegro.

Strengths	Weaknesses
<ul style="list-style-type: none"> Electric machines can be phased in as existing machinery reaches end of life. Potential for long-term fuel cost savings. The proposed solutions are known technologies mitigating technical and commercial risk. 	<ul style="list-style-type: none"> Electric machines can be phased in as existing machinery reaches end of life. At present, electric machines are 10% to 30% more expensive than fossil power alternatives.⁴⁷ However, this could come down as global adoption takes off.
Opportunities	Threats
<ul style="list-style-type: none"> Electrification of industrial machinery will reduce dependence on imported diesel and petrol, and can improve balance of trade. 	<ul style="list-style-type: none"> Successful implementation contingent on development of renewable electricity

⁴⁷ ERM. 2023. [Industrial Non-Road Mobile Machinery Options: Techno-Economic Feasibility Study](#).

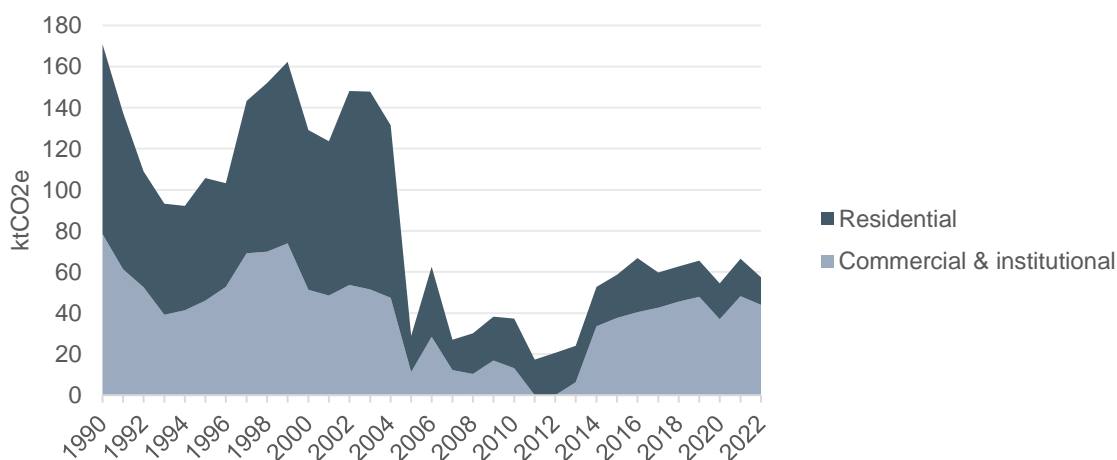
<ul style="list-style-type: none"> • Potential for synergies with electrification of transport. • Increased domestic electricity demand can provide anchor demand for new build renewables which can then capture value from power exports. 	<p>generation capacity and having sufficient grid capacity</p> <ul style="list-style-type: none"> • Electrification of machinery may be reliant on technological improvements for some machines
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2.4 Energy | Energy use in buildings

2.4.1 Description and context

Emissions from the buildings sector predominantly come from commercial and institutional (including public) buildings more than residential buildings. On aggregate, the sector contributes a relatively small share of total emissions, with just 1.7%. However, this is partially driven by the large share of biomass used for heating in the residential sector which has a relatively low carbon intensity compared with fossil fuels. Energy efficiency and electrification of heating in residential buildings currently heated with biomass will however deliver other benefits, including air quality improvements within the home and better protection of forest ecosystems resulting in an increase in the forest sink.

Figure 19 Historic emissions from buildings by subsector⁴⁸



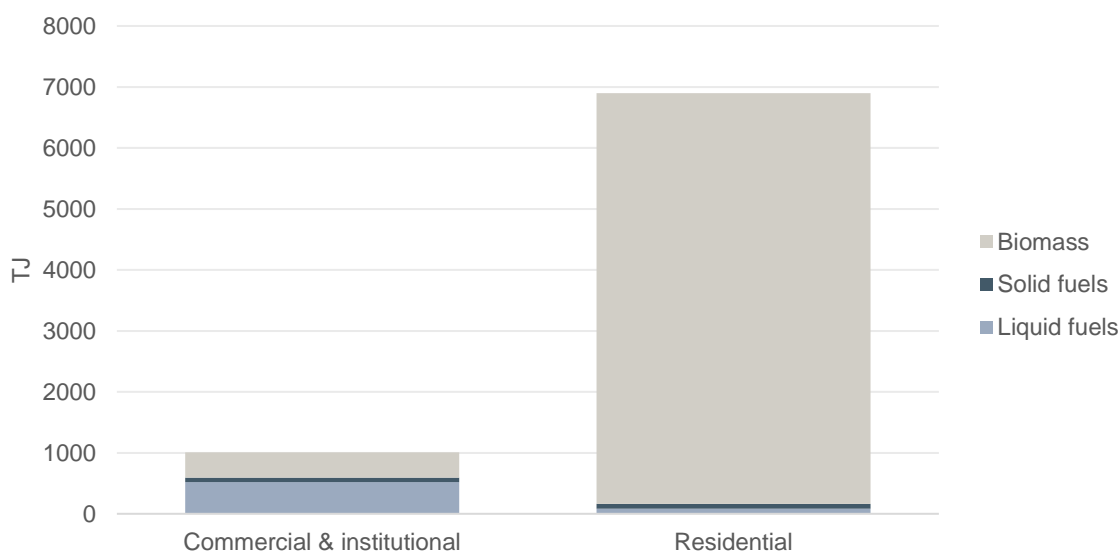
Source: Environmental Protection Agency of Montenegro. 2024. [National Inventory Document 2024 of Montenegro](#).

Biomass in the residential sector provides by far the largest amount of fuel consumed in buildings (note that Figure 20 does not include consumption of electricity, which is the primary energy source in commercial buildings and a common source of household cooling in the coastal region of Montenegro). However, use of solid and liquid fossil fuels in commercial and

⁴⁸ In the National Inventory Document 2024 of Montenegro, residential and commercial sector emissions are presented in aggregate. While emissions from buildings will contribute the vast majority of these, a small share can be attributed to other small machines, however for the purposes of the LCDS this share is assumed to be negligible.

institutional buildings is three to four times as large as fossil fuel use in the residential sector and as a result emissions from the commercial sector provide the majority of buildings emissions.

Figure 20 2022 fuel consumption in buildings by subsector⁴⁹



Source: Environmental Protection Agency of Montenegro. 2024. [National Inventory Document 2024 of Montenegro](#).

Use of biomass for heating is typically a very inefficient source of heating. Across the Western Balkans the average energy loss of the energy content of biomass when used for heating is around 40% to 50%⁵⁰. The resultant particulate matter from burning of biomass contributes to poor air quality, and inefficient use of fuel contribute to over harvesting of forests for fuel. Improving energy efficiency and fuel switching can therefore deliver benefits, beyond directly leading to reduced GHG emissions.

2.4.2 Strategy and planning documents

Montenegro has prepared a building renovation study (BRS)⁵¹ to establish a long-term renovation strategy to improve the energy efficiency of the stock of public and private, residential and non-residential buildings in the county. The objectives of the BRS include:

- Specifying measures towards a high energy efficiency stock of buildings in Montenegro over the next 10-20 years and beyond.

⁴⁹ In the National Inventory Document 2024 of Montenegro, residential and commercial sector emissions are presented in aggregate. While emissions from buildings will contribute the vast majority of these, a small share can be attributed to other small machines, however for the purposes of the LCDS this share is assumed to be negligible.

⁵⁰ World Bank. 2017. Biomass-Based Heating in the Western Balkans – A Roadmap for Sustainable Development.

⁵¹ Economic Consulting Associates. 2025. Study on the improvement of the energy efficiency of buildings in Montenegro.

- Identifying measures for acceleration of the energy efficiency-oriented renovation of the building stock.
- Setting specific targets for the reduction of energy consumption in existing buildings.
- Setting up a rational and effective framework for the governance of building renovation activities, to enable integrated effects on both, the achievement of climate related goals and economic development.

Full implementation of the strategy is forecast to lead to a fuel mix in the buildings sector of 73% electricity and 27% biomass. PAMs defined for the buildings sector for the LCDS are targeted towards achieving this fuel mix.

2.4.3 Policy measures

NECP policy measures.

The NECP outlines multiple regulatory amendments to support uptake of energy efficiency within buildings. These actions will lay the regulatory foundation for implementation of Montenegro's BRS and for achieving decarbonisation of the buildings sector. Also included in the NECP is the introduction of financial mechanisms to support energy efficiency and uptake of electrification by households and individuals, in the long run these mechanisms can be extended and expanded to support 2050 targets for the buildings sector.

Several PAMs in the NECP cover the adoption of decentralised generation by prosumers, located at the site of power consumption. For the purposes of the LCDS, these PAMs are considered power supply, have therefore been included in the power generation sector, and are not listed here. The PAMs included for the building sector focus on energy demand from buildings, including energy efficiency and fuel switching.

Development and implementation of energy efficiency regulatory framework in buildings.

NECP scenario	WEM scenario
Description	Establishment of a regulatory framework setting minimum requirements for refurbished and new buildings. Establishing such a framework will involve transposing EU Directive (EU) 2018/844 into national legislation.
Actions for delivery	<ul style="list-style-type: none"> ● Transpose relevant aspects of Directive (EU) 2018/844 into national legislation.
Relevance for the LCDS	Adoption of a legal framework will provide a legal basis for implementing the BRS.

District heating in Pljevlja.

NECP scenario	WAM scenario
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Description	Development of district heating in Pljevlja town after the ecological refurbishment of TPP Pljevlja. District heating will lead to the eliminate of use of lignite as a fuel for heating in Pljevlja town.
Actions for delivery	<ul style="list-style-type: none"> • Construction and development of the district heating network. This has already begun.
Relevance for the LCDS	<p>Similar district heating projects elsewhere in Montenegro will not be feasible considering TPP Pljevlja is the only large power plant in the country.</p> <p>The change in fuel demand associated with the project is reflected in the LCDS scenario modelling. This includes the expectation that the district heating network will transition to being fuelled with biomass once TPP Pljevlja is retired.</p>

Implementation of energy efficiency measures in public buildings.

NECP scenario	WEM scenario
Description	Improvement of building envelope, instillation of heating, ventilation, and air conditioning (HVAC) systems, water heating, lighting, energy management systems, and renewable energy as well as implementing behavioural and operational changes related to energy use in public buildings.
Actions for delivery	<ul style="list-style-type: none"> • Undertake energy efficiency audits. • Implement identified energy efficiency measures.
Relevance for the LCDS	Implementation of energy efficiency measures in public municipal buildings represents a first step towards implementation of the BRS.

Implementation of energy efficiency measures in public infrastructure.

NECP scenario	WEM scenario
Description	Montenegro's Law on Efficient Energy Use obliges local governments to prepare a programme for improvement of energy efficiency in local government operations. This includes improving energy efficiency in across all local government functions.
Actions for delivery	<ul style="list-style-type: none"> • Undertake energy efficiency audits. • Implement identified energy efficiency measures.
Relevance for the LCDS	Implementation of energy efficiency measures across public operations represents a first step towards implementation of the BRS.

Establishment and implementation of energy efficiency criteria in public tendering.

NECP scenario	WEM scenario
Description	Make energy efficiency a mandatory technical requirement in all public tendering.
Actions for delivery	<ul style="list-style-type: none"> • Amendment to the Law on Efficient Use of Energy.

Relevance for the LCDS	Strengthening legal requirements to consider energy efficiency in public tendering will support the implementation of the BRS.
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Energy labelling and eco-design requirements for energy related products.

NECP scenario	WEM scenario
Description	Implement regulatory framework defining energy labelling and eco-design requirements.
Actions for delivery	<ul style="list-style-type: none"> • Transpose relevant aspects of Directive (EU) 2018/844 into national legislation. This has already been completed.
Relevance for the LCDS	Energy labelling and eco-design requirements support implementation of wider energy efficiency and electrification objectives.

Establishment and development of energy management in the public sector.

NECP scenario	WEM scenario
Description	Establishment of an organisational structure for energy management in public buildings.
Actions for delivery	<ul style="list-style-type: none"> • 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, and energy service companies).
Relevance for the LCDS	Implementation of energy management in public buildings will support the implementation of the BRS.

Methodology for defining energy-poor groups and measures to reduce energy poverty.

NECP scenario	WAM scenario
Description	Define criteria for identifying energy-poor households based on guidelines proposed by the Energy Community Secretariat.
Actions for delivery	<ul style="list-style-type: none"> • Preparation of a methodology for identifying energy-poor households.
Relevance for the LCDS	Identifying households and individual in energy poverty will help to target funding and financial support for improving energy efficiency as included in the implementation of the BRS, which is included as a PAM in the LCDS.

Financial incentives for citizens / private households (for energy efficiency investments).

NECP scenario	WEM scenario
Description	Implementation of financial support mechanisms for households and individuals using public funds. Financial support is intended for measures reducing energy consumption as well as solar and modern forms of biomass.
Actions for delivery	<ul style="list-style-type: none"> Implementation of various financial support mechanisms.
Relevance for the LCDS	Ongoing financial support mechanisms will be needed to fully implement the BRS. Lessons learned from early financial support programmes can be used to improve effectiveness and efficiency of future programmes.

LCDS PAMs.

For the buildings sector the LCDS focuses on implementation of Montenegro's BRS. The strategy outlines a detailed set of policy actions, building on PAMs included in the NECP, which can deliver the renovation objectives laid out in the plan.

Buildings LCDS PAM IM.1: Implementation of Montenegro's BRS.

Description	Montenegro has developed a BRS to improve the energy efficiency of the national stock of public and private, residential and non-residential buildings, in a cost-effective manner. The BRS outlines a detailed list of policy actions needed to achievement the energy efficiency and fuel switching objectives included within the strategy, these are outlined below.
Actions for delivery	<ul style="list-style-type: none"> Adopt a cross-government target which represents an ambitious scale of energy renovation activity. Fully establish the enabling regulatory framework. Establish a standing commission drawn from key Government Ministries and Agencies to oversee BRS delivery. Establish an operational energy efficiency renovation programme for each sector (residential, commercial, public). Establish smart and regular monitoring and reporting procedures for progress reporting and review. Adopt a phased approach for implementation in each sector, building on early successes and learnings. Review cost optimal methodology for renovation works to inform next upgrading of building regulations. Finalise definitions and guidance on NZEB (Nearly Zero Energy Buildings) – and, looking forward, ZEB (Zero Emission Buildings) for different building types. Implement the legal and financial infrastructure to facilitate entry of energy service companies (ESCOs), based on projects and studies carried out to date. Secure resources needed to establish a strong, properly resourced Ministry and/or subordinate authority, which can effectively manage

and coordinate activities in the sector, meet its functional obligations, manage the energy performance certificate (EPC) system, and maintain reliable and comprehensive data bases. Commit adequate resources to this authority to enable it to discharge its assigned functions in relation to evaluation, due diligence, technical, economic, financial, legal and other risk assessment of investment proposals.

- Finalise the establishment of EPC registers (both residential and non-residential).
- Establish adequate capacity, including targeted training and technical assistance for municipal authorities to equip them to discharge their enforcement functions in relation to building permits based on Minimum Requirements for Energy Performance, NZEV, and EPC compliance including for renovations.
- Deliver exemplar pilot/ demonstration projects with accessible learnings for transmission to the construction industry in general.
- Deliver training programmes, including 'Training the Trainers', ongoing training of professionals and practical training of the construction workforce.
- Registration of adequate numbers of qualified professionals to provide a basis for market confidence in engaging energy service providers.
- Provide a coherent suite of tools (eg manuals, software) and online systems (eg databases of registered products and installers).
- Launch the first rounds of funding applications, with selected incentives, including some mix of grants, soft/preferential/ green loans, energy services guarantees.
- Plan to deploy Eco Fund and donor sources of finance to support delivery of a balanced mix of the most suitable exemplary front line building renovation projects, capacity building (pilots, technical assistance etc.) and pioneering developmental projects, with deep renovations in the public sector representing up to 50% of the available budget in the first 3 years until the next BRS update.
- Seek to recruit new financial resources into the Eco Fund on a continuing basis.
- Consider establishing a rigorous programme of energy audits, particularly for commercial buildings, to address present data limitations, assess techno-economic feasibility and help to prioritise opportunities and resources for energy efficiency renovation.
- Adopt monitoring and verification (M&V) protocols to help establish investor confidence.
- Consider applying Model Energy Performance Contracts to assist ESCO uptake, possibly on a pilot demonstration basis.
- Allow exchequer budget finance, for example grant schemes, to be made available on a multiannual programme basis.
- Deliver regular promotional campaigns to the different market segments, co-ordinated with the applicable financial instruments on offer.
- Seek to develop and pilot the concept of a 'one stop shop' service to building owners, championed by a municipal authority under the aegis of the NECP.

Included in existing strategy

- This PAM focuses on the implementation of Montenegro's BRS and is therefore directly aligned with that strategy.
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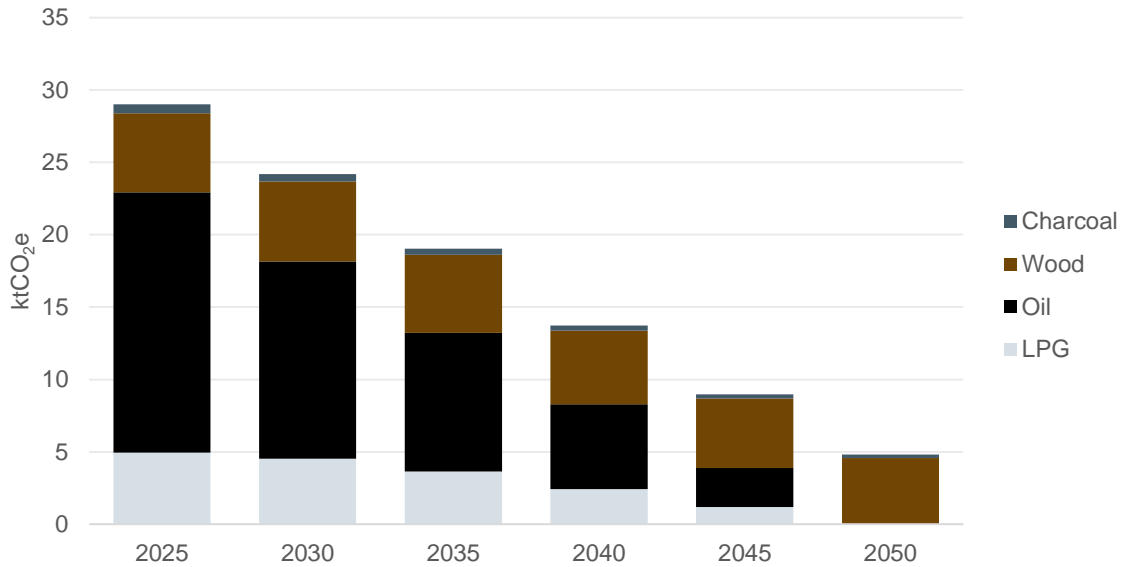
Investment need	<ul style="list-style-type: none"> The total investment cost of implementing the BRS is estimated to be between € 66 million and € 100 million per year over 25 years, corresponding to total cost of € 1.6 billion to € 2.5 billion.
Energy and climate change dimension	<ul style="list-style-type: none"> Implementation of the BRS will reduce direct GHG emissions by facilitating fuel switching from fossil fuel combustion within buildings to electricity. Energy efficiency improvements will reduce emissions indirectly by reducing total final energy demand from the buildings sector.
Governance dimension	<ul style="list-style-type: none"> Implementation of the BRS will be led by the Ministry of Energy and Mines. Close coordination with local municipalities, who will be responsible for any public buildings, will be necessary. The Eco Fund will be responsible for management of funds allocated for use as grants to support BRS implementation.
Social dimension	<ul style="list-style-type: none"> The BRS can have a strong social impact by improving living conditions within homes, and potentially helping to alleviate houses suffering from energy poverty. The alleviation of energy poverty while managing the energy transition process is a core pillar to a just transition by ensuring decarbonisation actions do not exacerbate inequalities and lower living standards for low income households. Switching away from direct combustion of fuels within the home can have significant health impacts by improving indoor air quality.
International dimension	<ul style="list-style-type: none"> Implementation of a BRS is required under EU law. As a party to the Energy Community, Montenegro has committed to adopt the EU energy Acquis.

2.4.4 Emission reduction targets

Implementation of the BRS can lead to a 92% reduction in GHG emissions from the buildings sector, including a complete phase out of direct combustion of fossil fuels. Residual emissions come from ongoing use of biomass fuel sources, wood and charcoal.

Complete phaseout of biomass sources may be difficult both for technical and social reasons in rural communities. However, use of high efficiency wood stoves and reducing harvesting and improved management of forests used as a source of biomass feedstock can help to minimise the environmental impacts of use.

Figure 21 Forecast buildings emissions by fuel in LCDS scenario

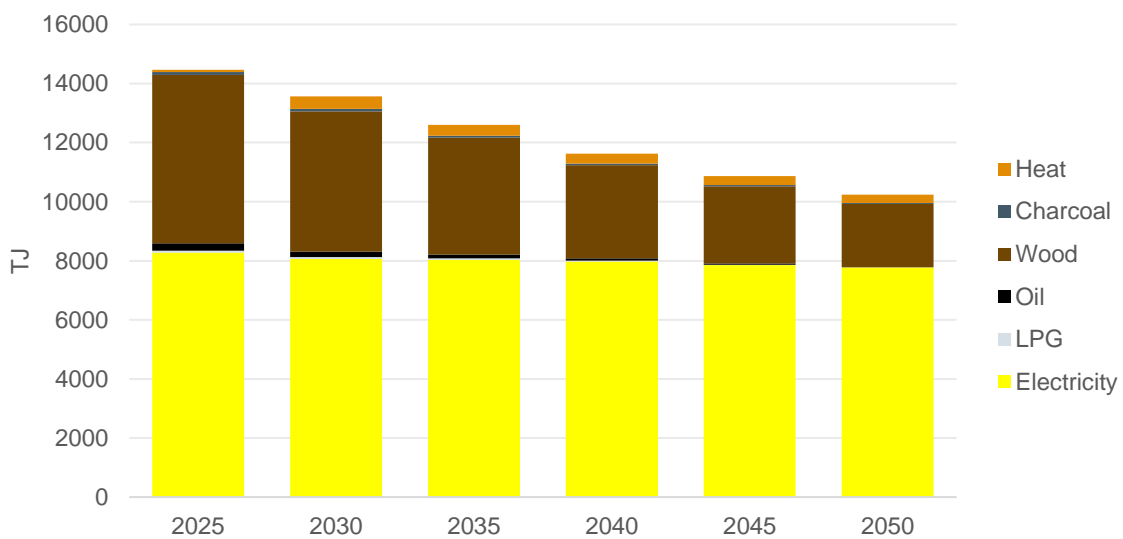


Source: Economic Consulting Associates based on NECP data.

Despite significant fuel switching to electricity in the period to 2050, total electricity consumption marginally falls as a result of improvements in energy efficiency (driven predominantly by heat pump installation) offsetting increased uptake of electricity. Use of wood and charcoal fall over time due to a combination of fuel switching and energy efficiency improvements.

After the ecological reconstruction of TPP Pljevlja, heating in Pljevlja town is provided by district heating (included in Figure 22 as heat). Heat will initially be supplied by TPP Pljevlja before switching to biomass once the TPP Pljevlja retires.

Figure 22 Forecast fuel use in the buildings sector in LCDS scenario



Source: Economic Consulting Associates based on NECP data.

2.4.5 Sectoral SWOT

Renovation of buildings to improve energy efficiency and reduce direct combustion of fuels can deliver benefits to building owners, users, and society. While renovation will deliver long terms cost savings, upfront cost will be high. Financial, regulatory, and technical support will be needed to ensure full delivery of the BRS.

Table 9 Strengths, weaknesses, opportunities, and threats of buildings decarbonisation in Montenegro.

Strengths	Weaknesses
<ul style="list-style-type: none"> Improved energy efficiency is likely to deliver long-term reduction in energy cost for households and businesses. 	<ul style="list-style-type: none"> Upfront investment cost of energy efficiency investments and building renovation is high. Low-income households may be unable to make these investments. Improvement to the building stock can provide significant disruption to residents.
Opportunities	Threats
<ul style="list-style-type: none"> Reduced energy demand from energy efficiency, and reduced reliance of imported fossil fuels, can improve energy security. Building renovation will increase the asset value of buildings. Improved energy efficiency can directly address the societal problem of energy poverty. Reduced direct combustion of biomass and fossil fuels in the home can improve health outcomes. Innovative financial models can help low-income households access benefits from increased energy efficiency. 	<ul style="list-style-type: none"> Uptake of energy efficiency and building renovation needs active engagement from households, communication of the benefits will be essential. Limited supply of skilled installers of energy efficiency solutions may slow or inhibit progress.

2.5 Non-energy | Industrial processes and product use (IPPU)

2.5.1 Description and context

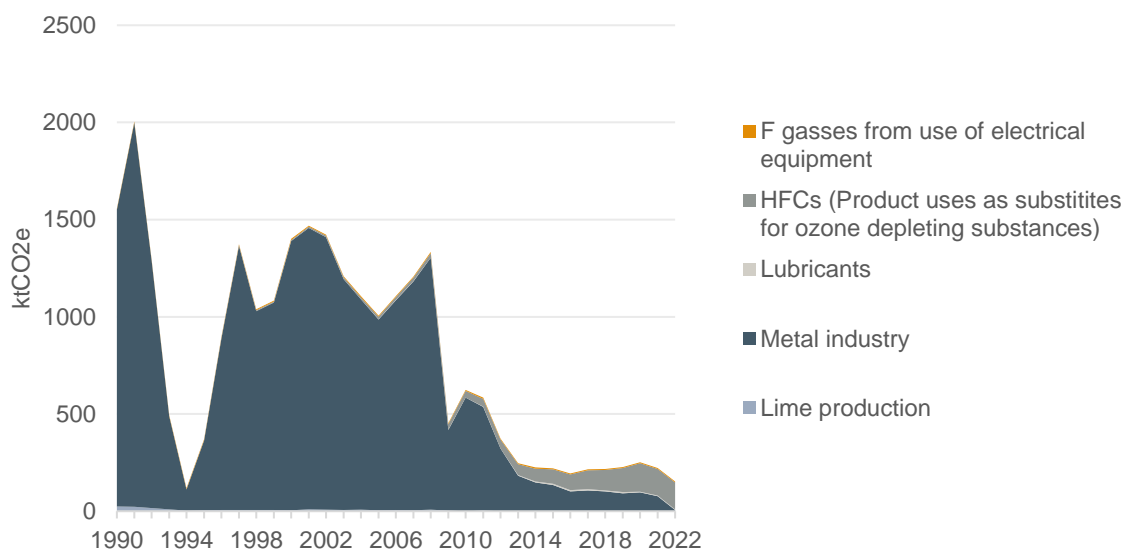
IPPU contributed 4.5% of total GHG emissions in 2022. Emissions from hydrofluorocarbons (HFCs) make up the dominant share of IPPU GHG emissions. Use of HFCs has grown significantly since 2005 due to increasing use of refrigeration, air conditioning, and fire protection. PAMs addressing IPPU emissions included in the LCDS therefore focus on the phase down of HFCs.

Historically, IPPU emissions have been significantly higher than current levels with the majority coming from the metals industry. However, with the steel plant not currently operating and the aluminium plant is not operating primary production of aluminium, IPPU emissions from this

sector have fallen. In 2022 IPPU emissions from the metals industry were just 0.2% of total emissions.

Lubricants used in machinery and transport and F gases from use of electrical equipment make up a minor share of IPPU emissions. Lime production had previously contributed a minor share IPPU emissions, however since 2011 domestic production has stopped and all lime is now imported into Montenegro.

Figure 23 Historic emissions from IPPU



Source: Environmental Protection Agency of Montenegro. 2024. [National Inventory Document 2024 of Montenegro](#).

2.5.2 Strategy and planning documents

Montenegro has prepared the *Proposal Plan for the Implementation of the Kigali Amendment (Phase I) for Montenegro*. The purpose of the plan is to establish a comprehensive strategy for implementation of the Kigali Amendment to the Montreal protocol to reduce the use of HFC substances in the period 2024-2029. The plan outlines specific actions to be undertaken, including associated budget requirements, in this first phase to achieve the targeted 10% reduction in HFC emissions by 2029.

The document also outlines the long-term strategy for the reduction of HFC substances, through breaking the time to 2050 into four phases. Each of these phases has a specific reduction target towards the final objective of reducing use of HFCs by 80% by 2040, these targets are presented in Table 10 below. It is expected that a detail plan for each phase will be prepared in advance of that phase beginning.

Table 10 Emissions reduction targets by Phase for implementation of the Kigali Amendment

Phase	Phase I	Phase II	Phase III	Phase IV
Time period	January 1, 2024 to December 31, 2029 (six years)	January 1, 2030 to December 31, 2035 (six years)	January 1, 2036 to December 31, 2040	January 2041 to December 31, 2045 (five years)
Reduction target	10% reduction by 2029	30% reduction by 2035	50% reduction by 2040	80% reduction by 2045

Source: Environmental Protection Agency Montenegro. Proposal Plan for the Implementation of the Kigali Amendment (Phase I) for Montenegro (2024-2029).

2.5.3 Policy measures

NECP PAMs.

Montenegro has adopted the Law Acknowledging Amendments to the Montreal Protocol on Substances that Deplete the Ozone Layer, which sets a legal requirement for Montenegro to meet the target set in the Kigali Amendment of achieving an 80% reduction in HFC use and therefore associated emissions by 2045. The NECP includes a measure to develop a plan for achieving this target. This plan has been prepared, including detailed actions for Phase I covering the period 2024 to 2029.

Reduction of HFCs in line with the Law Acknowledging Amendments to the Montreal Protocol on Substances that Deplete the Ozone Layer.

NECP scenario	WEM scenario
Description	Development of a plan in line with the requirements of the Law Acknowledging Amendments to the Montreal Protocol on Substances that Deplete the Ozone Layer.
Actions for delivery	<ul style="list-style-type: none"> • Development of a plan for the reduction of the consumption of HFC substances. This plan has already been developed for Phase I, as outlined above. • Allocation of financial resources for plan implementation.
Relevance for the LCDS	Phases II, III and IV of the plan for reduction of HFCs will be implemented in throughout the LCDS timeline.

LCDS PAMs.

Montenegro has already introduced a legal requirement to meet the requirements of the Kigali Amendment to the Montreal Protocol, and has prepared a plan for the first phase of meeting these requirements. As such, the LCDS seeks to continue this process by including the need to prepare equivalent strategies for subsequent phases for HFC reduction, and allocation of funds to support delivery of these plans as necessary.

Industrial processes and product use LCDS PAM IPPU.1: Development and implementation of plans for Phases II, III and IV for reduction of HFC use in line with the Kigali Amendment.

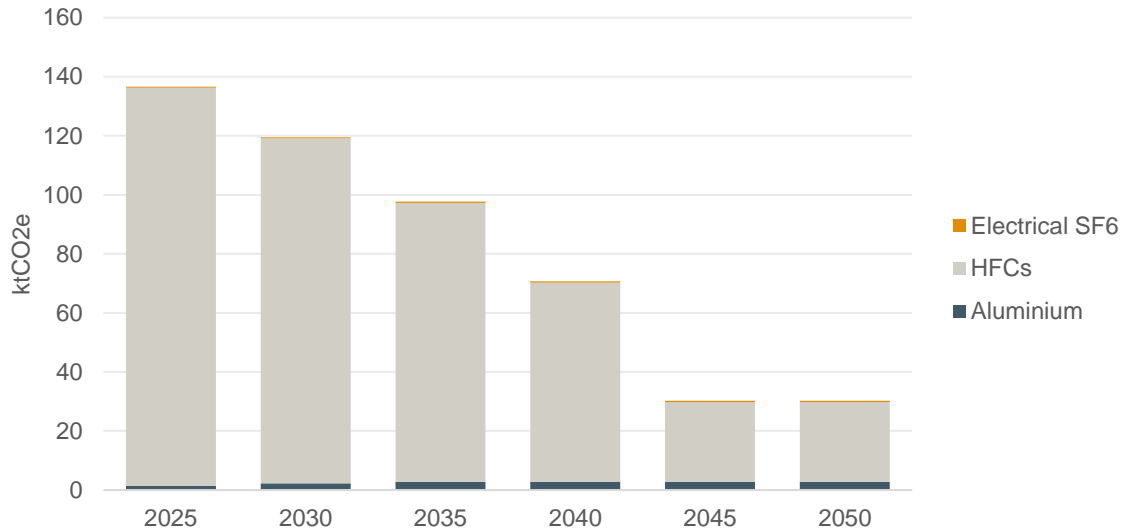
Description	Development of plans for Phases II, III, IV of implementation of the Kigali agreement.
Actions for delivery	<ul style="list-style-type: none"> • Develop and public a plan for Phases II, III, IV in the year preceding each phase. • Identify and allocate funding to be used in support of implementing the plan.
Included in existing strategy	<ul style="list-style-type: none"> • Development of these plans is foreseen in the initial plan for reduction of HFCs developed for Phase I (2024 to 2029).
Investment need	<ul style="list-style-type: none"> • Per the Phase I plan, the majority of investment is expected to be undertaken by the private sector when replacing HFC emitting equipment and therefore the need for public sector investment is expected to be minimal. • Funding for Phase I has been allocated for various technical and regulatory activities with total budget €189,600, expected to be supported by the United National Industrial Development Organisation (UNIDO).
Energy and climate change dimension	<ul style="list-style-type: none"> • Phase down in the consumption of HFCs is expected to see a proportional phase down in HFC emissions.
Governance dimension	<ul style="list-style-type: none"> • Development of plans for the reduction of HFCs is expected to be led by the Montenegro Environment Protection Agency.
Social dimension	<ul style="list-style-type: none"> • Uptake of HFC free technologies will be public sector lead. If global adoption of new technologies lags expected rates, there is a risk of high costs.
International dimension	<ul style="list-style-type: none"> • The PAM is in line with Montenegro's commitments to the Kigali Amendment to the Montreal Protocol.

2.5.4 Emission reduction targets

Implementation of the NECP and LCDS PAMs leads to IPPU emissions falling by 80% by 2050 relative to 2022 levels. As well as the residual 20% of HFC emissions in line with Kigali Agreement requirements, a small amount of fluorocarbon emissions from electricity network components and from aluminium production remain.

In the process of preparing plans for each phase in the process of implementing the Kigali Agreement, assessment should be made of the potential to strengthen ambition in reduction of HFCs beyond 2045. Similarly, if technologies become available to fully eliminate IPPU from electricity networks and aluminium production then a plan should be made to adopt these technologies.

Figure 24 Forecast IPPU emissions by source in LCDS scenario



Source: Economic Consulting Associates based on NECP data.

2.5.5 Sectoral SWOT

Montenegro is listed as an Article 5 country in the Kigali Amendment⁵², and is therefore eligible for international funding and technical support for implementation. Leveraging this support can help address possible weaknesses and threats associated with skills shortages and costs to consumers.

Table 11 Strengths, weaknesses, opportunities, and threats for IPPU emissions reduction in Montenegro.

Strengths	Weaknesses
<ul style="list-style-type: none"> As an Article 5 country under the Kigali agreement, Montenegro is eligible for international funding and technical support for implementation. Can leverage simultaneous uptake of technologies across the EU to help achieve economies of scale and reduce costs. 	<ul style="list-style-type: none"> There may be a skills shortage of skilled installers and technicians.
Opportunities	Threats
<ul style="list-style-type: none"> Transitioning to modern cooling systems can help improve energy efficiency, creating synergies with emissions reduction strategies for the buildings and industrial sectors. 	<ul style="list-style-type: none"> Investment is expected to be private sector lead, which may impose an undue cost burden on households and businesses.

⁵² United Nations. 2016. [Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer](#).

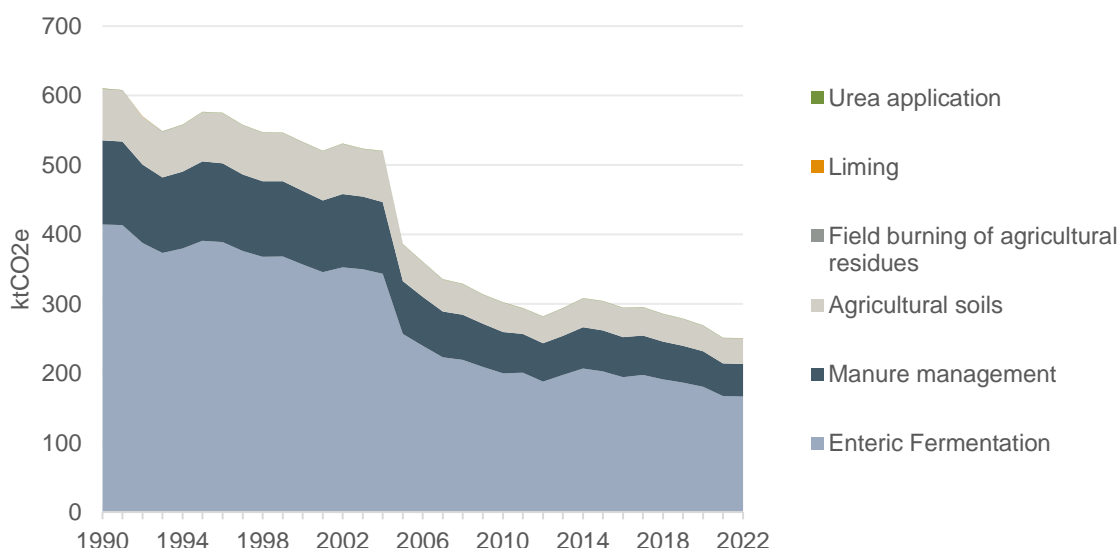
2.6 Non-energy | Agriculture

2.6.1 Description and context

Agricultural emissions are relatively large in Montenegro, contributing approximately 14.4% of total emissions in 2022. Enteric fermentation from ruminant livestock is the largest source of agricultural emissions, accounting for 66% in 2022. Agricultural soils and manure management accounted for 19% and 16% respectively. Liming, urea application, and burning of agricultural residues all account for very small shares.

Across the period 1990 to 2022 agricultural emissions have steadily fallen due to ongoing decline in the number of cattle and sheep, driven by outward migration from agricultural regions. The significant dip in emissions in 2005 is due to a change in statistical methods for estimating livestock numbers, and therefore may not fully reflect reality.

Figure 25 Historic emissions from agriculture



Source: Environmental Protection Agency of Montenegro. 2024. [National Inventory Document 2024 of Montenegro](#).

2.6.2 Strategy and planning documents

Montenegro has prepared the Strategy for the Development of Agriculture and Rural Areas 2023-2028, with the purpose of outlining direction for development of agricultural and rural areas and sustainably managing agricultural resources and the environment.

The strategy notes that agriculture is a notable source of methane and nitrogen suboxide from livestock and use of fertilisers. Priorities listed in the strategy related to the management of these issues include:

- Promotion of organic agriculture (reducing the negative impact of agriculture on the environment, preserving biodiversity, enhancing the quality of agricultural products, and contributing to affirming Montenegro as an ecological state).

- Support to investments concerning manure management.

These priorities are aligned with the PAMs included in the NCEP.

2.6.3 Policy measures

NECP PAMs.

The draft NECP includes two PAMs for agricultural emissions, each aligned with priorities included in the Strategy for the Development of Agriculture and Rural Areas.

Support for organic agricultural production.

NECP scenario	WAM scenario
Description	Reduce usage of synthetic fertiliser by 20% to reduce associated emissions in N ₂ O.
Actions for delivery	<ul style="list-style-type: none"> • Financial support is offered to producers following organic production processes according to the Organic Production Act. • Certification procedures for production of organic products have been introduced.
Relevance for the LCDS	While the LCDS does not have specific recommendations for additional mitigation action in the agricultural sectors, it is recommended that the measures included in the NECP continue to be promoted.

Support to manure management.

NECP scenario	WAM scenario
Description	Improvement in cattle manure management systems leading to a reduction in N ₂ O emissions.
Actions for delivery	<ul style="list-style-type: none"> • Financial support for constructure and/or reconstruction of facilities for storing manure and/or reconstruction of facilities (basins) for storing manure or the procurement of specialised manure tanks.
Relevance for the LCDS	While the LCDS does not have specific recommendations for additional mitigation action in the agricultural sectors, it is recommended that the measures included in the NECP continue to be promoted.

LCDS PAMs.

Deep decarbonisation of the agricultural sector remains difficult, with limited technological options for reduction in emissions from in particular enteric fermentation. As such, no specific actions for further emissions reductions actions in the agricultural sector are included in the LCDS at this time. Montenegro should however adopt appropriate mitigation measures as and when they become available. As such, responsibility should be allocated within the Ministry of Agriculture, Forestry and Water Management to monitor developments in agricultural mitigation technologies, and plan to adopt those considered relevant to Montenegro.

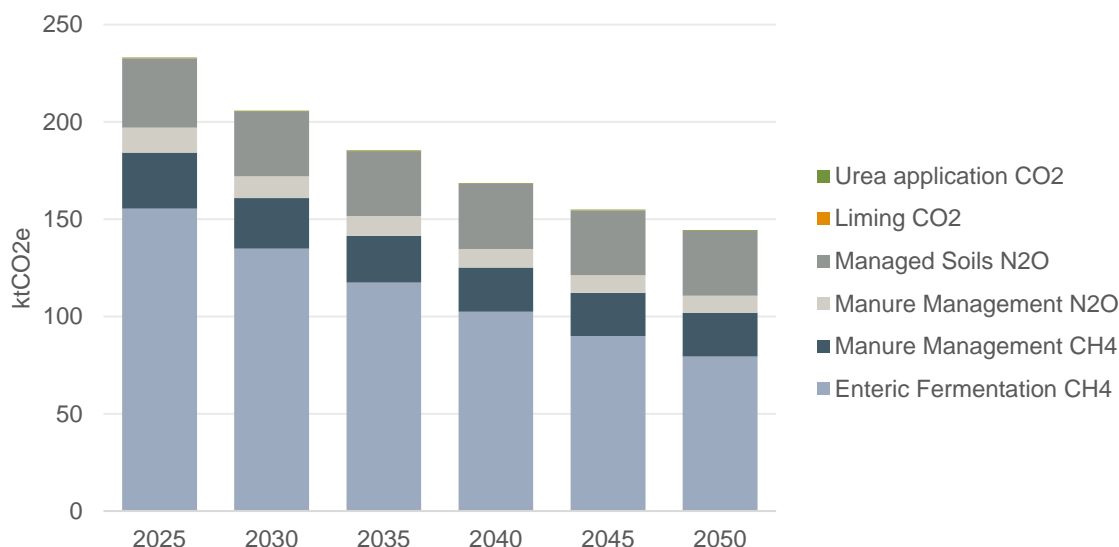
Agriculture LCDS PAM AG1: Assignment of responsibility within the Ministry of Agriculture, Forestry and Water Management to monitor international developments in agricultural mitigation technologies.

Description	Ongoing monitoring of international developments in agricultural mitigation technologies to identify options for Montenegro as they become available.
Actions for delivery	<ul style="list-style-type: none"> • Establish a working group within the Ministry with responsibility for monitoring. • If appropriate mitigation actions are identified, undertake a detailed assessment of potential in Montenegro, including pilot projects; and proposed options for promotion of these actions.
Included in existing strategy	<ul style="list-style-type: none"> • This measure seeks to build on existing measures outlined in the NECP.
Investment need	<ul style="list-style-type: none"> • Investment need should be assessed in any detailed assessment of mitigation actions.
Energy and climate change dimension	<ul style="list-style-type: none"> • Ongoing identification of potential mitigation measures.
Governance dimension	<ul style="list-style-type: none"> • Development of plans for the reduction of HFCs is expected to be led by the Montenegro Environment Protection Agency.
Social dimension	<ul style="list-style-type: none"> • Detailed assessment of potential mitigation measures should include identification of any social risks or benefits.
International dimension	<ul style="list-style-type: none"> • This measure aims to leverage international experience by identifying mitigation practices as they become adopted in other countries. Focus areas for monitoring should include the EU, other Balkan countries, and agricultural based economies investing in agricultural mitigation research and development (eg New Zealand).

2.6.4 Emission reduction targets

Despite no mitigation measures being identified in addition to those included in the NECP, agriculture emissions fall by 43% in the LCDS scenario by 2050 relative to 2022. Emissions reductions are driven by a combination of measures implemented to improve manure management and reduce use of synthetic fertilisers, and because of assumed reductions in the total stock of ruminant animals. Forecast decline in stock numbers is based off historical trends, largely driven by migration of people away from rural areas in Montenegro.

Figure 26 Forecast agriculture emissions by source in LCDS scenario



Source: Economic Consulting Associates based on NECP data.

2.6.5 Sectoral SWOT

Progress in emissions reductions through declining ruminant livestock numbers is both a strength and a weakness, enabling reductions with minimal direct interventions but having consequences for agricultural livelihoods and food supply. Promotion of organic practices could however be part of a strategy to offset reduced output from livestock by creating new product opportunities.

Table 12 Strengths, weaknesses, opportunities, and threats for agricultural emissions reduction in Montenegro.

Strengths	Weaknesses
<ul style="list-style-type: none"> Despite minimal intervention measures, agricultural emissions are expected to see significant reductions. 	<ul style="list-style-type: none"> At present, reduction of emissions from enteric fermentation is largely only possible through reduced stock numbers. Reduced stock numbers, and resulting reduced agricultural production, can have adverse impacts on agricultural livelihoods and food supply in Montenegro.
Opportunities	Threats
<ul style="list-style-type: none"> Adoption of organic processes can enable production of premium organic products for export. 	<ul style="list-style-type: none"> Strategy is heavily reliant on research and development internationally to enable long-term decarbonisation.

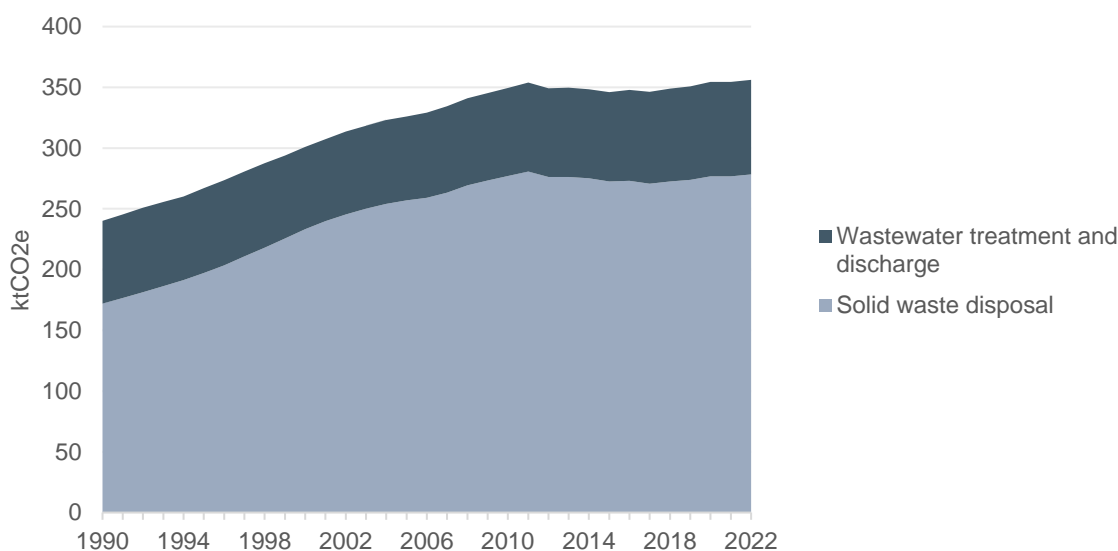
2.7 Non-energy | Waste

2.7.1 Description and context

Waste sector emissions contributed 10.3% of total emissions in 2022. 78% of waste emissions come from solid waste disposal, with the remaining 22% coming from wastewater treatment and discharge.

Emissions from solid waste disposal have grown consistently from 1990 to 2022 due to growth in waste generation rates. Emissions from wastewater have increased, due to increased proportion of the population being connected to sewerage systems and increased protein in diets, but at a slower rate than from solid waste.

Figure 27 Historic emissions from waste



Source: Environmental Protection Agency of Montenegro. 2024. [National Inventory Document 2024 of Montenegro](#).

2.7.2 Strategy and planning documents

Key planning documents for the improvement of the waste sector in Montenegro are:

- The State Waste Management Plan for the Period 2025-2029.
- The Spatial Plan for Montenegro to 2040.

The State Waste Management Plan for the Period 2025-2029.

The State Waste Management Plan for the Period 2025-2029 (DPUO 2025-2029) outlines a strategic plan for sustainable waste management in Montenegro. The strategy outlines targets for increased separation of recycling and separation, including and most importantly for GHG

emissions from the sector, targets for reducing the amount of biodegradable waste deposited in landfill. Key overarching targets related to organic waste and waste separation are:

- The amount of organic waste in solid waste is to reduce by 20%, 50% and 65% relative to 2010 by 2025, 2025, and 2033 respectively.
- 45%, 72% and 100% of remaining waste is to be processed before disposal by 2025, 2029, and 2033 respectively.

Planned actions to achieve these targets include modernisation of the waste collection and transport system, reorganisation of collection service areas, improvement of collection route plans, development of a network of transfer stations, development of a network of recycling centres, and improving separate collection of waste organic oils and fats.

The Spatial Plan for Montenegro to 2040.

Development of the waste sector for the period to 2040 is outlined in the Spatial Plan for Montenegro to 2040. Planned development is focused on alignment with EU legislation on waste management.

It is planned for existing landfills in Bar (Možura) and Podgorica (Livade) to be improved, and for two further regional waste management centres to be developed in Nikšić and Bijelo Polje. For the existing landfills, planned improvements include:

- Capacity expansion.
- Development of power generation utilising land fill gas.
- Construction of a leachate treatment plant for at Bar.
- Construction of a composting centre.
- Construction of a centre for correct processing of waste tyres.

All municipalities are to be required to develop recycling yards, including the development of several regional waste management centres. This is anticipated to be lead at the municipality level.

With regards to wastewater, four plants for incineration of residual sewage sludge are planned. These plants will be capable of producing electricity and hot water as a by-product.

2.7.3 Policy measures

NECP PAMs.

The NECP outlines a comprehensive package of measures for reduction of emissions in the waste sector.

Reduction of bio-waste in municipal waste.

NECP scenario	WEM scenario.
Description	Increase separation of collection of solid waste to decrease the amount of organic waste being disposed in landfills, with the target to reduce the volume of organic waste in solid waste by 75% by 2033. This PAM represents an enhancement of the targets set in the DPUO 2025-2029.
Actions for delivery	<ul style="list-style-type: none"> • Implementing a section of primary separation (separate bins for dry and wet waste). • Developing a network of waste collection in rural areas. • Construction of recycling yards in municipalities. • Educational and awareness raising activities.
Relevance for the LCDS	LCDS focuses on implementation of NECP PAMs for the waste sector.

Increase of connection rate to sewerage system.

NECP scenario	WEM scenario
Description	Reducing emissions from waste water by through increasing connection to the sewerage system and reduce the number of septic tanks.
Actions for delivery	<ul style="list-style-type: none"> • Design of expanded sewerage network. • Tendering for equipment and construction works. • Monitoring of implementation.
Relevance for the LCDS	LCDS focuses on implementation of NECP PAMs for the waste sector.

Increase of CH₄ recovery in landfills.

NECP scenario	WAM scenario
Description	Increase CH ₄ recovery with the objective to use recovered gas to generate electricity, targeting 2 MW of generation capacity from recovered gas by 2030.
Actions for delivery	<ul style="list-style-type: none"> • Prepare a study on feasibility of gas extraction from all landfills in Montenegro. • Prepare inception designs for CH₄ recovery systems and corresponding electricity generators. • Tendering for equipment and construction works. • Monitoring of implementation.
Relevance for the LCDS	LCDS focuses on implementation of NECP PAMs for the waste sector.

LCDS PAMs.

PAMs outlined in the NECP are ambitious and are likely to require significant allocation of public financial resources. Waste mitigation in the LCDS therefore focuses on implementation of these PAMs. As shown in Section 2.7.4, the PAMs achieve significant emissions reduction from the waste sector.

Full decarbonisation of the waste sector is likely to rely on technological improvement and improvement of other processes, and Montenegro should seek to adopt new technologies and processes as they become feasible. As such, responsibility should be allocated within the Ministry of Ecology, Sustainable Development and Northern Development to monitor developments in waste management technology and processes, and plan to adopt those considered relevant to Montenegro. Focus should be placed on progress in this area made in the EU.

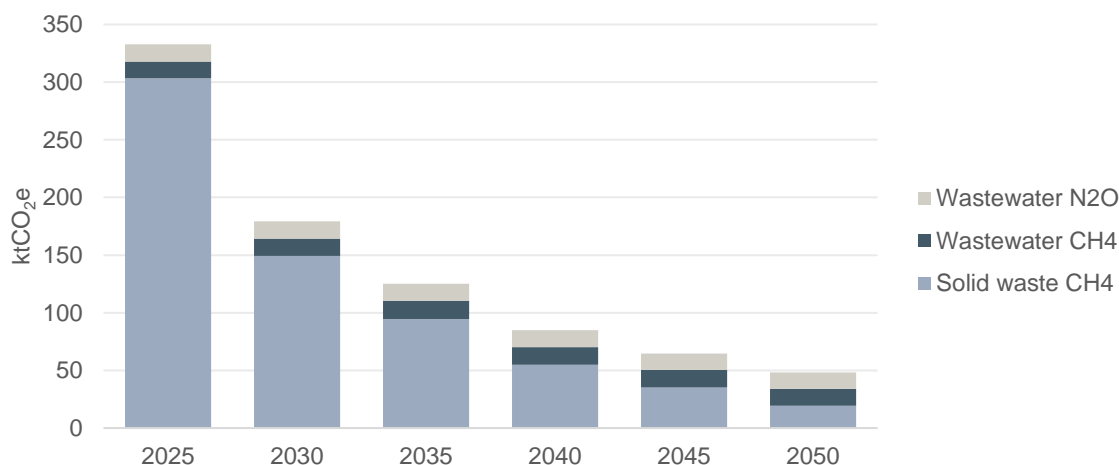
Waste LCDS PAM W1: Assignment of responsibility within the Ministry of Ecology, Sustainable Development and Northern Development to monitor international developments in waste management technologies and processes.

Description	Ongoing monitoring of international developments in improvements in waste management technologies and to identify options for Montenegro as they become available.
Actions for delivery	<ul style="list-style-type: none"> • Establish a working group within the Ministry with responsibility for monitoring. • If appropriate technologies and processes are identified, undertake a detailed assessment of potential in Montenegro, including pilot projects; and proposed options for promotion of these actions.
Included in existing strategy	<ul style="list-style-type: none"> • This measure seeks to build on existing measures outlined in the NECP.
Investment need	<ul style="list-style-type: none"> • Investment need should be assessed in any detailed assessment of mitigation actions.
Energy and climate change dimension	<ul style="list-style-type: none"> • Ongoing identification of potential mitigation measures.
Governance dimension	<ul style="list-style-type: none"> • Assessment of waste management technologies and processes is expected to be led by the Ministry of Ecology, Sustainable Development and Northern Development.
Social dimension	<ul style="list-style-type: none"> • Detailed assessment of potential mitigation measures should include identification of any social risks or benefits.
International dimension	<ul style="list-style-type: none"> • This measure aims to leverage international experience by identifying mitigation practices as they become adopted in other countries. Focus areas for monitoring should include the EU, and best practice waste management examples such as Vienna, Bogota, or San Francisco.

2.7.4 Emission reduction targets

Implementation of the NECP PAMs can lead to emissions from the waste sector falling by 86% by 2050. The majority of emissions reduction comes from the solid-waste subsector, where a combination of reduced organic waste in landfills and methane capture can drive reductions in methane emissions.

Figure 28 Forecast waste emissions by source in LCDS scenario



Source: Economic Consulting Associates based on NECP data.

2.7.5 Sectoral SWOT

Montenegro has a strong advantage in waste sector improvement being located beside the EU where planned measures, while nascent in Montenegro, have already proliferated. Montenegro should leverage knowledge and experience in EU neighbours to facilitate efficient implementation.

Table 13 Strengths, weaknesses, opportunities, and threats for waste sector emissions reduction in Montenegro.

Strengths	Weaknesses
<ul style="list-style-type: none"> While nascent in Montenegro, organic separation and methane capture are mature and proven in the EU. Methane capture with power cogeneration has strong synergies with power system decarbonisation. 	<ul style="list-style-type: none"> Reducing the volume of organic waste in landfills is reliant on public engagement and participation in waste separation. Education and awareness building will be needed to support this. Investment cost of new waste infrastructure is large.
Opportunities	Threats
<ul style="list-style-type: none"> New jobs will be created in the waste management sector. Increased connection to the sewerage network is likely to improve public health outcomes. 	<ul style="list-style-type: none"> If use of landfills becomes too difficult, there is a risk of increased illegal dumping.

2.8 Non-energy | land use, land use change, and forestry (LULUCF)

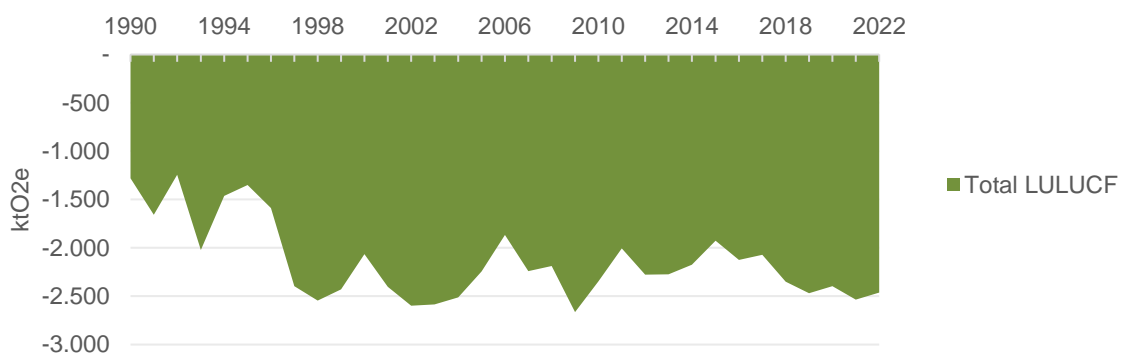
2.8.1 Description and context

The LULUCF sector in Montenegro provides a significant carbon sink, yielding net negative emissions of 2,462.58 ktCO₂e in 2022. The sector is dominated by CO₂ absorptions from forest land, which dominate emissions from other sub-sectors. Harvested wood products also contribute a small amount of negative emissions.

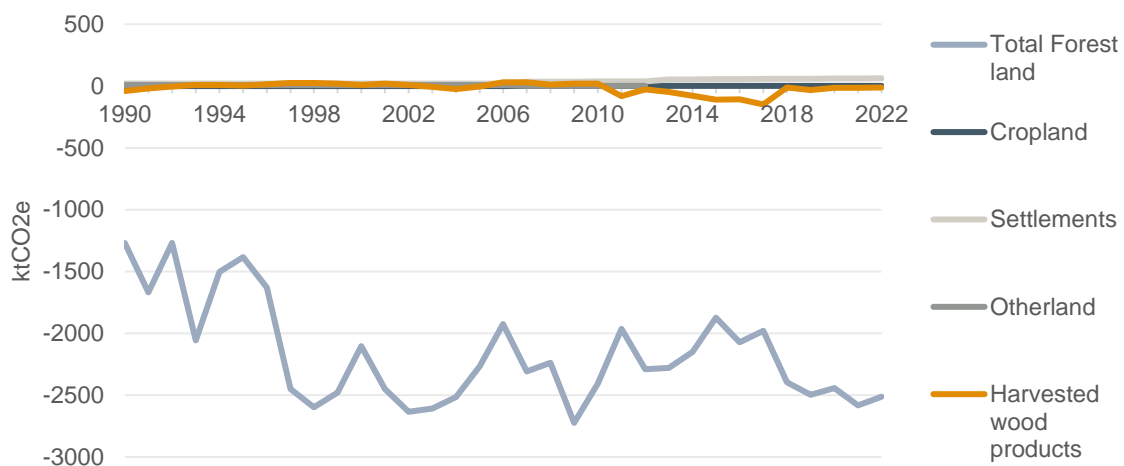
Forests cover approximately 70% of Montenegro’s land area, with the total area of forest land remaining approximately stable since 1990. Land use generally is stable in Montenegro, with typically limited land use change exhibited across all land use categories year to year. Annual variations in the scale of absorptions from the forestry sector are due to variations in timber harvest and the area of land affected by forest fires.

Figure 29 Historic emissions from land use land use change and forestry

Total LULUCF emissions



LULUCF emissions by sub-sector



Source: Environmental Protection Agency of Montenegro. 2024. [National Inventory Document 2024 of Montenegro](#).

2.8.2 Strategy and planning documents

The key sectoral planning document for the forestry sector is the Forest Development Strategy of Montenegro 2023-2028. Of most relevance to increasing the scale of the forestry emissions sink, the strategy outlines three strategic and operational objectives for sustainable forest management, these are:

- Improving the existing state of forests.
- Increasing the level of forestation.
- Combating the reduction of forest cover and forest degradation at the regional level.

In addition, objectives focusing on adaptation and resilience to climate change include forest fire prevention, which will increase the average annual level of the forest sink by reducing the expected area affected by forest fires.

The above objectives, and actions specified, are broadly aligned with PAMs included in the NECP aimed at enhancing the forest sink.

2.8.3 Policy measures

NECP PAMs.

The NECP includes two measures aimed at increasing emissions absorptions from the LULUCF sector.

Reduction in the area annually affected by wildfires.

NECP scenario	WAM scenario.
Description	Undertake actions to reduce the area of forest burnt annual in forest fires.
Actions for delivery	<ul style="list-style-type: none"> • Preservation of open areas between forests and support meadow mowing. • Improving the organisation of institutions involved in forest fire fighting. • Investments in equipment and preventative measures in prevention and fire fighting. • Development and testing of rehabilitation methods for fire burnt areas. • Exchange of experience and cooperation with institutions from the area.
Relevance for the LCDS	These measures will need to be undertaken on a continuous basis throughout the lifetime of the LCDS.

Further increases in the share of industrial round wood used for long-term products.

NECP scenario	WAM scenario.
Description	Increase the amount of harvested wood used for long-term products, reducing the share of harvested wood used for energy products.
Actions for delivery	<ul style="list-style-type: none"> • Restricting use of high-quality round wood for industrial purposes, targeting increasing the share of industrial round wood by 10% by 2030.
Relevance for the LCDS	Increased use of harvested wood used for long life products will be offset by reduced use of wood as a fuel as targeted in other sectors of the LCDS.

LCDS PAMs.

Additional PAMs included in the LCDS seek to further increase absorption from the LULUCF sector, as well as considering improvements to Montenegro's monitoring, reporting, and verification (MRV) framework.

LULUCF LCDS PAM LULUCF1: Conversion of coppice to high forests.

Description	Transition 1,690 hectares from coppice to high forest over the course of the strategy period, thereby augmenting biomass stocks.
Actions for delivery	<ul style="list-style-type: none"> • Identification of coppice areas to be converted. • Cost and implementation assessment of coppice areas to be converted. • Over the course of the five-year period, conversion of 388 hectares is assumed to be initiated annually. • Conversion is expected to take 10 years.

Included in existing strategy	<ul style="list-style-type: none"> The measure was identified in the World Bank PMI Study covering the potential for use of carbon crediting to support growth in the forest carbon sink.
Investment need	<ul style="list-style-type: none"> Investment cost will vary by location, and cost assessments should be undertaken for each site.
Energy and climate change dimension	<ul style="list-style-type: none"> Conversion of coppice to high forests will lead to an one off increase in the forest sink, with a small ongoing increase due to increased total carbon stock.
Governance dimension	<ul style="list-style-type: none"> Forest conversion will be led by the Forestry Department of the Ministry of Agriculture, Forestry and Water Management.
Social dimension	<ul style="list-style-type: none"> Care will need to be taken that coppice forests to be converted are not essential sources of heating fuel for households. Alignment with reduced use of biomass as a fuel as foreseen in the buildings sector can help manage this risk.
International dimension	<ul style="list-style-type: none"> This measure is in line with the EU forest strategy for 2030 which includes the objective to ensure forest restoration and reinforced sustainable forest management for climate adaptation and forest resilience.⁵³

LULUCF LCDS PAM LULUCF2: Consider inclusion of carbon removals from soils for Forst Land, Cropland and Grassland for the LULUCF sector.

Description	There may be additional potential to increase the overall carbon removals reported by the country by including additional carbon pools, especially in soils for Forest land, Cropland and Grassland, given that land use conversions are minor and the fact that these land accounting categories account for 86% of the overall country area. Uncertainty estimations and advanced MRV are required to monitor changes.
Actions for delivery	<ul style="list-style-type: none"> Detailed cost benefit assessment balancing the need for increased MRV against the potential benefits of increasing the forest sink in the national GHG inventory.
Included in existing strategy	<ul style="list-style-type: none"> This measure is a recommended action in the LULUCF GHG inventory review recently completed⁵⁴.
Investment need	<ul style="list-style-type: none"> Cost of advanced MRV should be estimated in the detailed cost benefit assessment.
Energy and climate change dimension	<ul style="list-style-type: none"> While this measure can increase reported emissions absorption, it will not directly contributed to increased physical absorption of emissions.
Governance dimension	<ul style="list-style-type: none"> Implementation should be managed by the Environmental Protection Agency as the entity responsible for the GHG emissions inventory.

⁵³ European Commission. [New EU forest strategy for 2030](#). Accessed: 24 June 2025.

⁵⁴ Gauss International Consulting. 2024. GHG emission projections up to 2030 and 2050, including mitigation measures necessary to reach the 55% target of GHG emission decrease and provide inputs for the update of the NDC relying on appropriate methodology.

Social dimension	<ul style="list-style-type: none"> • Correctly accounting for the environmental benefits of conservation measures can help encourage conservation leading to increased provision of ecosystem services for local communities.
International dimension	<ul style="list-style-type: none"> • Improvement of GHG reporting procedures can facilitate better alignment with international climate agreement.

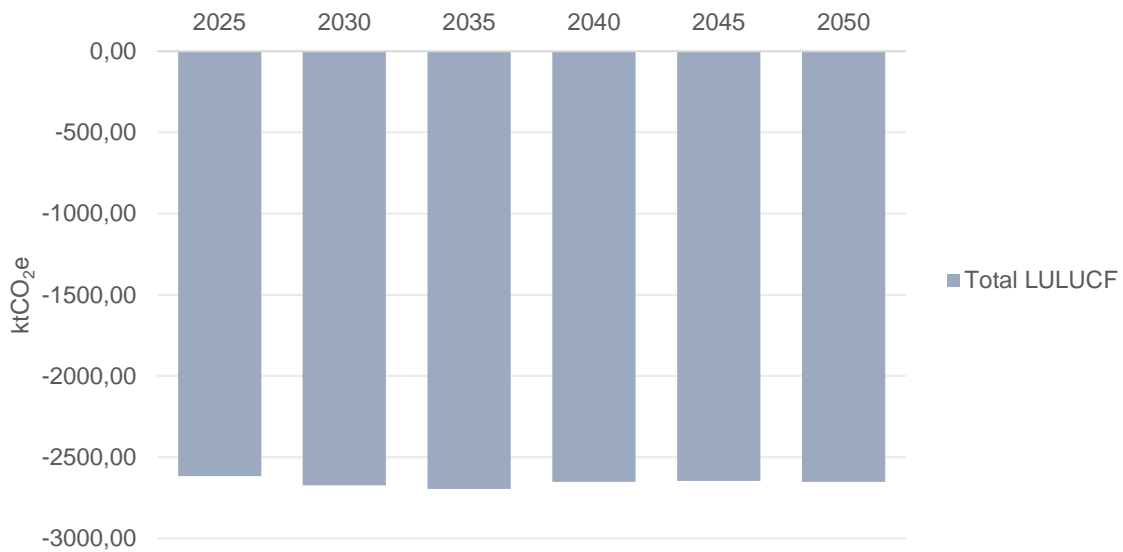
2.8.4 Emission reduction targets

Implementation of the NECP and LCDS PAMs lead to an increase in the average level of annual emissions absorptions from LULUCF. In the 10 years from to 2022, average absorptions were 2,278 ktCO₂e. After implementation of the NECP and LCDS, average absorptions are expected to increase to 2,551 ktCO₂e.

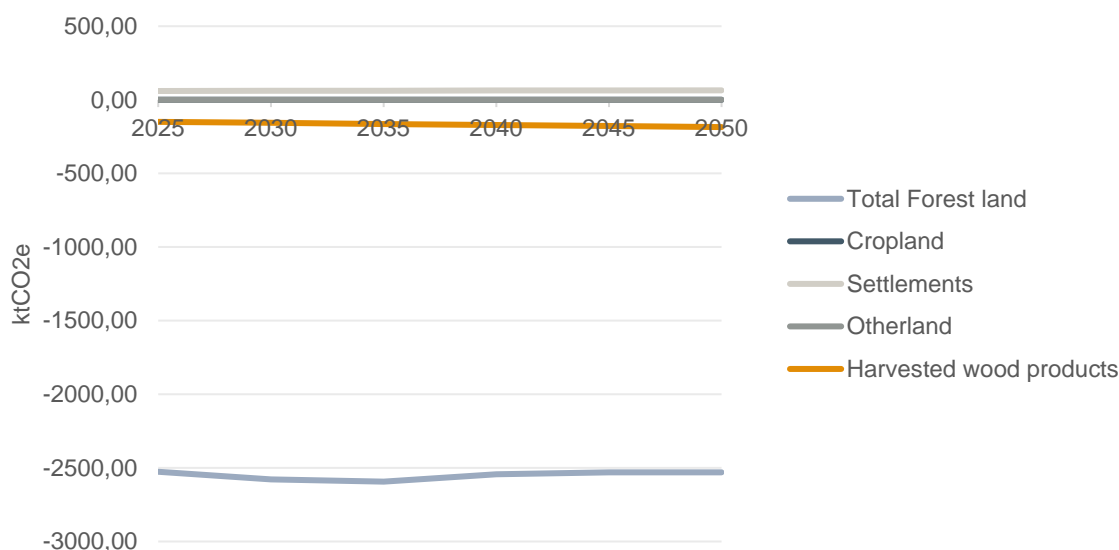
Reduced annual variation due to better management of forest fires is the main contributor to increased absorption. Slightly higher absorptions in the period 2030 to 2035 are because of increases in the carbon stock as coppice forests are converted to high forests through LCDS PAM LU2, in the long run the higher carbon stock resulting from this measure leads to a small increase in ongoing absorptions (9 ktCO₂e per year).

Figure 30 Forecast LULUCF emissions in LCDS scenario

Total LULUCF emissions



LULUCF emissions by sub-sector



Source: Economic Consulting Associates based on NECP data.

2.8.5 Sectoral SWOT

Montenegro has a strong natural advantage with forests providing a large carbon sink to offset emissions. However, the sector currently provides minimal contribution to gross domestic product (GDP) and therefore may have political difficulty in securing financial resources.

Table 14 Strengths, weaknesses, opportunities, and threats for LULUCF sector emissions reduction in Montenegro.

Strengths	Weaknesses
<ul style="list-style-type: none"> Improvement of the forest sink leverages Montenegro’s existing strengths as considering the high percentage of forest land cover. Abandoned agricultural lands are naturally reforesting, better management can increase the carbon storage from these lands. 	<ul style="list-style-type: none"> Despite the size of the forest sink, the sector contributes a very small amount to GDP and therefore may face difficulties securing financial resources.
Opportunities	Threats
<ul style="list-style-type: none"> Enhanced management of forests can create jobs in forest management, and potentially in tourism areas stimulated by the improved condition of the forests. 	<ul style="list-style-type: none"> Climate change is likely to lead to hotter and drier summers which could increase the frequency and severity of forest fires. There is significant difference in the quality of management of privately owned and publicly owned forests. Poor management of private forests represents a risk to implementation of forest management.

3 Aggregate emissions reduction achieved through the LCDS

3.1 Description of scenarios

The LCDS has been developed as a long-term enhancement of the NECP, and together the two documents provide three scenarios of low carbon development for Montenegro:

- The NECP WEM scenario (lowest ambition).
- The NECP WAM scenario (medium ambition).
- The LCDS scenario (highest ambition).

The LCDS scenario assumes all climate related PAMs outlined in the NECP are implemented. In addition, the LCDS defines further PAMs targeting reducing emissions from each of the major emitting sectors as close to zero as possible based on available and expected evolution of technologies.

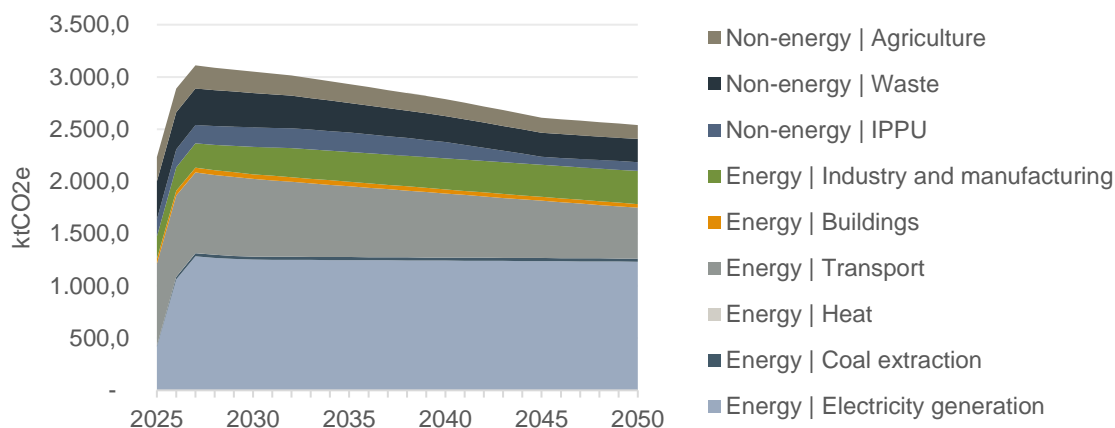
3.2 Forecast sectoral emissions by scenario

NECP WEM scenario.

The NECP WEM scenario does not include the retirement of TPP Pljevlja, and does not foresee sufficient capacity of new build renewable energy generation to reduce the utilisation of TPP Pljevlja by 2050. As a result, emissions from power generation are not reduced by 2050.

While emissions from transport, waste, agriculture, IPPU, and buildings all fall; progress is overall limited as PAMs targeting electrification are not implemented. Furthermore, emissions from energy use in industry and manufacturing increase in this scenario due to assumed growth in sectoral output.

Figure 31 Forecast emissions by sector in NECP WEM scenario.



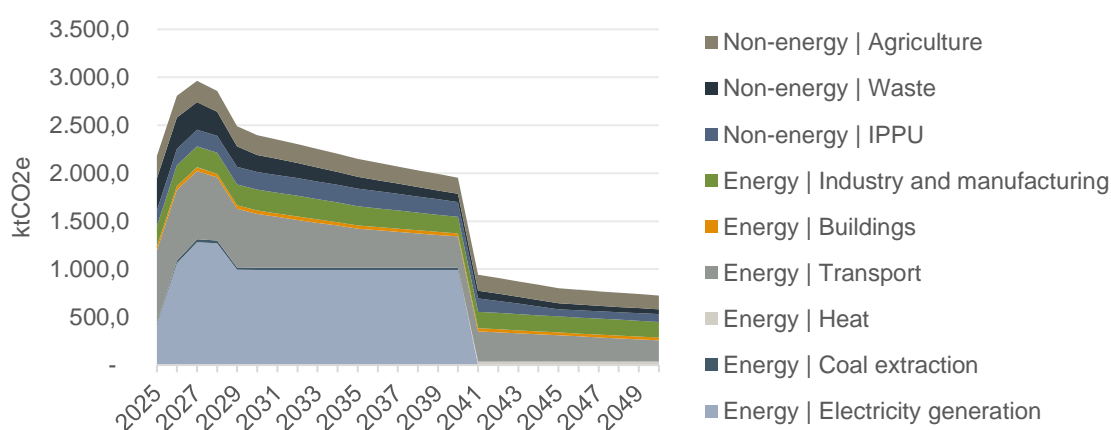
Source: Economic Consulting Associates based on NECP data.

NECP WAM scenario.

Meaningful additional PAMS implemented in the WAM scenario include significant additional uptake of renewable energy power generation, uptake of electric mobility and modal shifting in transport, electrification of machinery, and implementation of major improvements in waste management. The result of these measures is a significant reduction of total emissions relative to the WEM scenario.

A first wave of renewable energy generation capacity is expected to come online around 2029 in the WAM scenario, facilitating a fall in utilisation for TPP Pljevlja, and a resulting fall in resulting emissions. TPP Pljevlja is expected to come offline in 2041 in this scenario, leading to complete elimination of GHG emissions from the power generation sector.

Figure 32 Forecast emissions by sector in NECP WAM scenario.



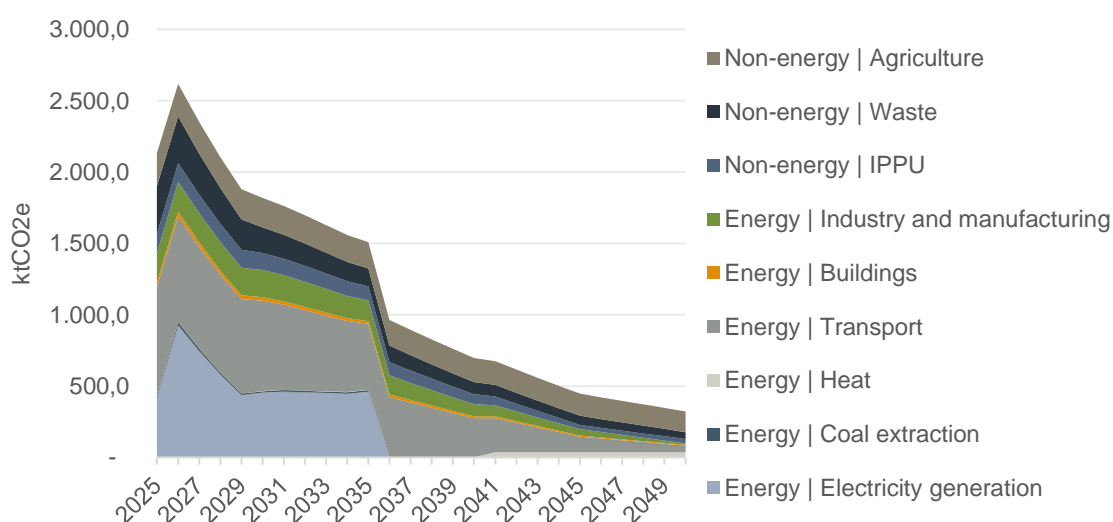
Source: Economic Consulting Associates based on NECP data.

LCDS scenario.

Compared to the NECP WAM scenario, the LCDS scenario sees additional installed renewable energy generation capacity coming online, increased ambition in the electrification of transport and industry, implementation of a comprehensive building renovation programme, and reduction of HFCs in line with the requirements of the Kigali Amendment to the Montreal Protocol. The cumulative effect of these PAMs is an accelerated reduction of emissions from non-power sector sources starting from 2030.

By 2050 in the LCDS scenario, total gross GHG emissions fall to 322 ktCO₂e, corresponding to 9% of reported 2022 emissions. Agriculture contributes by far the largest share of residual emissions, highlighting the important of implementation of Agriculture LCDS PAM AG1 which assigns responsibility to the Ministry of Agriculture, Forestry and Water Management to monitor international progress in developing emissions mitigation options for that sector.

Figure 33 Forecast emissions by sector in LCDS scenario.



Source: Economic Consulting Associates based on NECP data.

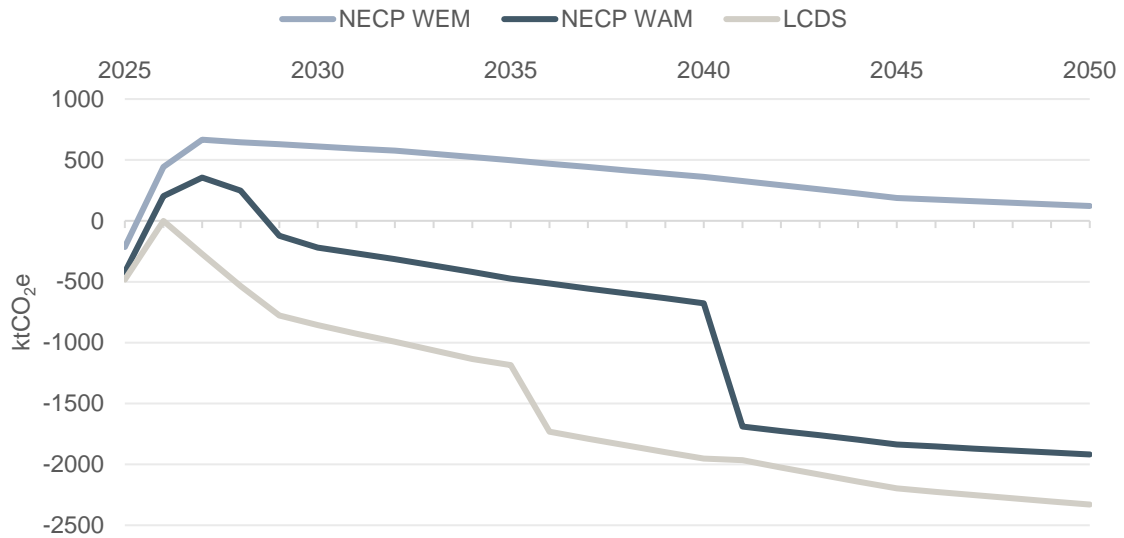
3.3 Comparison of net emissions across scenarios

Both the NECP WAM and LCDS scenario achieve net zero emissions between 2030 and 2035. This milestone is achieved in each case when development of new build renewable power generation facilitates a reduction in the utilisation of TPP Pljevlja. In the NECP WEM scenario, utilisation of TPP Pljevlja does not fall at any stage and the impact of other mitigation PAMs is relatively small, as a result this scenario does not achieve net zero emissions at any point.

Considering the early stage at which Montenegro achieves net zero emissions in the NECP WAM scenario, the LCDS has focused on driving sectoral emissions as close to zero as possible in the major emitting sectors. While the reductions that can be achieved by implementing the strategy are notable, there remain residual emissions across several sectors. It is therefore important to review this strategy on an ongoing basis to assess

progress and identify any technological advancements that may enable strengthening of sectoral PAMs to strive towards zero emissions.

Figure 34 Net GHG emissions across scenarios



Source: Economic Consulting Associates based on NECP data.

A five-year Action Plan for the LCDS has been prepared for the period 2026 to 2030, and it is foreseen that similar Action Plans will be prepared at corresponding five-year intervals. Preparation of each Action Plan represents a suitable milestone for overall LCDS review, and where possible to add additional PAMS to strengthen ambition.

Annexes

A1 LCDS Low Emissions Analysis Platform (LEAP) model summary

Energy use and emissions projections reported in the LCDS have been made using an economy wide model of Montenegro developed in the Low Emissions Analysis Platform (LEAP). LEAP is a software tool developed by the Stockholm Environment Institute (SEI) for integrated energy, climate change mitigation and air pollution abatement planning. At least 60 countries have used LEAP to help develop their NDCs submitted to the UNFCCC.⁵⁵

The LEAP model used for the LCDS is based on a LEAP model initially developed for use in preparing Montenegro's NECP. This approach was chosen to ensure the analysis underpinning the two strategies is fully aligned.

Development of the LEAP model began with constructing a baseline scenario modelling what would be expected to happen to sectoral output, energy consumption, and emissions in the absence of any mitigation policies occurring. Baseline projections are based on the following underpinning drivers:

- Household energy consumption growth is driven by population growth forecasts.
- Service sector output growth is driven by population growth forecasts. Energy intensity of the services is assumed to fall in the baseline.
- Industrial and manufacturing output, and therefore energy consumption and IPPU emissions growth, is driven by GDP growth forecasts. This includes growth in secondary aluminium production.
- Transport demand growth follows historical growth rates.
- Livestock numbers and associated emissions from enteric fermentation and manure management are assumed to fall following historical rates.
- Solid waste generated, and therefore associated emissions, is assumed to grow following historical rates.
- Carbon absorption from forests is assumed to follow the historical average.

Policies and measures (PAMs) for the three policy scenarios are layered on top of the baseline projections to estimate the impact of each PAM on production, energy demand, fuel mix, and emissions.

⁵⁵ LEAP. 2025. [Stockholm Environment Institute](#). Accessed: 22 February 2026.

A2 LCDS sensitivity scenario

The LCDS scenario presents a very ambitious pathway for decarbonisation across all major emitting sectors. There is, however, a degree of uncertainty associated with achieving each of the PAMs included in the scenario. To provide an indication of the implications of some PAMs (or parts of PAMs such as specific renewable energy projects) not being delivered, the LCDS Strategic Environmental Impact Assessment team undertook an assessment of all PAMs to identify those considered to be at highest risk of not being fully delivered. Based on the PAMs identified, a sensitivity scenario has been modelled to estimate the impact on energy supply and demand, and resulting impacts on emissions. A list of the high risk PAMs and the expected degree of uncertainty is provided in Table 15 below.

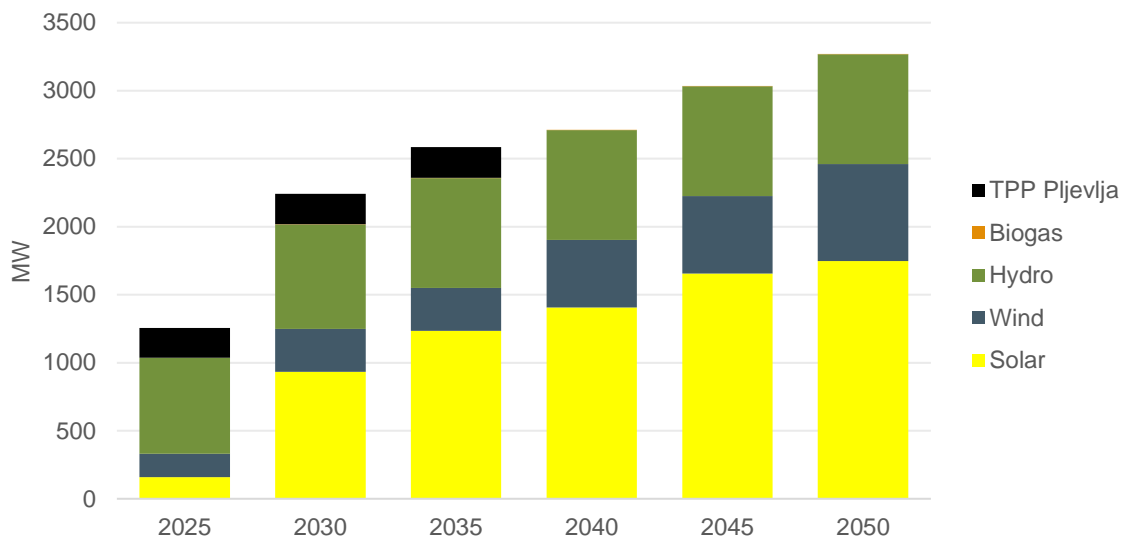
Table 15 List of high-risk PAMs and projects

PAM	Notes	How reflected in sensitivity scenario
Realisation of HPP Komarnica	Environmental impact assessment has not been accepted by the EPA.	Assumed to not be developed.
Realisation of HPP Kruševo	The project is in conflict with the Law on nature protection and has cross-border challenges due to location close to Bosnia and Herzegovina border.	Assumed only 50% of planned capacity is realised.
All solar projects.	There are risks caused by grid capacity and financial limitations.	Assumed only 30% of planned capacity is delivered.
LCDS PaM T.4 50% of on road vehicles to be zero emissions by 2040, and 90% to become zero emissions by 2050.	Full delivery unlikely when considering current trends with the renewal rate of the car fleet.	Assumed only 30% of electrification target is realised (27% of vehicles become zero emissions by 2050).

Source: Green Environment Services.

Lower than expected delivery of new hydro and solar projects implies lower overall renewable generation capacity. Almost 6 GW less capacity is developed than in the LCDS scenario where capacity reaches over 9 GW by 2050. The early closure of TPP Pljevlja is the single largest influencing factor on the emissions trajectory difference between the LCDS scenario and the NECP WAM or NECP WEM scenarios. The sensitivity of emissions to the rate of growth of solar projects is therefore conditioned instead on how this imposes increased utilisation in the years prior to retirement of TPP Plevlja. A slower rate of build requires higher utilisation (as well as greater substitution from imports, the emissions from which are not captured here).

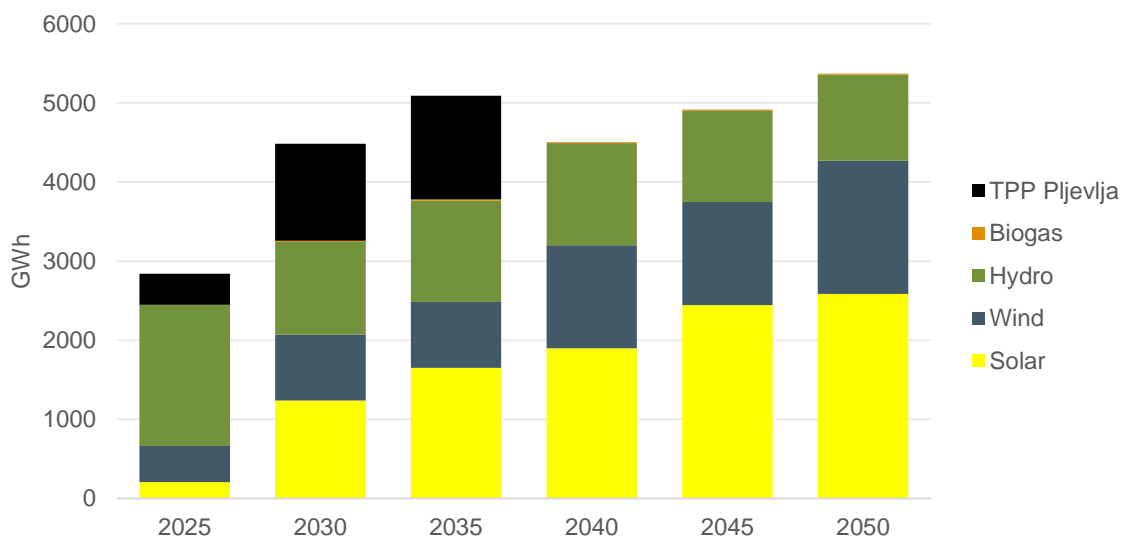
Figure 35 Installed power generation capacity in LCDS sensitivity scenario



Source: Economic Consulting Associates based on NECP data.

Total power generation is also much lower compared to the LCDS scenario. 2050 generation is less than 5,500 GWh, compared with over 9,000 GWh in the LCDS scenario. The drop in domestic generation between 2035 and 2040 when TPP Pljevlja comes offline is made up for with a corresponding increase in imports.

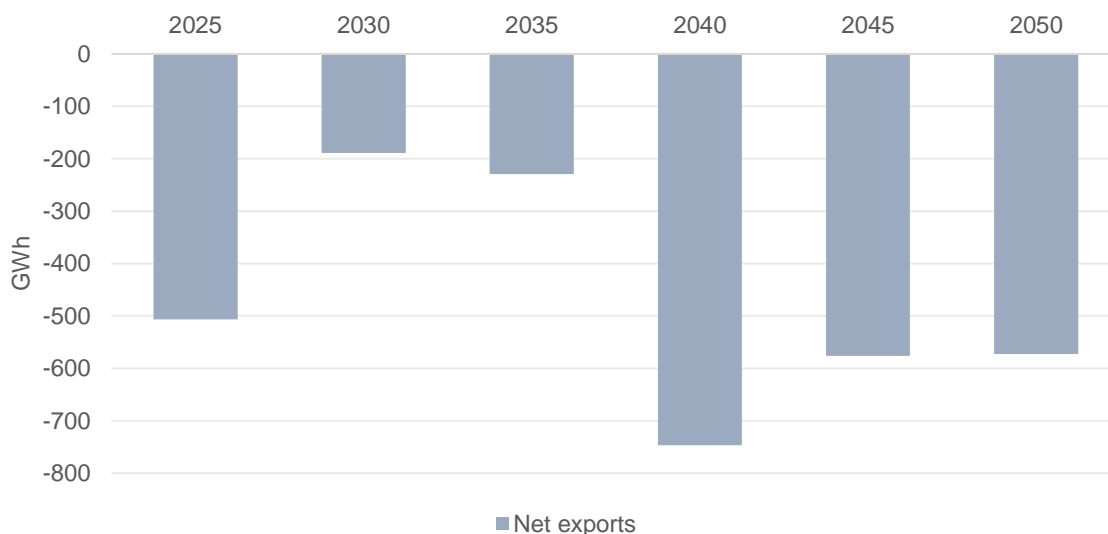
Figure 36 Power generation in LCDS sensitivity scenario



Source: Economic Consulting Associates based on NECP data.

As a result of lower development of new build renewable energy, Montenegro remains reliant on power imports throughout the period to 2050 and does not become an exporter of power at any point. Relatively high imports are seen in 2025 while the ecological reconstruction of TPP Pljevlja take place. Imports again spike in 2035 when TPP Pljevlja retires.

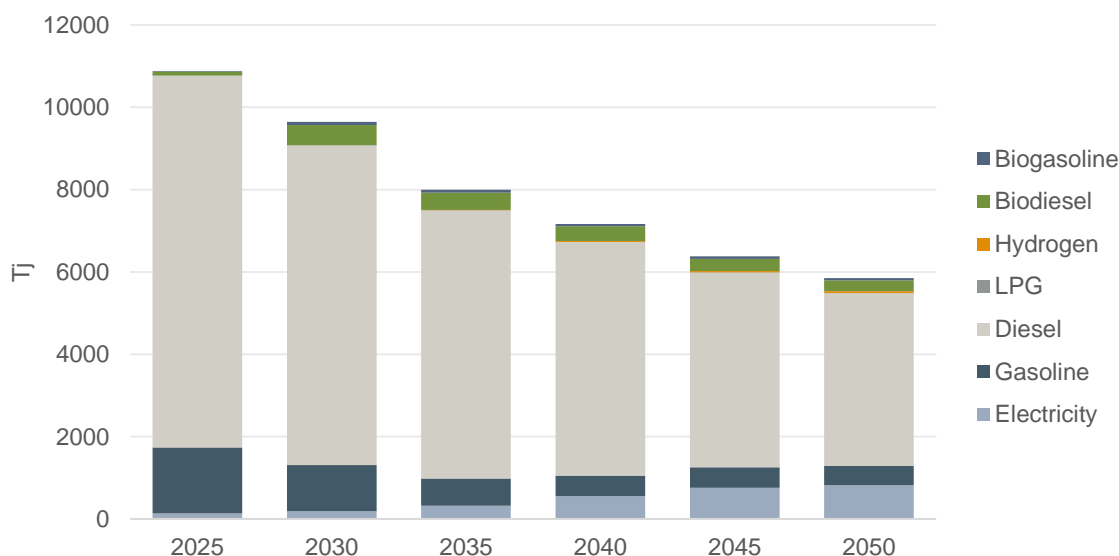
Figure 37 Net exports of power generation in LCDS sensitivity scenario



Source: Economic Consulting Associates based on NECP data.

Lower total power generation is partially offset by lower electricity demand from the transport sector due to reduced switching from ICE vehicles to EVs, however at no point does demand reduce sufficiently to eliminate the need for net imports of electricity. Reduced switching from ICE vehicles to EVs also implies much higher consumption of fossil fuel, primarily diesel, persists in the transport sector in 2050.

Figure 38 Fuel use in the transport sector in LCDS sensitivity scenario

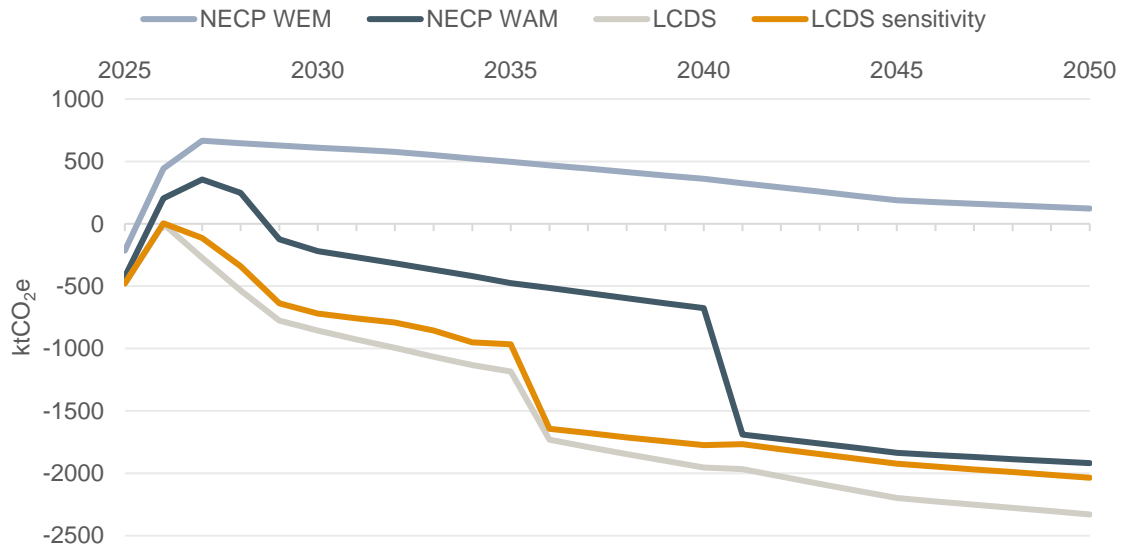


Source: Economic Consulting Associates based on NECP data.

Aggregate impact on emissions of the high-risk PAMs not being realised is relatively small. In the first ten years emissions are higher than in the LCDS because of higher utilisation of TPP Pljevlja. After 2035, emissions remain higher than in the LCDS due to higher ongoing

consumption of fossil fuels in transport. The closure of TPP Pljevlja is clearly observable in the LCDS and NECP WAM scenarios in the years 2035 and 2041 respectively.

Figure 39 Net GHG emissions across scenarios



Source: Economic Consulting Associates based on NECP data.