Republic of North Macedonia
Ministry of Environment and Physical Planning

NDC Implementation Roadmap for North Macedonia 2020-2030

November 2021

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Project Manager: Pavlina Zdraveva
Authors: Seth Landau, Lili Ilieva PhD
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Abbreviations

AFOLU	Agriculture, forestry and land use change
BAU	Business as usual
EBRD	European Bank for Reconstruction and Development
ENDC	Enhanced Nationally Determined Contributions
EU	European Union
GHG	Greenhouse Gasses
GEFF	Green Economy Financing Facility
IPP	Independent Power Producer
LULUCF	Land Use, Land Use Change and Forestry
MAC	Marginal Abatement Cost
MEPSO	Market Operator of North Macedonia
MoEPP	Ministry of Environment and Physical Planning
NEEAP	National Energy Efficiency Action Plan
PPA	Power Purchase Agreement
SDG	Sustainable Development Goals
UNFCCC	United Nations Framework Convention on Climate Change

Executive summary

Overview of the Enhanced Nationally Determined Contributions

In April 2021, the Macedonian Government has submitted its enhanced NDC (ENDC) significantly increasing the ambition to reduce GHG emissions. In line with the increased ambition, the ENDC includes **social aspects** such as the impact of the proposed mitigation measures for creation of green jobs, adopting a **gender-responsive approach**, and enhanced engagement of the youth. Additionally, the ENDC highlights the vital role of the **private** sector in the mitigation actions and the contribution to the **regional development** of the Republic of North Macedonia.

Mitigation targets by 2030

The ENDC is specific to the GHG emission reduction in the energy, agriculture, forestry and land use (AFOLU) and waste sectors. The overall mitigation target in the ENDC is to **reduce 51% of GHG emissions compared to 1990 levels (82% reduction in net GHG emissions)**. Disaggregated GHG emission reduction targets by sector include (Figure 1):

- **Energy: 66% reduction**
- **Agriculture: 29% reduction**
- **Land Use, Land Use Change and Forestry (LULUCF): 95% removals increase**
- **Waste: 21% reduction**

The objective of the ENDC Implementation Roadmap 2020-2030 is to provide a pathway with concrete mitigation actions and financing needs to achieve the transformational change envisioned under the ENDC.

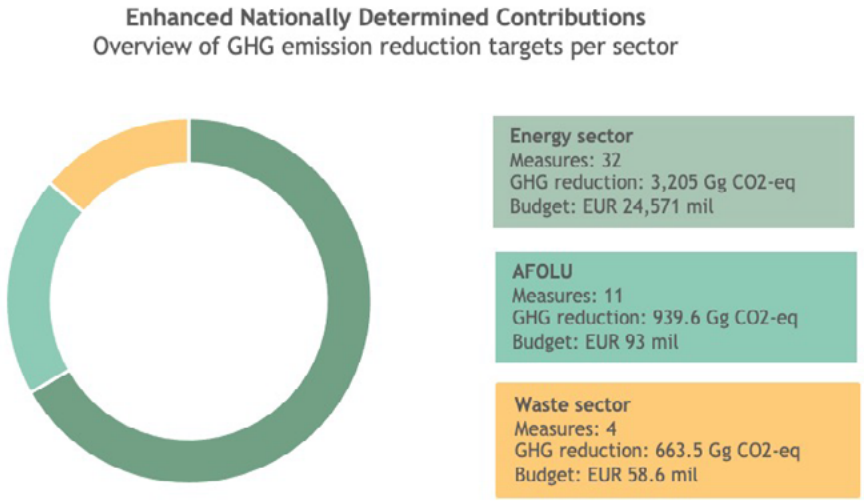


Figure 1. Overview of the GHG emission reduction targets in the ENDC

Note: the circle represents annual GHG reductions in comparison to 1990 levels in 2030

Governance and institutional arrangements

The implementation of the mitigation measures under the ENDC will require the engagement of diverse actors and coordination amongst development partners and public-sector, private-sector, and non-state actors. The draft Law on Climate Action defines the Ministry of Environment and Physical Planning (MoEPP) as the leading institution to coordinate climate related activities as well as to establish the National inventory system and the System for reporting on policies, measures, and projections of Republic of North Macedonia. The overall coordination of activities in relation to the ENDC is under the responsibility of the MoEPP. The draft law foresees the establishment of an intergovernmental body: the National Climate Change Council, which will assess the progress in the implementation of national strategies and plans related to climate change.

Implementation pathway

The implementation of the ENDC Roadmap, referred to here as the Roadmap, will consider three timescales: short-term (2020-2022), mid-term (2022 – 2025) and long-term (2025 – 2030).

Enabling elements, capacity building, and technical assistance needs

The Government should implement regulations on energy efficient buildings, light bulbs, and industrial operations

The Report on Institutional Capacity Assessment (2020) highlights that the following tasks will require institutional capacity:

- Monitoring, verification of the data that will be entered in the MVP platform, execution of appropriate changes, communication with the entities that enter information
- Coordination of MVP and MRV platforms

Financing strategy

The Republic of North Macedonia has made initial progress in implementing financial instruments, that support mitigation within the energy sector and AFOLU sectors; however, the scale of investments needed for the full implementation of the Roadmap outpaces North Macedonia's current ability to finance the transformational change envisioned. Therefore, new or significantly expanded financial instruments and support are needed.

Financing requirements for the North Macedonia ENDC exceed EUR 20 billion through 2030. This Roadmap seeks to establish a comprehensive implementation and financing pathway considering the most attainable financing scenarios given current investment patterns and structures for the country's largest emissions sector, energy, as well as the waste and AFOLU sectors. It also considers the fiscal implications of the COVID-19 pandemic and the need to rebuild the economy with a new source of green jobs by prioritising those measures as part of the methodology.

Overview of the sources of funding for the mitigation actions per sector and in total

	Source of Funding	Total amount (ml EURO)	%
Energy	All	24,863	100%
	Government ONLY	925	4%
	Other source of financing ONLY (No government)	10,527	42%
	Mixed financing (government +private sector, donors, consumer)	13,411	54%
Agriculture	All	110	100%
	Government ONLY	0	0%
	Other source of financing ONLY (No government)	110	100%
	Mixed financing (government +private sector, donors, consumer)	0	0%
Waste	All	58.6	100%
	Government ONLY	0	0%
	Other source of inancing ONLY (No government)	58.6	100%
	Mixed financing (government + private sector, donors, consumer)	0	0%
Total	**All**	**25,031**	**100%**
	Government ONLY	925	4%
	Other source of financing ONLY (No government)	10,696	43%
	Mixed financing (government + other (private sector, donors, consumer)	13,411	54%

Policy pathway

	Short-term 2020-2022	Mid-term 2022-2025	Long-term 2025-2030
Energy Sector	**Energy generation**		
	Reduction of network losses		
	Incentives		
	Solar rooftop power plants		
	RES without incentives		
	Energy efficiency		
	Replace incandescent lights	New passive buildings	Heat pumps
	Street lightening	Solar thermal/ solar thermal PV	Increased use of central heating
	Retrofitting residential buildings		
	Transport		
		Railway	Renew car fleet
			Electrification of transport
AFOLU	**Livestock**		
	Reduction of CH4 emissions		
	Reduction of N20 emissions		
	Forestry		
	Integrated management of forest fires		
	Afforestation		
	Land use change		
	Conversion of land use	Biochar for carbon sink	
	Perennial grass	Photovoltaic irrigation	
Waste	**Waste sector**		
		Landfil gas flaring	
		Mechanical and biological treatment	
		Selection of waste - paper	
		Improved waste and materials management	

Overview of the timeline for the implementation of the mitigation measures

1. Introduction: background and the context of climate change

1.1. Goal and objective of the roadmap

The ENDC Implementation Roadmap follows the framework of undertaking and communicating ambitious efforts in GHG mitigation as indicated in Article 3 of the Paris Agreement. The goal of the roadmap is to provide a pathway for the implementation of specific mitigation actions in North Macedonia. As such, the Roadmap is a tool that can be used to:

1. Increase awareness and provide guidance for key stakeholders on the actions necessary to achieve the ENDC target.
2. Set out a pathway with concrete mitigation actions and interventions leading to emission reductions and transformational change in the energy, agriculture, forestry and land use change (AFOLU) and waste sectors.

The Roadmap provides a snapshot of the ambitious targets of the ENDC **(Section 2)**, an overview of the mitigation measures in the key sectors – energy, AFOLU and waste – highlighting the targets and the financial strategy for their implementation **(Section 3)**. The Roadmap also outlines the governance structure needed for the implementation of the ENDC **(Section 4),** the implementation strategy **(Section 5)** and the Financial strategy **(Section 6).**

1.2. Background information

The Republic of North Macedonia (25,713 km2) is landlocked country, located in the middle of the Balkan Peninsula. It has a diverse topography with high mountains and deep valleys, large and small natural lakes and picturesque rivers. The agricultural land covers 50% of the surface area while forests cover about one third from the country. The country has a diverse climate, with eight climatic regions.

The enhanced Nationally Determined Contribution (ENDC) was prepared against a backdrop of the country being a candidate for EU membership and becoming 30th member of the NATO Alliance. The results from the past reforms including the solid macroeconomic fundamentals, job creation, and an open economy that has attracted foreign investment will help the country to capitalize on this renewed outlook. However, the weak state institutions, low and declining productivity of local firms, and deficiencies in competition and investment policy and business regulation continue to pose serious structural challenges to economic growth. A competitive business legal framework is missing, so the private sector is weak and incapable to fully exploit the country's location. Furthermore, there are risks to fiscal sustainability and the Government has limited fiscal space to stimulate the economy properly.

The Republic of North Macedonia, a non-Annex I party to the United Nations Framework Convention on Climate Change (UNFCCC), ratified the Paris Agreement in November 2017, with the following nationally determined contribution (NDC) to the global efforts for GHG emissions reduction (initial NDC, submitted 2015): "To reduce the CO2 emissions from fossil fuels combustion for 30%, that is, for 36% at a higher level of ambition, by 2030 compared to the business as usual (BAU) scenario." The focus of the initial NDC is on climate change mitigation, and particularly to CO2 emissions from fossil fuels combustion which covers almost 80% of the total GHG emissions in the country. The following sectors are of dominant share: energy supply, buildings and transport.

In April 2021, Macedonian Government has submitted its enhanced NDC significantly increasing the ambition to reduce GHG emissions (chapter 2).

The Republic of North Macedonia is a candidate country for European Union (EU) membership, and as a Contracting Parity of Energy Community, committed to work towards the 2050 climate neutrality target – the heart of the European Green Deal, like the rest of the EU in the framework of the Energy Community.

2. Enhanced Nationally Determined Contributions and the Implementation Roadmap

2.1. Overview of the enhanced NDC

Snapshot of the ENDC	
Target (2030)	**To reduce 51% of GHG emission compared to 1990 levels** (82% reduction in net GHG emissions).

The ENDC wove **sustainable development** into its mitigation policies and measures (PAMs), quantifying the nexus of sustainable development and climate change mitigation. Specifically, related to economic and environmental dimensions, Marginal Abatement Cost (MAC) Curve was developed to perform economic and environmental evaluation of the PAMs. The **social aspects** of the mitigation PAMs are addressed by

(i) calculation of the newly created jobs (8,000 green jobs by 2030)
(ii) introduction of the gender indicators in some of the PAMs with an aim to make them gender-responsive and
(iii) organization of a virtual youth consultation on the enhanced NDC, designed to ensure that the voices of young people are expressed in the NDC and that there will be broad ownership for the enhanced NDC goals.

The ENDC also includes a **regional dimension** within the country. The five priority measures from the draft Strategy for Regional Development 2019-2029 include:

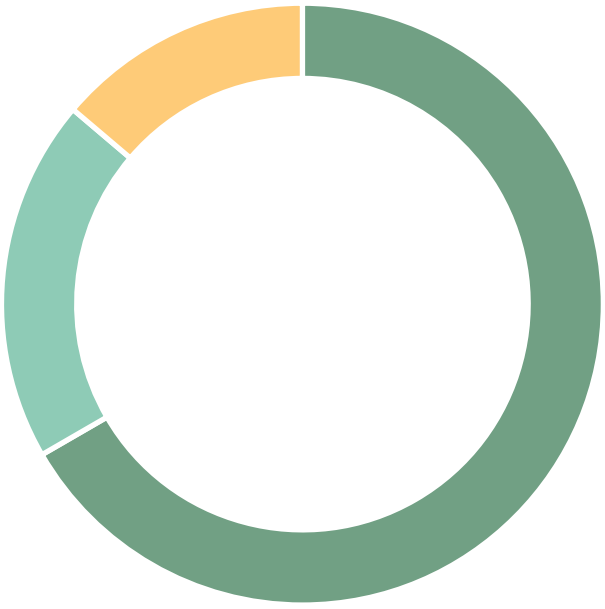
1. Ensuring just transition (Pelagonija and Southwest region)
2. Increasing renewable electricity production (Southeast, East and Northeast region)
3. Increasing energy efficiency in industry (Skopje, Polog and Vardar region)
4. Improving energy efficiency in households (East, Pelagonija, Vardar and Skopje region) and
5. Mitigation of climate change through landfill gas burning (in all regions where regional landfills with waste mechanical and biological treatment will be constructed).

The ENDC includes specific ambitious mitigation actions, with a vision to include the adaptation component in subsequent submissions. The ENDC consists of 63 mitigation measures in the following sectors:

- energy sector (32 measures)
- agriculture, forestry and other land use (AFOLU) (11 measures) and
- waste management sector (4 measures).

It also includes 16 additional measures to facilitate the implementation of mitigation measures, such as carrying out pilot projects or adopting new programs. Figure 2 shows an overview of the GHG emission reduction targets per sector and the estimated financing needs.

Enhanced Nationally Determined Contributions
Overview of GHG emission reduction targets per sector



Energy sector
Measures: 32
GHG reduction: 3,205 Gg CO2-eq
Budget: EUR 24,571 mil

AFOLU
Measures: 11
GHG reduction: 939.6 Gg CO2-eq
Budget: EUR 93 mil

Waste sector
Measures: 4
GHG reduction: 663.5 Gg CO2-eq
Budget: EUR 58.6 mil

Figure 2. Overview of the GHG emission reduction target in the ENDC

Note: the circle represents annual GHG reductions in comparison to the baseline / without measures scenario in 2030

The Financing Strategy for the Enhanced Nationally Determined Contributions in North Macedonia (2021) provides a strategic vision of the opportunities and financial modalities required for the implementation of the proposed measures. This Roadmap is based on the ENDC technical and financial studies summarised in Figure 3 below.

Enhanced Nationally Determined Contributions – Roadmap for implementation

Technical Studies

- Technical report on the measures for the enhanced NDC
- NDC - SDG synergies and trade-offs in Macedonian conditions
- Rapid socio-economic assessment of the Macedonian enhanced NDC targets/measures
- Rapid assessment report on the benefits of circular economy on mitigation of GHG emissions in the waste sector
- Assessment of the potential for climate friendly cooling solutions

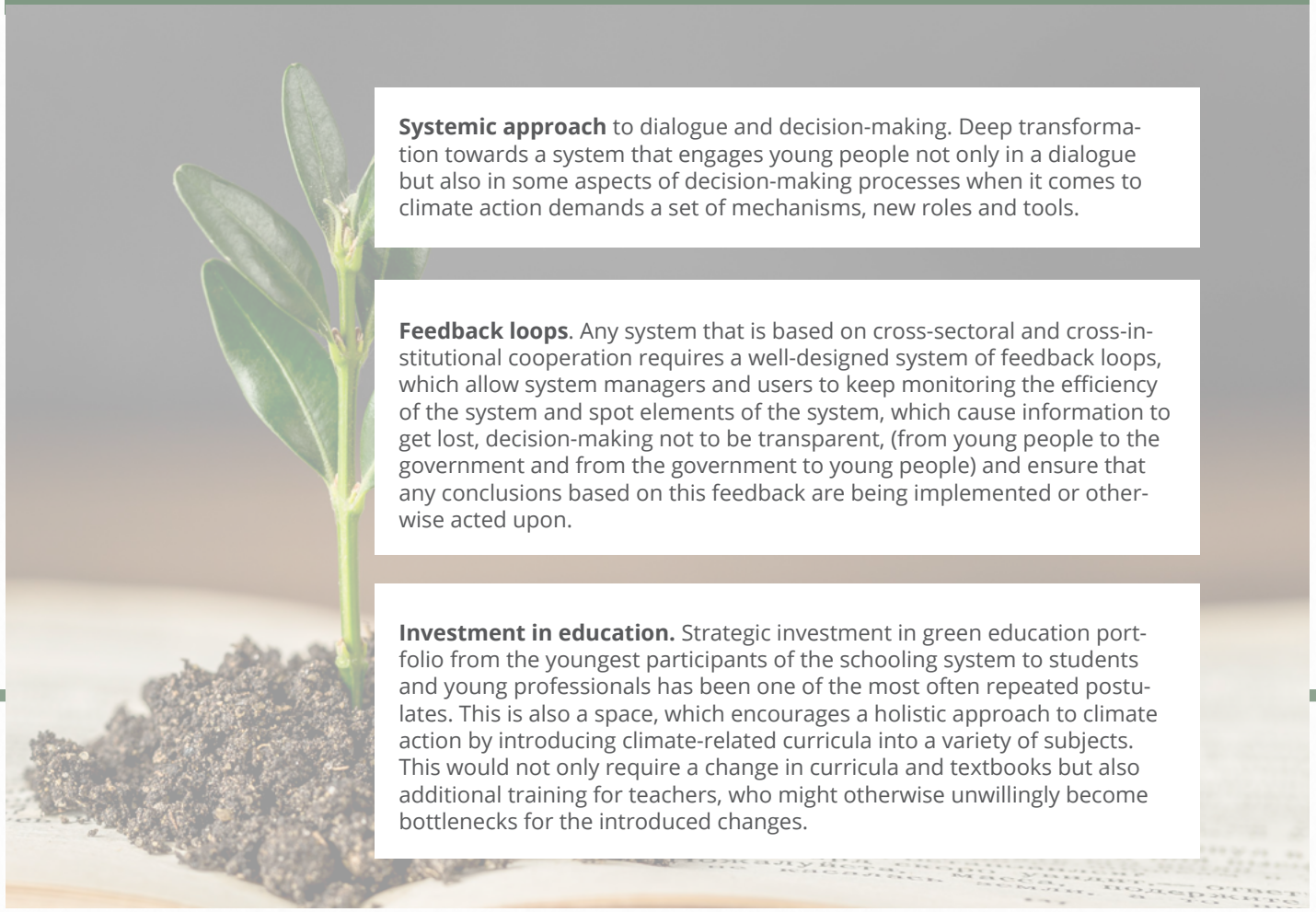
Financial Studies

- Financing Strategy for the enhanced NDC
- Development of Roadmap for the Introduction of a National Carbon Tax in North Macedonia
- De-risking investments in North Macedonia's enhanced NDC

Figure 3. Overview of the key technical and financial studies underpinning the developing of the NDC Roadmap for implementation

Box 1. Recommendations for engagement with youth

In the framework of stakeholder engagement in climate change action in North Macedonia, youth play a key role. Youth for Climate proposes systemic solutions to enhance the participation of youth in climate action. The solutions include:



Systemic approach to dialogue and decision-making. Deep transformation towards a system that engages young people not only in a dialogue but also in some aspects of decision-making processes when it comes to climate action demands a set of mechanisms, new roles and tools.

Feedback loops. Any system that is based on cross-sectoral and cross-institutional cooperation requires a well-designed system of feedback loops, which allow system managers and users to keep monitoring the efficiency of the system and spot elements of the system, which cause information to get lost, decision-making not to be transparent, (from young people to the government and from the government to young people) and ensure that any conclusions based on this feedback are being implemented or otherwise acted upon.

Investment in education. Strategic investment in green education portfolio from the youngest participants of the schooling system to students and young professionals has been one of the most often repeated postulates. This is also a space, which encourages a holistic approach to climate action by introducing climate-related curricula into a variety of subjects. This would not only require a change in curricula and textbooks but also additional training for teachers, who might otherwise unwillingly become bottlenecks for the introduced changes.

2.2. Alignment of the Roadmap with the SDGs

The mitigation measures proposed in the ENDC aim to contribute directly to the SDG and the Agenda 2030. Therefore, to provide evidence of the SDG-NDC nexus, a study was conducted using the Q-SCAN tool: NDC – SDG synergies and trade-offs in Macedonian conditions.

The results show that the energy sector is dominant in influencing the SDGs. The strongest synergies remain with SDG 8: Decent work and economic growth due to the new job opportunities in renewable energy deployment and in the construction and retrofit market; sustained economic growth, improved economic efficiency per unit of product and sustained support of entrepreneurship.

The contribution of each activity within the key ENDC sector is further demonstrated in **Section 3.**

2.3. Alignment of the Roadmap with national policies

The Republic of North Macedonia is a candidate country for EU membership, and as a Contracting Party of the Energy Community committed to work towards the 2050 climate neutrality target – the heart of the European Green Deal. In the recent past, North Macedonia has been active in the development of overarching national strategies, policies, and plans, which are relevant to the energy, AFOLU, and waste sectors. Energy and transport are central to reducing North Macedonia's GHG emissions and constitute important areas of focus for EU Accession.

In December 2019, the country adopted a National Strategy for Energy Development up to 2040, which is the first strategy of an Energy Community Country. The ENDC reflects the "Green Scenario" from the National Strategy for Energy Development up to 2040, which integrates climate and environmental aspects into the recommended measures and enables overall energy sector modernisation and transformation. Additionally, the country is developing a National Developing Strategy and the ENDC will be integrated in it to ensure that economic development will follow a low-carbon and resilience pathway. The country's Smart Specialization Strategy, which is currently in the process of development, will contribute to achieving the low carbon development via research and development of innovative solutions.

The roadmap aligns with the goals and objectives of the abovementioned national policies and plans in the three sectors considered in the ENDC. These strategies, policies, and plans are comprehensive and focus predominantly on sustainable development, green growth, poverty reduction, and access to modern services. The nine strategies, policies, and plans are highlighted in the table below, along with their alignment to the mitigation actions and needs of the energy, AFOLU and waste sector under the roadmap.

National policies and plans	Applicability to different ENDC sectors		
	Energy	AFOLU	Waste
Long-Term Strategy on Climate Action (2021)	X	X	X
Law on Climate Action (draft 2021)	X	X	
National Energy and Climate Plan (2021)	X	X	X
Strategy for Energy Development up to 2040 (2019)	X		
Strategy for Regional Development 2019-2029 (2021)	X	X	
Energy Efficiency Strategy	X		
Strategy for Agriculture and Rural Development 2021-2027 (2021)		X	
Waste Management Plan of the Republic of Macedonia 2020 – 2026 (2021)			X

3. Mitigation Actions by Sector

3.1. Energy sector

Target by 2030: GHG reduction of 3,205 Gg CO2-eq
Financing: EUR 24,571.8 mil

The mitigation actions identified within the energy sector are split between the following sub-sectors:

- Electricity Generation and Transmission
- Energy Efficiency
- Transport

The figure below depicts the overall GHG emission reduction to be achieved via the mitigation actions in the energy sector, which is expected to be **3,205 Gg CO2-eq** in 2030 compared to 1990. The total investment costs in the energy sector to achieve this level of GHG mitigation is estimated to be **EUR 24,571.8 mil** between 2020 – 2030. If the investments from the private sector are exempted, the remaining investments amount to around 3,570 mil. Figure 4 shows a summary of the mitigation measures.

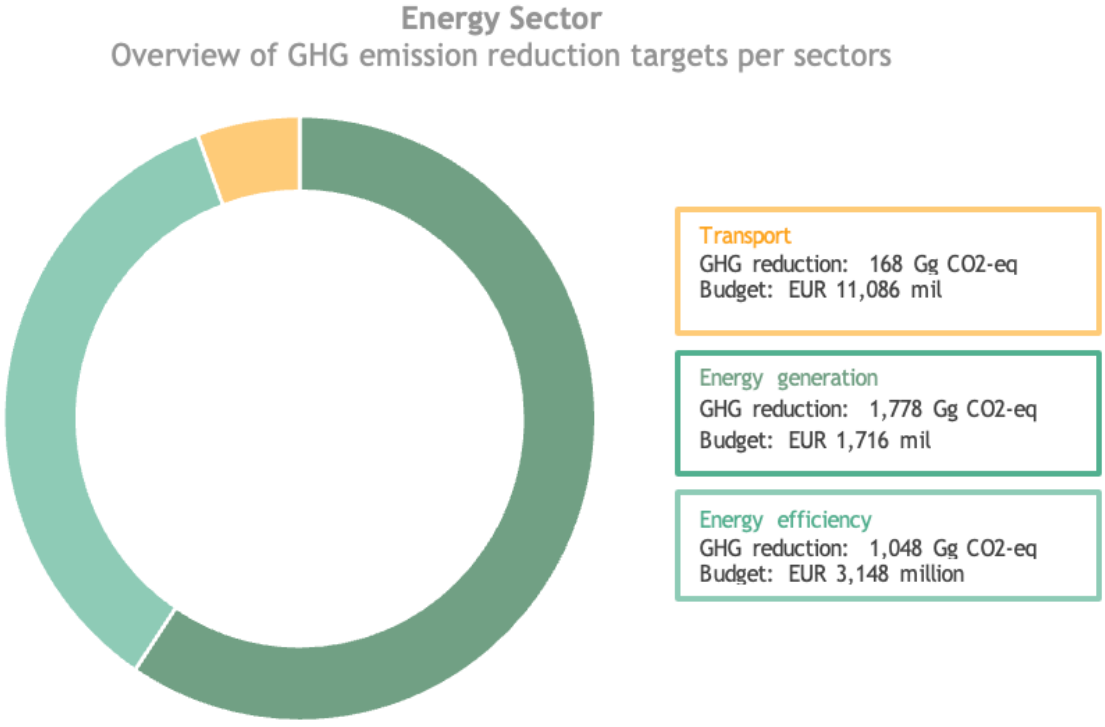


Figure 4. Energy sector – overview of mitigation actions

3.1.1. Energy generation

GHG emission reduction targets for 2030

The mitigation actions defined for the energy generation sub-sector aim to achieve GHG emission reductions of **1,778 Gg CO2-eq** by 2030. A substantial part of the GHG emission reductions will be achieved with the installation of a large hydropower plant (740 Gg CO2-eq), followed by the introduction of feed-in tariffs and premiums for renewable energy (383 Gg CO2-eq) and a reduction in network losses (323 Gg CO2-eq). The installation of rooftop solar systems and other renewable energy systems without incentives are also part of the mitigation actions. Figure 5 shows an overview of the mitigation actions under the Energy Generation sub-sector.

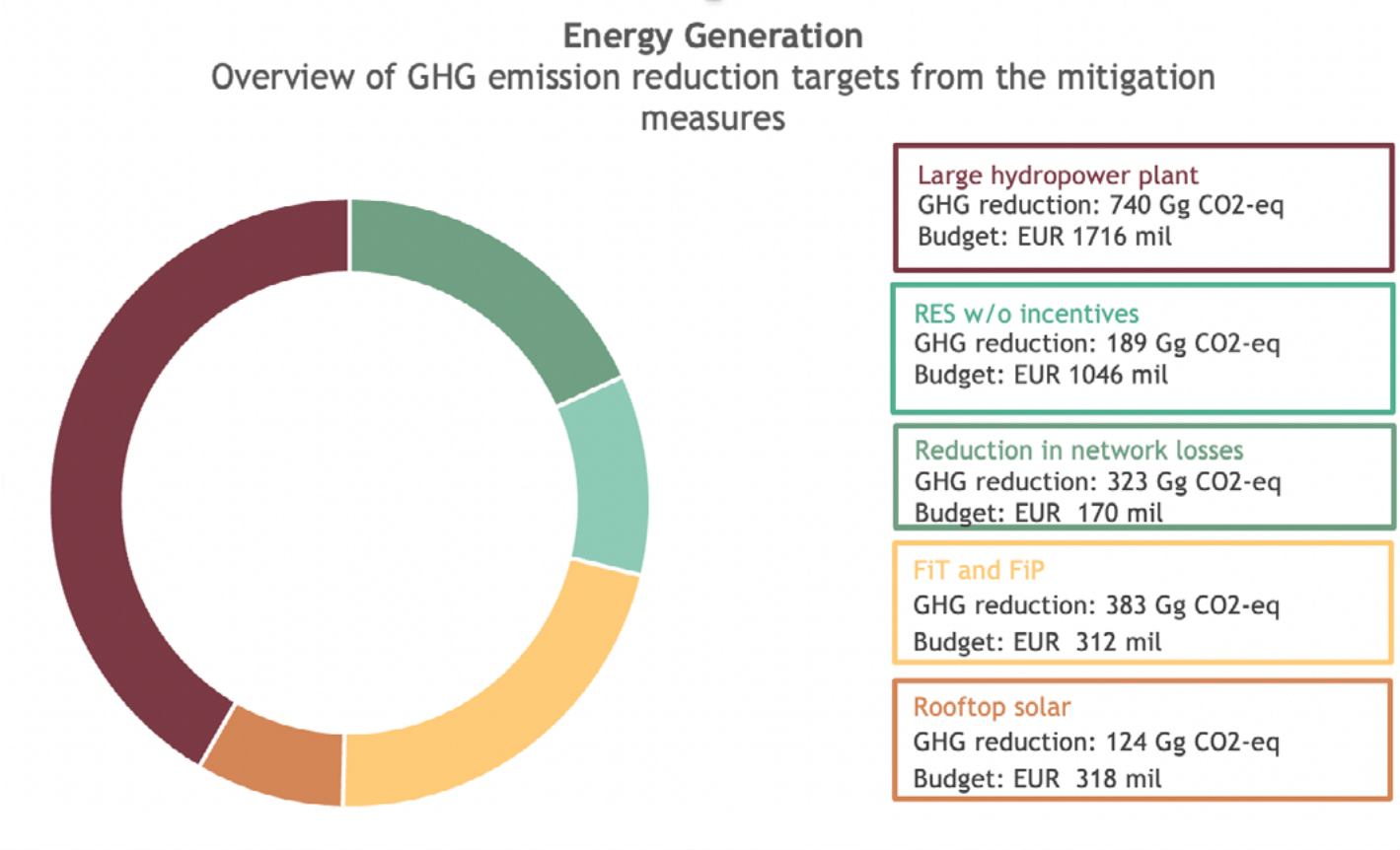


Figure 5. Overview of the GHG emission reduction potential from the mitigation actions under the energy generation sector

Mitigation measures

The mitigation actions identified will lead to sub-sector transformation and GHG mitigation in electricity generation and transmission under the Roadmap, and are implementable in the short-, medium-, and long-term (2020 - 2030). These mitigation actions include:

- **Reduction of network losses:** Technical measures for reducing distribution electricity losses in electricity and heat networks.
- **Installation of large hydropower plants:** Infrastructure measures to increase the domestic generation capacity of renewable energy with capacity of 800 MW.

• **Installation of other renewable energy systems without incentives:** Increase of the domestic generation capacity from renewable energy sources from:
  - Solar rooftop power plants (256 MW)
  - Renewable Energy Sources without incentives (Wind, Solar, Biogas) (515 MW)
  - Biomass power plants (10MW)

• **Introduction of incentives for stimulation of renewable energy generation:** Policy and financial measures (incentive feed-in tariffs and premiums) to stimulate the construction of new small hydro power plants, wind and biogas with capacity of 423 MW.

Some of the mitigation measures are urgent and require immediate implementation to ensure the achievement of the GHG reduction targets. Among these measures are the reducing network losses, the incentives (feed-in tariffs and premiums) and the installation of solar rooftops, renewable energy systems and in particular the large hydropower plant to replace coal. The implementation of these measures does not require substantial financing and at the same time will results in considerable amount of GHG emission reductions (848 Gg CO2-eq) and additional social and environmental benefits (815 new jobs). Table 2 summarises the mitigation actions and indicates their contribution to the SDGs.

Table 2. Overview of the types of mitigation actions under the energy generation sub-sector

Mitigation actions		GHG emission reduction [Gg CO2-eq]	Type			SDG
			Technical	Regulatory	Policy	
1	Reduction of network losses	323.4	X			
2	Large hydro power plants	740.7	X			
3	Incentives feed-in tariff	149.5	X	X		
4	Incentives feed-in premium	162.6	X	X		
5	Solar rooftop power plants	164.3	X	X		
6	RES without incentives	202.8	X	X		

Financing strategy

The implementation of the mitigation measures on energy generation are estimated to cost **EUR 5,587 mil.**

A strategic approach for the financing of these measures is the encouraged engagement with the private sector. The private sector can be counted on to produce much of the EUR 5.6 billion required given certain preconditions, long term debt provided by multilateral banks and other incentives. Feed-in-tariffs and -premium policies for renewables will need to be set at appropriate levels by national tenders. The most cost-effective technologies, supply chains and sources of financing for low-emission energy

generation must be used if consumers are not to suffer energy price hikes.

So far, much of the finance for renewable energy has come with the support of multilateral banks. North Macedonia features the largest number of greenfield plants financed by the EBRD in the Western Balkans (20 plants, 15 financed directly and five through intermediaries).

The mitigation measures can be financed by a combination of financing mechanisms including blended finance, risk reduction, long-term loans, third party finance with free energy audits, among others. Key actors for the financing of the measures include banks (e.g. EIB and EBRD), subsidies from central and local governments, and the private sector. The table below provides an overview of the proposed financial mechanisms and key actors for the financing of the sub-sector mitigation actions.

Table 3. Overview of the financial modalities of the mitigation measures for the energy generation sub-sector

Mitigation measures	Budget [EUR]	GHG emission reduction [Gg CO2-eq]	Financial mechanism	Government	Private sector	Banks
Reduction in network losses	170 mil	323	Long term loans			X
FiT and FiP	312 mil	383	Project financing	X	X	X
RES without incentives	1,046 mil	189	Blended finance		X	
Rooftop solar	318 mil	142	Third party finance		X	
Large hydropower plant	1,716 mil	740	Commercial Banks			X

Box 2. Policies supporting investments in Renewable Energy Generation

Many of the required policies are in place to attract private capital to alternative energy generation. The Action Plan for Renewable Energy Sources and the National Energy Efficiency Action Plan (NEEAP) constitute a foundation for modernisation and competitiveness.

North Macedonia's energy policy aims to decrease the state-owned share of the market from 80% to 30% by 2025, igniting demand for Independent Power Producer (IPPs) which can compete in power generation with long term power purchase agreements. Similar regulations have stimulated a rapid transition to green energy in other countries in Europe.10 IPPs need not be entirely privately financed, owned or operated, as North Macedonia is already taking advantage of long-term public financing from development banks such as the EBRD, and this will increase significantly in the future.

Box 3. Enabling elements, capacity building, and technical assistance needs

• The Government should produce feasibility studies to reduce uncertainties related to environmental issues and potential cost overruns for the installation of renewable energy systems. Cimate change risk assessment for identified sites as well as the required Environmental Impact Assessments.

• There is a need for support to the private sector renewable programme by (i) providing technical support to the Market Operator of North Macedonia (MEPSO) to review the Power Purchase Agreement (PPA), and (ii) assisting local authorities in the finalisation of a market standard PPA for renewable energy projects.

3.1.2. Energy efficiency

GHG emission reduction targets for 2030

The mitigation actions defined for the energy efficiency sub-sector aim to achieve GHG emission reductions of **1,048 Gg CO2-eq** by 2030. A significant segment of the GHG emission reductions will be achieved with the installation of a large hydropower plant (740 Gg CO2-eq), followed by the introduction of Feed-in tariffs and premiums for renewable energy (383 Gg CO2-eq) and reduction in network losses (323 Gg CO2-eq). The installation of rooftop solar systems and other renewable energy systems without incentives are also part of the mitigation actions. Figure 6 below shows an overview of the mitigation actions under the energy efficiency sub-sector.

Mitigation measures

The mitigation actions identified include a wide range of energy efficiency technologies focusing on improved lightening and buildings. These mitigation actions include (see Figure 6):

- **Phasing out of incandescent lights**: Improve the efficiency of lighting following the EU policies
- **Improvement of street lightening in the municipalities:** Reduce the costs and increase the quality of street lighting
- **Retrofitting commercial and residential buildings:** Reconstructions of residential buildings including windows replacement to meet the requirements under Energy Efficiency Law
- **Increased use of heat pumps:** Phasing out heating devices with resistive heaters, as well as inefficient biomass stoves and their replacement with heat pumps in compliance with EU Climate and Energy Policy.
- Biomass CHP
- **Solar thermal:** Reduction of the energy costs and improvement of the efficiency
- **Construction of passive buildings:** Construction of new zero energy buildings
- **Increased use of central heating systems:** Increased use of the existing central heating systems through the implementation of information campaigns for connecting new consumers, including those who have been disconnected from the system in the past.
- **Energy efficiency obligation schemes:** Fulfilment of the obligation under Article 7 of the EE Directive

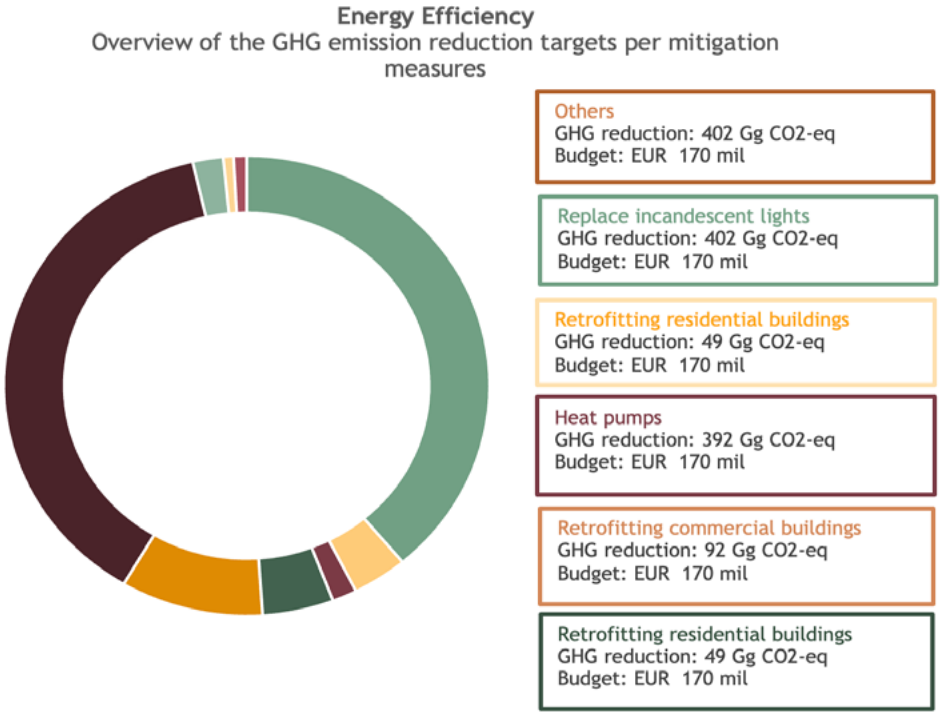


Figure 6. Overview of the GHG emission reduction potential of the mitigation measures under the energy efficiency sub-sector

Some of the energy efficiency measures are urgent and require implementation in the short-term, as they are expected to bring benefits within a short timeframe. Among these measures are the phaseout of incandescent lights and the improvement of street lightening municipalities he incentives Table 4 summarises the mitigation actions and indicated their contribution to the SDGs.

Mitigation actions	GHG emission reduction [Gg CO2-eq]	Type			SDG
		Technical	Regulatory	Policy	
Phasing out of incandescent lights	401.8		X	X	
Improvement of street lightening in the municipalities	37.9	X			
Construction of passive buildings	17	X	X		
Retrofitting residential buildings	162.6	X	X		
Retrofitting commercial buildings	98.2	X	X		
Increased use of heat pumps	369.5		X	X	
Solar thermal/solar thermal PV	25.5	X			
Increased use of central heating	9.3	X			
Energy efficiency obligation schemes	162.8	X	X		

Financing strategy

The implementation of the energy efficiency measures is estimated to cost **EUR 3,148 mil.**

A strategic approach to mobilise finance for energy efficiency actions is to incentivise citizens to adopt such practices. Credit lines are offered through commercial banks from EBRD (through the Green Economy Financing Facility - GEFF) to support adoption of green technology. Loans are provided for citizens and housing associations for investment in energy efficiency of residential buildings including in new heat or geothermal pumps, efficient stoves, windows, and installation of solar panels, insulation on walls, roof or floors, investments in hot water collectors. Citizens also obtain the right to apply for a grant of up to 20% of the total amount of the investment.

Energy efficiency projects for households work particularly well in partnership with municipalities, with funding coming from international banks. Initiated by the owners and/or supported by commercial banks and funds. Commercial banks and energy efficiency funds can provide financing to municipalities, with compensation added to higher rent where tenants benefit. Municipalities are the natural beneficiary and implementation entity of these programs. They should seek the direct international funds to do so, including transfer of expertise. The City of Skopje, is encouraging the citizens to use renewable energy sources to heat their homes, implemented the measure to subsidize or provide a refund of part of the cost of pellet stoves in amount of 70%. For 2018 and 2019, a total of 7,255 grants were awarded.

Investments in heat pumps and improvements in building envelopes, including windows, could be bundled up into a 'residential decarbonisation financing mechanism' which would reduce the expenditure of municipal and national budgets for energy.

The table below shows a summary of the energy efficiency measures and the potential financing modalities. Boxes 4 and 5 describe what are the supporting policies for investment in energy efficiency and the enabling conditions.

Table 5. Overview of the financial modalities of the mitigation measures for energy efficiency

Mitigation measures	Budget [EUR]	GHG emission reduction [Gg CO2-eq]	Financial mechanism	Government	Private sector	Banks
Phasing out of incandescent lights	558 mil		Energy savings contracts	X	X	
Improvement of street lightening in the municipalities	19,5 mil		Project financing Energy savings contracts	X		
Construction of passive buildings	1,068 mil		Blended finance		X	X
Retrofitting residential buildings	283 mil		Low interest loans to families; lending from govt to municipality.		X	
Retrofitting commercial buildings	1,716 mil		Green" loans or bonds; Green mortgage			X

Increased use of heat pumps	942 mil		Home budgets, subsidies from government for fuel poverty	X		X
Solar thermal/solar thermal PV	530 mil		Energy Savings contracts			X
Increased use of central heating	331 mil		National budgets	X		X
Energy efficiency obligation schemes	3,2 mil		Energy Savings contracts			X

Box 4. Policies supporting investments in Energy Efficiency

The Government is adopting a binding energy efficiency scheme to achieve savings in final energy consumption. The Energy Efficiency Directive, the Energy Performance of Buildings Directive and a framework for labelling of energy consumption appliances were all adopted in 2020, and preparation of secondary legislation on energy consumption labelling and eco design is underway with assistance from USAID.

Large scale energy efficiency financing can be kickstarted with state-sponsored tools such as energy audits for buildings, and industrial and commercial operations. UNOPS is providing grants for preparation of a rulebook for energy audits for large enterprises. Under the Regional Energy Efficiency Program (REEP Plus) the government has requested EBRD aid for preparation of a package by-laws for commercial buildings. Hence, significant aid has assisted these initiatives in the form of international grants and expertise, which should prime the well for private investment. Distribution system operators and/or suppliers will then implement these demand side measures. Technical assistance from HABITAT has been provided for a typology for buildings in accordance with the TABULA methodology, and this will become part of the Strategy to 2030 for the Reconstruction of Housing, Public and Commercial Buildings.

Box 5. Enabling elements, capacity building, and technical assistance needs

The Government should implement regulations on energy efficient buildings, light bulbs, and industrial operations. The Report on Institutional Capacity Assessment (2020) highlights that the following tasks will require institutional capacity:

- Monitoring, verification of the data that will be entered in the MVP platform, execution of appropriate changes, communication with the entities that enter information
- Coordination of MVP and MRV platforms

3.1.3. Transport

GHG emission reduction targets for 2030

The mitigation actions defined for the transport sub-sector aim to achieve GHG emission reductions of **168 Gg CO2-eq** by 2030. A substantial part of the GHG emission reductions will be achieved with the renewing of other national road fleet (66.4 Gg CO2-eq), followed by the electrification of transport (61.6 Gg CO2-eq). The introduction of more advanced technologies for mobility are also part of the proposed mitigation measures. Figure 7 shows an overview of the mitigation actions under the tourism sector.

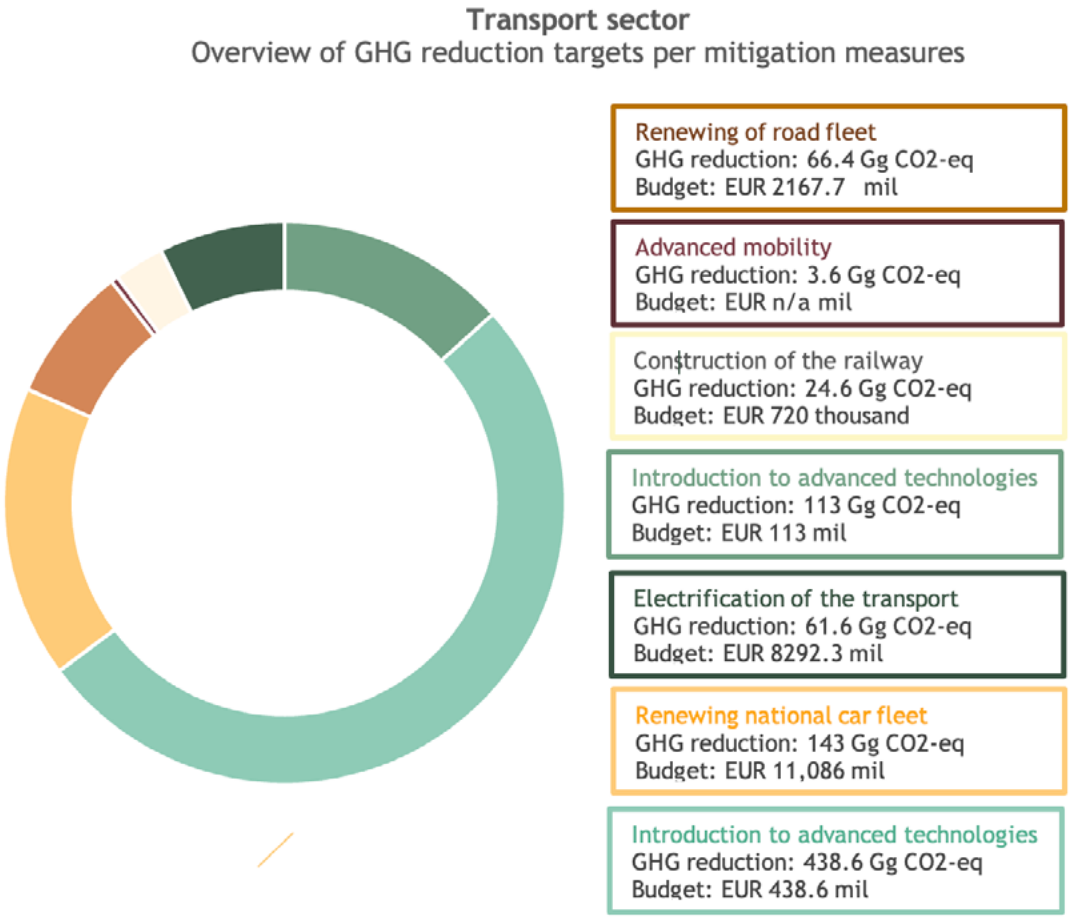


Figure 7. Overview of the mitigation measures and their GHG reduction potential under the transport sector

Mitigation measures

The mitigation actions identified will lead to sub-sector transformation and GHG mitigation in the transport sub-sector. The proposed measures have a different timeline between short-, medium-, and long-term (2020 - 2030). These mitigation actions include:

• **Public transportation use**: Increased use of railway and expansion of the railroad network to the Republic of Bulgaria

- **Renew and replace polluting vehicles:** Awareness raising and promotion of the use of advanced technologies and mobility models including bicycles and scooters
- **Introduction of electric vehicles:** Transition from fossil fuels-based vehicles to electric transport

These mitigation measures have a long-term character and require a strategic approach to ensure awareness raising, to incentivise behavioural change and establish enabling conditions such as legislation and infrastructure such as charging networks. The table below summarises the mitigation actions and indicated their contribution to the SDGs.

Table 6. Overview of the types of mitigation actions in the transport sub-sector

Mitigation actions	GHG emission reduction [Gg CO2-eq]	Type			SDG
		Technical	Regulatory	Policy	
Introduction of efficient electric motors	113	X			
Introduction of advanced tech-nologies	438.6	X			
Renewing of the national car fleet	143.1		X	X	
Renewing of national road fleet	66.4		X	X	
Advanced mobility	3.6		X		
Construction of the railway to the Republic of Bulgaria	24.6	X	X		
Electrification of the transport	61.6		X	X	

Financing strategy

The implementation of the mitigation measures in the transport sub-sector are estimated to cost **EUR 11,096 mil.**

The mitigation measures can be financed by a combination of financing mechanisms including green leases, government bonds, long term govt borrowing, E5P-financd electric "green" buses. Key actors for the financing of the measures include banks (e.g. EIB and EBRD), subsidies from central and local governments, and the private sector. A strategic approach for the financing of these measures is the encouraged engagement with the public and the private sector. The private sector can be counted on to produce much of the required investments given certain preconditions, long term debt provided by multilateral banks and other incentives.

For **public transport,** the role of the central government is important. Additionally, financing can be obtained from EIB, EBRD and/or infrastructure bonds. EBRD extended a EUR 145 mil sovereign loan (one-fourth of total project cost) to the Public Enterprise for Railways Infrastructure of North Macedonia (PERI) to modernise and upgrade 2nd phase of the Eastern part of

the Trans-European Rail Corridor VIII. There is a prospective for FDI financing from a Chinese rail project, Budapest-Belgrade-Skopje to Chinese-owned Thessaloniki port. European Union funding is also a possibility as part of a package of transport investment agreed at a summit in Trieste in July 2017, establishing a transport community[1] between the EU and the Western Balkans financed by the EBRD with a grant of EUR 68.6 mil of co-financing from the European Union through the Western Balkans Investment Framework.

The financing of the measures on **renewal and replacement of polluting vehicles** can be covered mostly by the private sector when it is assisted by a "carrot and stick" approach: "buy"/prohibit oldest cars to get them off the road; while subsidizing hybrids.

The table below provides an overview of the proposed financial mechanisms and key actors for the financing of the sub-sector mitigation actions. Box 6 and 7 describe what are the supporting policies for investment in the transport sector and the enabling conditions.

Table 7. Overview of the financial modalities of the mitigation measures for the energy generation sub-sector

Mitigation measures	Budget [EUR]	GHG emission reduction [Gg CO2-eq]	Financial mechanism	Government	Private sector	Banks
Introduction of efficient electric motors	113 mil	113	Green Leases, car loans		X	X
Introduction of advanced technologies	438.6 mil	438.6	Government bonds		X	X
Increased use of the railway	180.6 mil	43.1	Blended finance	X		
Renewing of the national road fleet	2167.7 mil	66.4	Third party finance		X	
Advanced mobility	n/a	3.6	Commercial Banks	X	X	X
Construction of the railway to the Republic of Bulgaria	0.720 mil	24.6	n/a	X		
Electrification of the transport	8292.3 mil	61.6	Long term govt borrowing, E5P-financed electric "green" buses	X	X	

[1] The EU document states that seven new transport projects in the Balkans were agreed at the summit, with an overall value of around €500 million, to be co-funded by the EU. It put the value of the Skopje-Sofia railway at €152 million, by far the biggest of the seven, with the EU grant providing almost half, or €70 million

Box 6. Policies supporting investments in transport sector

Clean transport regulations are dominated by improvement of fuel standards and public transport (electric buses and railways) as well as the renewal of the national fleet. The new Energy Law sets requirements for national standards for fuel quality and obliges the Ministry of Environment to adopt regulations on low carbon fuels. For light vehicle emissions, Regulation 443/2009 will establish a database of the vehicle fleet and its fuel economy. Increasingly tough fuel standards along with incentives for electric vehicles should accelerate the market for EVs, impacting fleet and individual purchase decisions. However, there is no immediate opportunity for private investors until electric vehicles become more prevalent, as charging infrastructure represents a chicken and egg-type barrier to entry. This could be addressed through public private partnerships with large energy or engineering companies seeking EU market share in charging infrastructure.

Box 7. Enabling elements, capacity building, and technical assistance needs

- Adopt a strategic approach to engage the private sector for example by reducing VAT from 18% to 5% for hybrid and electric vehicles; direct subsidizing of hybrid vehicles; excise duties on diesel fuel and petrol. Vehicle permits and "MOT" of used cars.
- Ensure that fuel standards are aligned with EU regulations.
- Design and implement a recycling and disposal policy for batteries of hybrid vehicles in place.
- Design and execute an awareness campaign among key stakeholders and the public, and addressees of the incentive scheme/ action.
- Provide training to key stakeholders (including scrappage facilities, car dealers, etc.).
- Institutionalise a monitoring mechanism to strengthen data and information gathering, reporting, and verification, and to increase compliance.

The Report on Institutional Capacity Assessment (2020) highlights that the following tasks will require institutional capacity:

- Transpose Regulation (EU) 2019/631 and Regulation (EU) 2019/1242
- In order to be able to monitor the implementation of the measures in the Transport sector, and increase the transparency of the implementation of the Enhanced NDC (and other strategic documents), it is necessary to coordinate the MoI system with the new MRV platform, which would work best if a mechanism is found for the MoI to enter this data directly into the MRV platform.
- Coordination and monitoring of the implementation of the projects that will be defined in the new Program for realization of the Energy Strategy, which is expected to be ready in 2021 (and is based on all strategic documents such as the Energy Strategy, NDC, NECP, TBUR) by the Ministry of Economy

3.2. Agriculture, Forestry, and other Land Use (AFOLU)

Target by 2030: GHG reduction of 939.6 Gg CO2-eq
Financing: EUR 93 mil

The mitigation actions identified within the Agriculture, Forestry and other Land Use (AFOLU) sector are split between the following sub-sectors:

- Livestock
- Forestry
- Land use change

Figure 8 depicts the overall GHG emission reduction to be achieved via the mitigation actions in the AFOLU sector, which is expected to be **939.6 Gg CO2-eq** in 2030 compared to 1990. The measures from the **Forestry category** contribute the most to the reduction of greenhouse gas emissions, i.e. **they account for 50.5% of the total emission reduction** from the AFOLU sector in 2030. In order to obtain this reduction, it is necessary to invest **93 € mil. for the period from 2020-2030**. It is estimated that 90% of the investments should come from the private sector. Measures with the **most significant** potential for greenhouse gas emissions reduction are the "**Use of biochar for carbon sink on agricultural land"** and "**Afforestation"**. Box 8 describes the supporting policies for investment in the AFOLU sector.

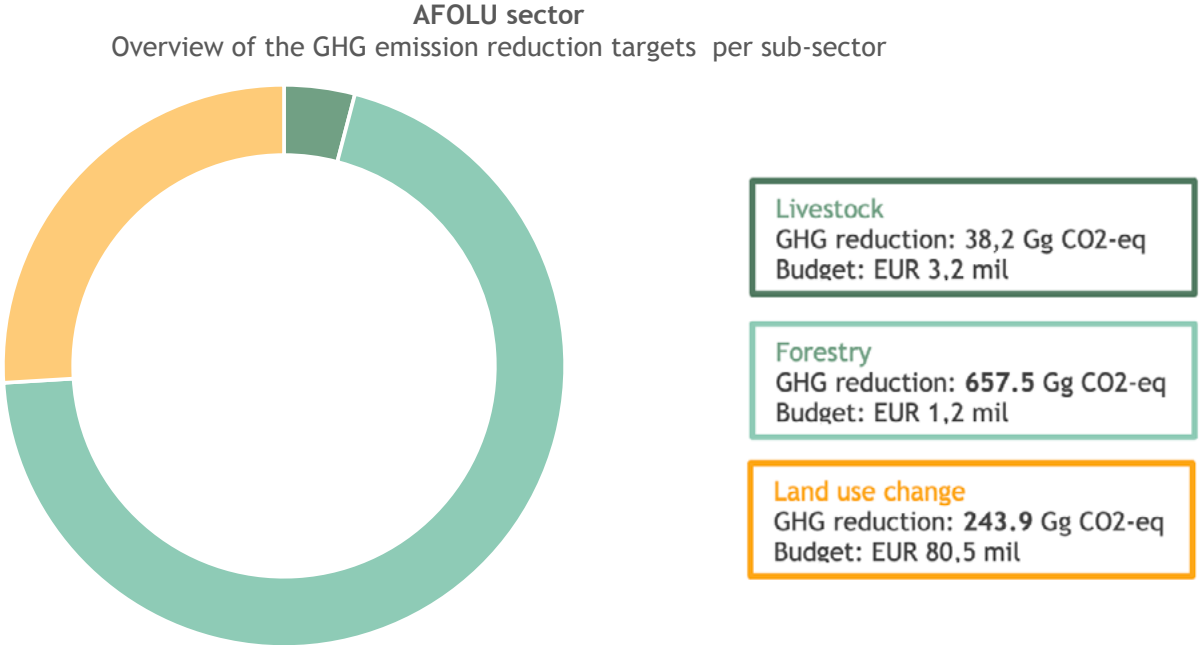


Figure 8. Overview of the mitigation actions under the AFOLU sector

Box 8. Policies supporting investments in AFOLU

North Macedonia has established a sound legal framework for nature protection that is aligned to the EU legislation. As an EU candidate it has ratified all relevant international agreements for nature, participates in the most pertinent meetings and complies with the relevant international reporting obligations. The Government has committed to providing the regulatory, institutional and economic frameworks for sustainable forest management and ensuring permanent financial mechanisms to improve the status of forests and the development of the forestry sector. These regulations must be combined with technology to increase the sequestration of carbon in the country's forests.

3.2.1. Livestock

GHG emission reduction targets for 2030

The mitigation actions defined for the livestock sub-sector aim to achieve GHG emission reductions of **38,2 Gg CO2-eq** by 2030. A substantial part of the GHG emission reductions will be achieved with the Reduction of CH4 emissions from enteric fermentation in dairy cows by 3% (35 Gg CO2-eq), followed by the reduction of N2O emissions (3,2 Gg CO2-eq). Figure 9 shows an overview of the mitigation actions under the livestock sub-sector.

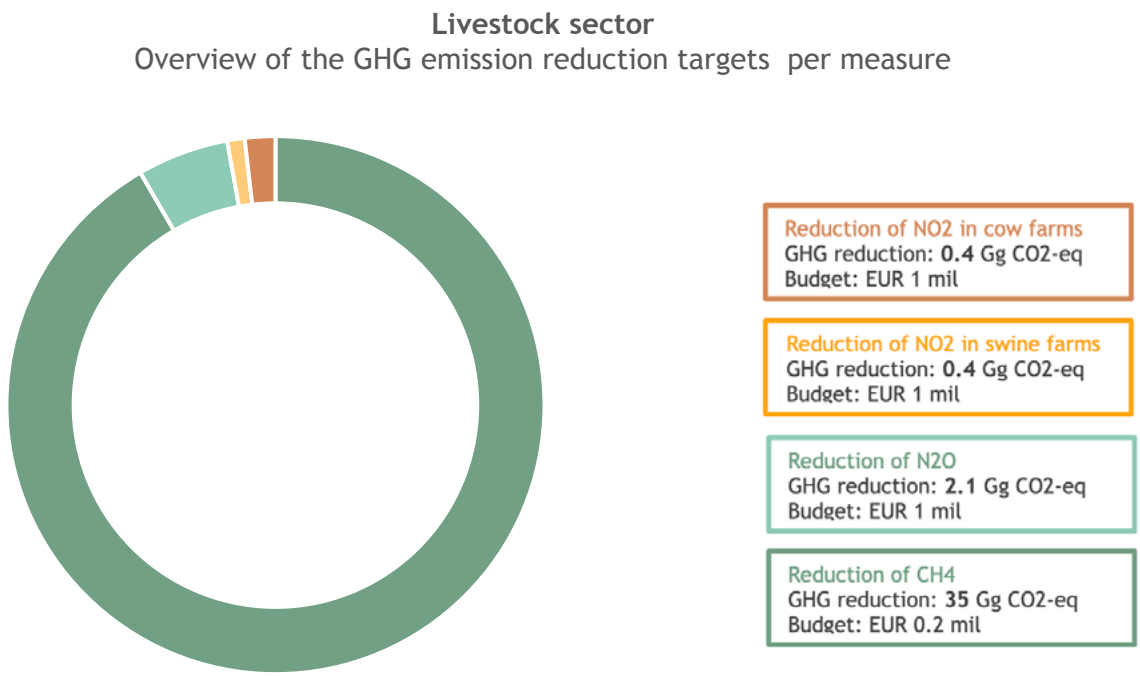


Figure 9. Overview of the mitigation actions under the livestock sector

Mitigation measures

The mitigation actions identified will lead to sub-sector transformation contributing to GHG mitigation in livestock under the Roadmap, and can be implemented in the short-, medium-, and long-term (2020 - 2030). These mitigation actions include:

- **Reduction of CH4 emissions from enteric fermentation:** Modification of the feed composition and nutrition practice
- **Reduction of N2O emissions from manure management:** Improvement of manure management in dairy cows and swine farms

These mitigation measures are of long-term character and will contribute as well to reaching EU targets. The implementation of these measures does not require substantial financing and at the same time will result in social and environmental benefits. Table 8 shows a summary of the mitigation sectors and their alignment with the SDGs.

Table 8. Overview of the types of mitigation actions under the livestock sub-sector.

Mitigation actions	GHG emission reduction [Gg CO2-eq]	Type			SDG
		Technical	Regulatory	Policy	
Reduction of CH4 emissions from enteric fermentation in dairy cows by 3%	35.0	X			
Reduction of N2O emissions from manure management in dairy cows by 20%	2.1	X			
Reduction of NO2 emissions from manure management in swine farms by 13%	0.4	X	X		
Reduction of N2O emissions from manure in dairy cows by 20% for farms below 50 Livestock Units	0.7	X	X		

Financing strategy

The implementation of the mitigation measures on livestock are estimated to cost **EUR 3.2 million**. Table 9 summarises the financial modalities for this sub-sector.

A strategic approach for the financing of these measures is the engagement with the private sector and carbon offset projects.

The government can incentivise desired feed types and feed suppliers to reduce emissions through animal feed. Biogas-based energy production already exists in North Macedonia. Industrial-scale manure treatment systems could be financed through the creation of a special purpose vehicle (SPV) with dairy farms investing alongside 3rd party investors.

Government regulations should require manure treatment and methane emission control (closed storage) with enforcement. Reusing manure as fertilizer represents an economic benefit and a potential reduction in emissions for those that otherwise use chemical fertilizer.

Table 9. Overview of the financial modalities of the mitigation measures for the livestock sub-sector

Mitigation measures	Budget [EUR]	GHG emission reduction [Gg CO2-eq]	Financial mechanism	Government	Private sector	Banks
Reduction of CH4 emissions from enteric fermentation in dairy cows by 3%	0.2 mil	35.0	Direct investment plus offsets		X	
Reduction of N2O emissions from manure management in dairy cows by 20%	1 mil	2.1	Direct investment plus offsets		X	
Reduction of NO2 emissions from manure management in swine farms by 13%	1 mil	0.4	Direct investment plus offsets		X	
Reduction of N2O emissions from manure in dairy cows by 20% for farms below 50 Livestock Units	1 mil	0.7	Direct investment plus offsets		X	

3.2.2. Forestry

GHG emission reduction targets for 2030

The mitigation actions defined for the forestry sub-sector aim to achieve GHG emission reductions of **657.5 Gg CO2-eq** by 2030. The GHG emission reductions targets will be achieved with the Establishing integrated management of forest fires (345 Gg CO2-eq), and afforestation measures (312.5 Gg CO2-eq). Figure 10 below shows an overview of the mitigation actions under the forestry sub-sector.

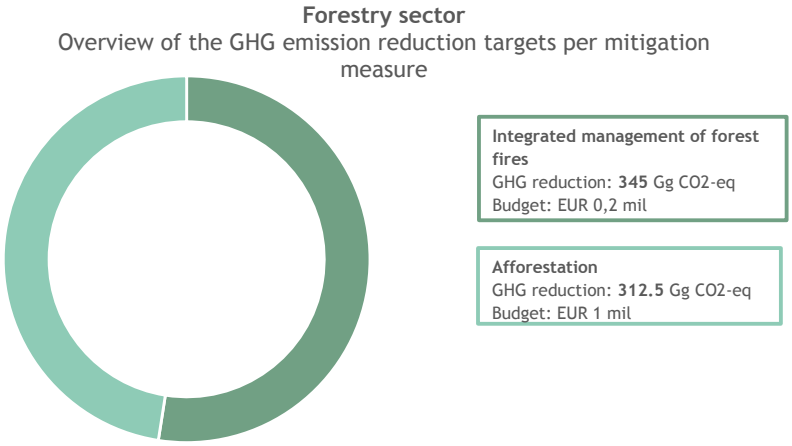


Figure 10. Overview of the mitigation actions under the forestry sector

Mitigation measures

The mitigation actions identified will lead to sub-sector transformation contributing to GHG mitigation in livestock under the Roadmap, and can be implemented in the short-, medium-, and long-term (2020 - 2030). These mitigation actions include:

- **Integrated management of forest fires:** Reducing the average annual burned area for 6000 ha
- **Afforestation:** Afforestation of 5000 ha of barren land with Oak (Quercus spp.)

These long-term measures will also contribute to reaching EU targets. The implementation of these measures does not require substantial financing and at the same time will result in considerable GHG emission reductions and additional social and environmental benefits (815 new jobs). Table 10 shows a summary of the mitigation sectors and their alignment with the SDGs.

Table 10. Overview of the types of mitigation actions under the forestry sub-sector.

Mitigation actions	GHG emission reduction [Gg CO2-eq]	Type			SDG
		Technical	Regulatory	Policy	
Establishing integrated management of forest fires	345	X			
Afforestation	312.5	X			

Financing strategy

The implementation of the mitigation measures in the forestry sector is estimated to cost **EUR 1.2 mil.**

A strategic approach for the financing of these measures consists of engagement with the private sector and carbon offset projects for the afforestation activities. Table 11 summarises the financial modalities for this sub-sector.

Table 11. Overview of the financial modalities of the mitigation measures for the forestry sub-sector

Mitigation measures	Budget [EUR]	GHG emission reduction [Gg CO2-eq]	Financial mechanism	Government	Private sector	Banks
Establishing integrated management of forest fires	0.2 mil	345	Government budget		X	
Afforestation	1 mil	312.5	Carbon developers		X	

Box 9. Enabling elements, capacity building, and technical assistance needs

Currently in North Macedonia, all recent relevant strategic documents for climate change include policies and measures from the LULUCF sectors. However, the Report on Institutional Capacity Assessment (2020) highlights that it is necessary in the future to make explicit verification whether the total GHG emissions and removals from these sectors are in line with the Regulation (EU) 2018/841. Additionally, there is no National forestry accounting plan yet developed in Macedonia, which is required by the Regulation.

3.2.3. Land use change

GHG emission reduction targets for 2030

The mitigation actions defined for the forestry sub-sector aim to achieve GHG emission reductions of **243,9 Gg CO2-eq** by 2030. The GHG emission reductions targets will be achieved with the Establishing integrated management of forest fires (345 Gg CO2-eq), and afforestation measures (312,5 Gg CO2-eq). Figure 11 shows an overview of the mitigation actions under the land use sub-sector.

Land use change
Overview of the GHG emission reduction targets per mitigation measure

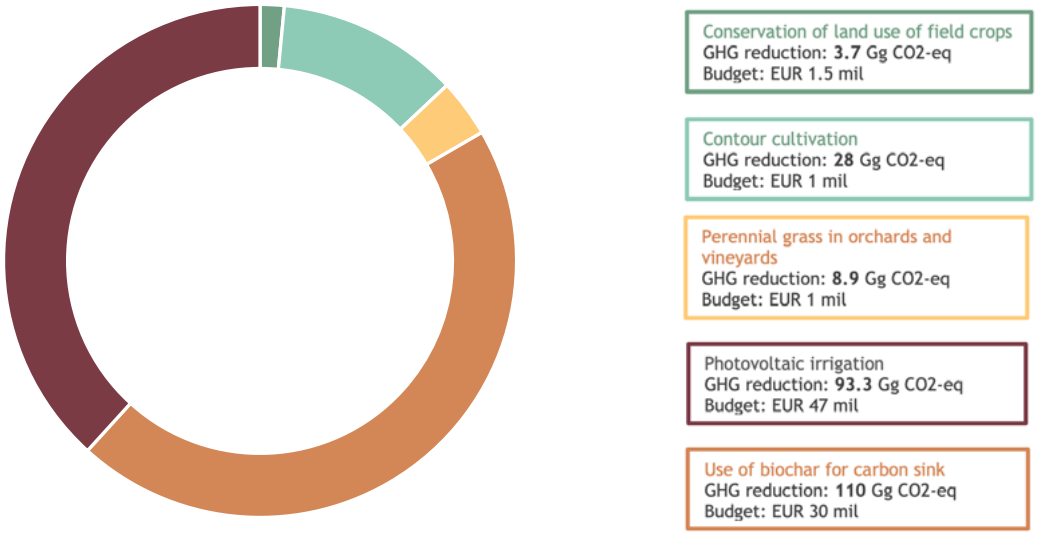


Figure 11. Overview of the mitigation actions under the land use change.

Mitigation measures

The mitigation actions identified in the land-use sub-sector will enhance the carbon sinks via the following measures:

- **Conversion of land use of field crops above 15% inclination**: To reduce the intensity of soil erosion and loss of soil organic matter
- **Contour cultivation on areas under field crops on inclined terrains (5-15%):** To reduce erosion of topsoil and conservation of soil organic mater
- **Use of biochar for carbon sink on agricultural land:** Carbon sink through negative emission technology.

These mitigation measures are of short-to mid-term character and will contribute as well to reaching EU targets. The measures for the conversion of land can be implemented with no costs and thus should be a priority. Contour cultivation means that all agro-technical operations should be across slope and exclude areas above 15% inclination. With a systematic campaign for increasing the awareness of the farmers, this measure can be widely adopted. Using government land, it may be possible to offer smaller plots of better land in exchange for the inclined terrains. The implementation of these measures does not require substantial financing and at the same time will results in multiple additional social and environmental benefits. Table 12 shows a summary of the mitigation sectors and their alignment with the SDGs.

Table 12. Overview of the types of mitigation actions under the land use sub-sector.

Mitigation actions	GHG emission reduction [Gg CO2-eq]	Type					SDG
		Technical	Regulatory	Policy	Research	Educational	
Conversion of land use of field crops above 15% inclination	3.7	X				X	
Contour cultivation on areas under field crops on inclined terrains	28	X				X	
Perennial grass in 9 orchard and vineyards on inclined terrains (>5%)	8.9	X				X	
Use of biochar for carbon sink	110	X			X	X	
Photovoltaic irrigation	93.3	X			X	X	

Financing strategy

The implementation of the mitigation measures on land use change are estimated to cost **EUR 80,5 mil**. Table 13 summarises the financial modalities for this sub-sector.

A strategic approach for the financing of these measures consists of engagement with the private sector and carbon offset projects.

Table 13. Overview of the financial modalities of the mitigation measures for the land use sub-sector

Mitigation measures	Budget [EUR]	GHG emission reduction [Gg CO2-eq]	Financial mechanism	Government	Private sector	Banks
Conversion of land use of field crops above 15% inclination	1.5 mil	3.7	Direct investment plus offsets		X	
Contour cultivation on areas under field crops on inclined terrains	1 mil	28	Direct investment plus offsets		X	
Perennial grass in 9 orchard and vineyards on inclined terrains (>5%)	1 mil	8.9	Direct investment plus offsets		X	
Use of biochar for carbon sink	30 mil	110	Carbon developers		X	
Photovoltaic irrigation	47 mil	93.3	n.a.		X	

3.3. Waste

Target by 2030: GHG reduction of 663.5 Gg CO2-eq
Financing: EUR 58.6 mil

The mitigation actions in the waste sector focus on **landfill gas,** which has the most significant potential for greenhouse gas emissions reduction. Figure 12 depicts the overall GHG emission reduction to be achieved via the mitigation actions in the waste sector, which is expected to be **663.5 Gg CO2-eq** in 2030 compared to 1990.

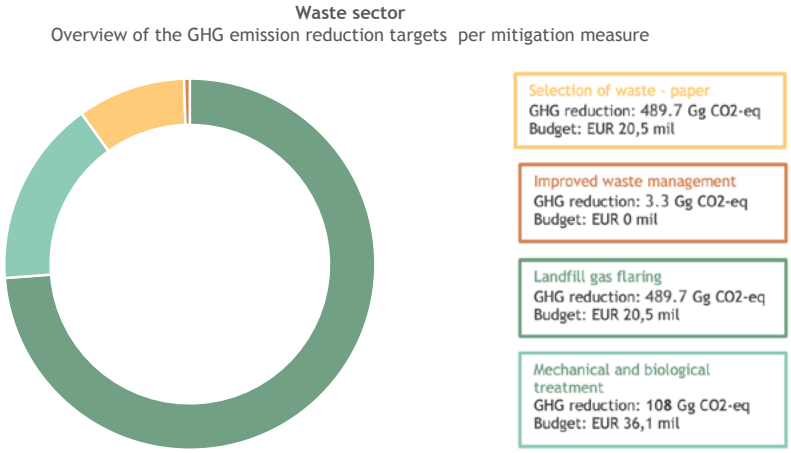


Figure 12. Overview of the mitigation actions under the waste sector

Mitigation measures

The mitigation actions identified will lead to sub-sector transformation contributing to GHG mitigation in waste sector under the Roadmap, and can be implemented in the short-, medium-, and long-term (2020 - 2030). These mitigation actions include:

- **Landfill gas flaring**
- **Mechanical and biological treatment (MBT) in new landfills with composting**
- **Selection of waste – paper**
- **Improved waste and materials management at industrial facilities stablishing integrated management of forest fires**

These long-term measures will also contribute to reaching EU targets. The implementation of these measures does not require substantial financing and at the same time will results social and environmental benefits. Table 14 shows a summary of the mitigation sectors and their alignment with the SDGs.

Table 14. Overview of the types of mitigation actions under the waste sector

Mitigation actions	GHG emission reduction [Gg CO2-eq]	Type			SDG
		Technical	Regulatory	Policy	
Landfill gas flaring	489.7	X			 
Mechanical and biological treatment (MBT) in new landfills with composting	108	X			
Selection of waste - paper	62.5	X			
Improved waste and materials management at industrial facilities	3.3	X			

Financing strategy

For the implementation of the mitigation scenario in the waste sector, the required investments are **EUR 58.6 mil.** The financing of landfill-to-energy projects, which capture methane from landfills to generate electricity, have two main revenue streams: electricity sales and (potentially) carbon offset sales.

Concessions with municipalities and Power Purchase Agreements (PPAs) with energy offtakes are needed. Table 15 summarises the financial modalities for this sub-sector. Box 10 provides information regarding the enabling conditions for the effective implementation of the mitigation measures in the waste sector.

Table 15. Overview of the financial modalities of the mitigation measures for the forestry sub-sector

Mitigation measures	Budget [EUR]	GHG emission reduction [Gg CO2-eq]	Financial mechanism	Government	Private sector	Banks
Landfill gas flaring	20.5 mil	489.7	Carbon offsets		X	
Mechanical and biological treatment (MBT) in new landfills with composting	36,1 mil	108	Carbon offsets		X	
Selection of waste - paper	2	62.5	Carbon offsets		X	
Improved waste and materials management at industrial facilities	0	3.3	Carbon offsets		X	

Box 10. Enabling elements, capacity building, and technical assistance needs

As there are no coherent national policy promoting municipal waste recycling and no investment programmes aimed at creating the necessary infrastructure at the municipal level, the following enabling policies will be needed for the effective implementation of the mitigation measures:

- A regulation that mandates flaring will create a baseline for landfill owners in terms of costs
- Landfill gas-based power production with a specific feed-in tariff
- A comprehensive monitoring and reporting on waste measurement for GHG emissions

3.4. Additional mitigation measures

To effectively implement the mitigation measures and achieve the ambitious targets of the ENDC, it is important to create the enabling conditions such as regulatory, technical and research enablers. The ENDC has identified 16 additional measures to enable the concrete mitigation actions. These additional measures focus on enabling the transition of the energy sector to a low-carbon sustainable energy system. Table 16 includes a summary of the additional mitigation measures with an estimated budget.

A key measure is the introduction of the CO_2 tax, which will enable the government to set the desired market signals immediately and allow for a gradual increase in the tax in support of Macedonian goals related to the Paris Agreement, Energy Community and EU accession. Implementing the tax would build experience in the country with carbon pricing and allow time and develop systems and build capacity needed to join the EU ETS in the future. In this regard, a Roadmap for the Introduction of a National Carbon Tax in North Macedonia has been prepared and guides the actions under this measure.

The 16 additional measures include:

1. Introduction of CO2 tax: Introduction of CO2 tax to stimulate the investments in RES and to increase the penetration of energy efficiency measures

2. Program for just transition: Development of socially responsible programmes for just transition to mitigate negative effects of associated job losses from the proposed measures.

3. Identification of the proper location for solar and wind power plants: Development of methodology for selection of the most appropriate location for solar and wind power plants considering social and environmental aspects.

4. Smart communities: Smart academic campuses could have an exemplary role where all advanced concepts and principles from smart energy systems can be tested with the goal for roll-out on larger scale.

5. Construction of 400 kV electricity transmission interconnection North Macedonia-Albania (Bitola-Elbasan): This project is the last segment of the Corridor 8 for transmission of electricity between Bulgaria, North Macedonia, Albania and Italy. The project is included in the List of Projects of Energy Community Interest (PECI).

6. Develop natural gas cross-border infrastructure to diversify supply routes and increase market competitiveness

7. Develop gas transmission network: Increase the access to the transmission network access for the industrial consumers.

8. Develop a gas distribution network: Diversification of the energy resources with focus on natural gas

9. Pursue regional electricity market integration: increase the electricity price competitiveness and affordability: Increase the electricity price competitiveness and affordability.

10. Develop further distribution system network to integrate more RES, including prosumers and more electric vehicles (EVs), as well as continuously improve network reliability

11. Price signal demand response: Introduce price signals to consumers in order to implement demand response.

12. Adoption of annual program for vulnerable consumers: Develop program for vulnerable costumers is needed that will protect them from the price shocks.

13. Participation in development of energy transition technologies and measures: Streamline energy transition technologies and measures into national R&I priorities

14. Increased level of education of sustainable energy needs: Adjust energy related curricula at all educational levels to make them responsive to energy transition trends

15. Inter-sectoral and geographical mobility of researchers: Encourage inter-sectoral and geographical mobility of researchers

16. Increase the role of SME sector in energy transition: Encourage SME sector to diversify their portfolio of services and products in RES and EE.

Table 16. Summary of the additional mitigation measures

Additional mitigation actions	Type				Budget [EUR]
	Technical	Regulatory	Research	Educational	
Introduction of CO2 tax		X			n.a
Program for just transition		X			n.a
Identification of the proper location for solar and wind power plants	X				n.a
Smart communities	X			X	n.a
Construction of 400 kV electricity transmission interconnection Macedonia-Albania	X				34 mil
Develop natural gas cross-border infrastructure	X	X			n.a
Develop gas transmission network	X				200 mil
Develop a gas distribution network:	X				n.a
Pursue regional electricity market integration		X			n.a
Develop further distribution system network to integrate more RES	X	X			n.a
Price signal demand response:		X			n.a
Adoption of annual program for vulnerable consumers	X	X			n.a
Participation in development of energy transition technologies and measures			X		n.a
Increased level of education of sustainable energy needs:		X	X		n.a
Inter-sectoral and geographical mobility of researchers		X	X		n.a

4. Implementation pathway

The implementation of the ENDC Roadmap will consider three timescales: short-term (2020-2022), mid-term (2022 – 2025) and long-term (2025 – 2030). Figure 13 shows the series of steps and measures to be implemented split by sector and according to the period for implementation.

	Short-term 2020-2022	Mid-term 2022-2025	Long-term 2025-2030
Energy Sector	**Energy generation**		
	Reduction of network losses		
	Incentives		
	Solar rooftop power plants		
	RES without incentives		
	Energy efficiency		
	Replace incandescent lights	New passive buildings	Heat pumps
	Street lightening	Solar thermal/ solar thermal PV	Increased use of central heating
	Retrofitting residential buildings		
	Transport		
		Railway	Renew car fleet
			Electrification of transport
AFOLU	**Livestock**		
	Reduction of CH4 emissions		
	Reduction of N20 emissions		
	Forestry		
	Integrated management of forest fires		
	Afforestation		
	Land use change		
	Conversion of land use	Biochar for carbon sink	
	Perennial grass	Photovoltaic irrigation	
Waste	**Waste sector**		
		Landfil gas flaring	
		Mechanical and biological treatment	
		Selection of waste - paper	
		Improved waste and materials management	

Figure 13. Overview of the timeline for the implementation of the mitigation measures

5. Governance structure and institutional capacity for ENDC implementation

5.1. Governance structure

The Roadmap is important not only to the climate change commitments of the Government of North Macedonia, but also to its contribution to the sustainable low-carbon development of the electricity (and energy efficiency) and transport sectors in North Macedonia as linked to their individual sectoral planning and alignment with the EU targets. The actions and elements related to the implementation of the Roadmap will require constant coordination and active efforts amongst stakeholders within the Government of North Macedonia, private sector, civil society and development partners.

The implementation of the policies and measures foreseen under the ENDC requires comprehensive policy planning, coordination, and implementation processes. This must be enabled by a comprehensive legal basis and legally established coordination instruments to facilitate cross-sectoral policy design and implementation, as well as mechanisms for monitoring the implementation of the foreseen policies and measures. The draft Law on Climate action provides an enabling environment for overarching policy coordination processes and defines the legal mechanism for monitoring progress towards the achievement of the national sustainable development pathway.

The draft Law on Climate Action defines the MoEPP as the leading institution to coordinate climate related activities as well as to establish the National Inventory System and the System for Reporting on Policies, Measures, and Projections of Republic of North Macedonia. As climate change is cross-sectoral, coordination and cooperation with other governmental stakeholders are crucial. While the overall coordination of activities in relation to the ENDC is under the responsibility of the MoEPP, there is a need for joint work and close coordination among all institutions for the effective implementation of mitigation actions and achievement of the set targets.

The draft Law foresees the establishment of an intergovernmental body – National Climate Change Council, which will assess the progress in the implementation of national strategies and plans related to climate change. This Council will bring together representatives from government institutions and provide a platform for inter-agency coordination, high-level strategic support and aligned implementation of the ENDC measures.

5.2. Institutional capacity

The effective implementation of the measures under the ENDC requires increased institutional capacities on the part of national governments. These capacities relate to six main sets of issues[2]:

1. Ability to launch and **coordinate** a whole-of-government process, incorporating contributions from all relevant governmental agencies and non-governmental parties as relevant.
2. Capacity to **integrate** NDC priorities into sectoral and cross- sectoral programmes and projects, to ensure that the latter do not undermine efforts to achieve the former, or vice versa.
3. Resources to **train** relevant government agency staff (and possibly non-government agency staff too), with a view to increasing the technical and managerial skills of these individuals.
4. Ability to engage all relevant stakeholders through **consultations** designed to elicit their input, so that this can be taken into consideration, thus increasing buy-in from stakeholders.
5. Competence to conduct a **regulatory framework revision**, to streamline and complement existing laws and regulations and strengthen related governmental processes and entities.
6. Ability to monitor progress and **report** on it, making the best use of existing data collection mechanisms and strengthening related capabilities wherever needed.

Additionally, the Republic of North Macedonia is a Contracting Party of the Energy Community (ENC), so it must comply with the specific requirements as presented by European Commission, EU policies and legislation regarding climate change action:

- EU Emissions Trading System (EU ETS) to reduce greenhouse gas emissions from the power sector, industry and flights within the EU
- Boosting energy efficiency, renewable energy and governance of EU countries' energy and climate policies

To assess the institutional and individual capacities for the implementation of the ENDC, two assessments (at individual and institutional level) were conducted: (1) Report on Institutional Capacity Assessment and (2) Capacity and Training Needs Assessment for Transparency in Climate Change MRV.

Both studies highlight that implementing a national administrative system for climate change requires suitable resources. Establishing and maintaining proper organizational relationships, establishing and adapting data flows, recruiting and retaining expertise, developing and implementing systems and tools, and delivering new outputs all require careful planning and maintaining of resources. It is critical that capacities are strengthened on climate change-relevant topics and in particular monitoring and reporting (e.g. MRV).

The results from the institutional assessment emphasize that capacity is needed to fulfil the reporting requirements of the Integrated National Energy and Climate Plans - NECP (every 10 years), Long-term Strategies (every 10 years, covering a planning period of at least 30 years), the Biennial progress reports and their follow up - Integrated National Energy and Climate Progress Reports (every two years).

[2] Bakhtiari, F., Hinostroza, M., and Puig, D. (2018): Institutional capacities for NDC implementation: a guidance document. UNEP DTU Partnership. Copenhagen

In parallel, accessing the EU ETS will require the Government to designate which authorities will be responsible for the establishment of the necessary policy and regulatory frameworks, and implementing the EU ETS will require additional decisions. Even before North Macedonia becomes an EU member, according to the guidelines of the Energy Community and in line with the Energy Strategy adopted by the Government, as well with the Enhanced NDC, it will be necessary to establish a national carbon pricing system (either voluntary or obligatory) in order to achieve the ambitious national climate change targets. The introduction of a such system would be a step towards entry into the European Union's scheme upon joining.

Additionally, there is a need to adopt in the near future guidelines for climate budget tagging to improve transparency and to enable the Government to capture, measure, report, and verify climate finance.

6. Financing the ENDC

6.1. Investment strategy

Financing requirements for the North Macedonia ENDC exceed EUR 20 billion in expenditures through 2030. The Roadmap seeks to establish a comprehensive implementation and financing pathway considering the most attainable financing scenarios given current investment patterns and structures for the country's largest emissions sector, energy, as well as the other sectors of waste, and AFOLU. It also considers the fiscal implications of the COVID-19 pandemic and the need to rebuild the economy with a new source of green jobs, by prioritising those measures as part of the methodology.

For the implementation of the mitigation measures under the ENDC, there is a need to engage diverse actors (central government, the private sector, development banks) and a mix of financial instruments. The Financing Strategy for the Macedonian enhanced Nationally Determined Contributions to Climate Change, provides a detailed overview and strategic approach to mobilize climate finance for the achievement of the ENDC targets by 2030. Box 11 shows a snapshot of the key guidance from the Financing Strategy. Given the nature of the mitigation measures and the required investments, a prioritization and identification of key de-risking investment actions are outlined in the report De-risking investments in North Macedonia's enhanced Nationally Determined Contributions.

Box 11. Prioritising mitigation measures for investment

The Financing Strategy was designed based on a set of prioritization criteria for the mitigation measures, including:

1. Invest first in those sectors which contribute the most to NDC emission targets
2. Invest in high-return technologies
3. Target infrastructure technologies with rapidly decreasing costs
4. Maximise green infrastructure jobs
5. Finance measures which maximise EU and other investment sources
6. Choose measures which can be highly leveraged by existing and planned regulation
7. Leverage funds made available from a national carbon tax
8. Maximise impact and benefits of the voluntary carbon markets

Source: UNDP, 2021. Financing Strategy for the Macedonian enhanced Nationally Determined Contributions to Climate Change

Regarding investments, the private sector has a dominate role as it participates with 85% in total investments needed for realization of the PAMs. So far, supported by feed-in tariff mechanism, 110 private companies have invested in 140 MW RES capacities (dominantly solar and small hydro). Table 17 presents a summary of the sources of funding of the mitigation actions by sector.

Table 17. Overview of the sources of funding for the mitigation actions per sector and in total

	Source of Funding	Total amount (ml EURO)	%
Energy	All	24,863	100%
	Government ONLY	925	4%
	Other source of financing ONLY (No government)	10,527	42%
	Mixed financing (government +private sector, donors, consumer)	13,411	54%
Agriculture	All	110	100%
	Government ONLY	0	0%
	Other source of financing ONLY (No government)	110	100%
	Mixed financing (government +private sector, donors, consumer)	0	0%
Waste	All	58.6	100%
	Government ONLY	0	0%
	Other source of inancing ONLY (No government)	58.6	100%
	Mixed financing (government + private sector, donors, consumer)	0	0%
Total	**All**	**25,031**	**100%**
	Government ONLY	925	4%
	Other source of financing ONLY (No government)	10,696	43%
	Mixed financing (government + other (private sector, donors, consumer)	13,411	54%

Source: UNDP, 2021. Financing Strategy for the Macedonian enhanced Nationally Determined Contributions to Climate Change

Box 12. Policies supporting investments for ENDC

North Macedonia's adoption of the Law on Strategic Investment (SIP) intends to encourage, attract, and create conditions for conducting strategic investments and will be of great importance to its ability to attract capital for the energy transition[3].

With SIP, the Government is firmly in the position to create financial conditions for large scale infrastructure investment. It may devise, within limits, subsidies, write-off or takeover of debts, exemption, reduction, or postponement of taxes, and granting loans and guarantees under favourable conditions. The Law on Strategic Investments optimises conditions for foreign investment, assuming it complies with environmental standards and strategic priorities.

Priority areas for the SIP are energy and infrastructure; potential investors in renewable energy will uniquely benefit from the SIP designation. With multiple, low-risk investment opportunities in sight, investors could initiate a large new investment cycle, positively impact the Country's competitive advantages and economic growth.

[3] Government of North Macedonia, 2020. Law on Strategic Investments. Available online: https://dejure.mk/zakon/zakon-za-strateshki-investicii-vo-republika-severna-makedonija

6.2. Financing instruments

Most of the mitigation measures can be financed through diverse financing instruments including private capital, international blended capital structures, for-profit vehicles such as energy efficiency funds, or low interest capital sourced from the international capital markets, such as green bonds. Private carbon funds and offset aggregators, which develop zero emission projects in anticipation of sale of offsets and removal credits can support these efforts, especially in the nature-based finance category. The Financing Strategy for the Macedonian enhanced Nationally Determined Contributions to Climate Change highlights that:

- Most of the measures, except regulatory measures, can be financed through private capital.
- Sources include international blended capital structures, for-profit vehicles such as EBRD energy efficiency funds, or low-interest capital sourced from the international capital markets, such as green bonds.
- Private carbon funds and offset aggregators which develop zero emission projects in anticipation of sale of offsets and removal credits can also support these efforts, especially in the nature-based finance category.
- Large renewable energy projects already benefit from government guarantee mechanisms to offset payment risk.
- A national or regional green bank could act as a repository of capital and expertise to assist in accelerating transition.
- New technologies and projects need to be developed as "shovel ready" investor opportunities to create a long-term competitive advantage for North Macedonia.

Further financing instruments include large renewable energy projects which benefit from government or international guarantee mechanisms, as well as a national or regional green bank, which could act as a repository of capital and expertise to assist in accelerating transition. New technologies need to be developed as "shovel ready" investor opportunities.

Though North Macedonia has made progress in implementing financial instruments and gaining support for energy sector investments in the past, the scale of investments needed for the implementation of the Roadmap outpaces North Macedonia's current ability to finance the transformational change envisioned by the ENDC. Therefore, new or significantly expanded financial instruments and support are needed. Example of such instruments are the green bonds. Figure 14 presents an overview of the existing and proposed financing instruments for the investments for the ENDC.

Green bonds: A green bond is a debt security that is issued to raise capital specifically to support climate related or environmental projects. North Macedonia can benefit from a growing, global determination among institutional investors to invest the world's capital to work for climate change mitigation. One way to tap into this opportunity is through the green bond market, which started a little over a decade ago with the EIB's first issuance of a Climate Awareness Bond in 2007. EUR 600 million was allocated to 14 renewable energy and energy efficiency projects. Since then, the market has grown substantially, particularly in the past 5 years. It offers significant growth potential to transitioning countries like North Macedonia.

By bridging the gap between providers of capital and green assets, green bonds help to reduce the cost of finance to meet climate targets. Like conventional bonds, green bonds allow the bond issuer to raise funds for projects or ongoing businesses; the "green" label indicates that the capital raised will be used to finance environmentally beneficial projects, and this is closely monitored.

Along with the growing amount of capital raised, the market has expanded to include a growing variety of issuers – the majority from Europe, then North America, and increasingly from Asia-Pacific, Latin America and Africa. Issuers and currencies in which green bonds are offered have also seen diversification. Green bonds are now issued by public and private institutions, including governments, government agencies, private corporations and financial institutions. In North Macedonia, green bonds could be used to raise long term, low interest rate capital with which to finance renewable energy, natural capital solutions such as carbon sequestration, etc. Structuring green bond exchange risk, monitoring and transparency will receive support from international aid.

An example of a potential green bond project sphere is hydropower. New certification tools are available to developers and operators that want to raise funds via green bonds. The International Hydropower Association (IHA) has stated that the hydropower criteria introduced by the Climate Bonds Initiative under the International Climate Bonds Standard clears the way for significant green investment in sustainable hydropower projects. Planned and finished hydropower projects of all sizes will be eligible for financing provided they meet strict qualifying criteria.

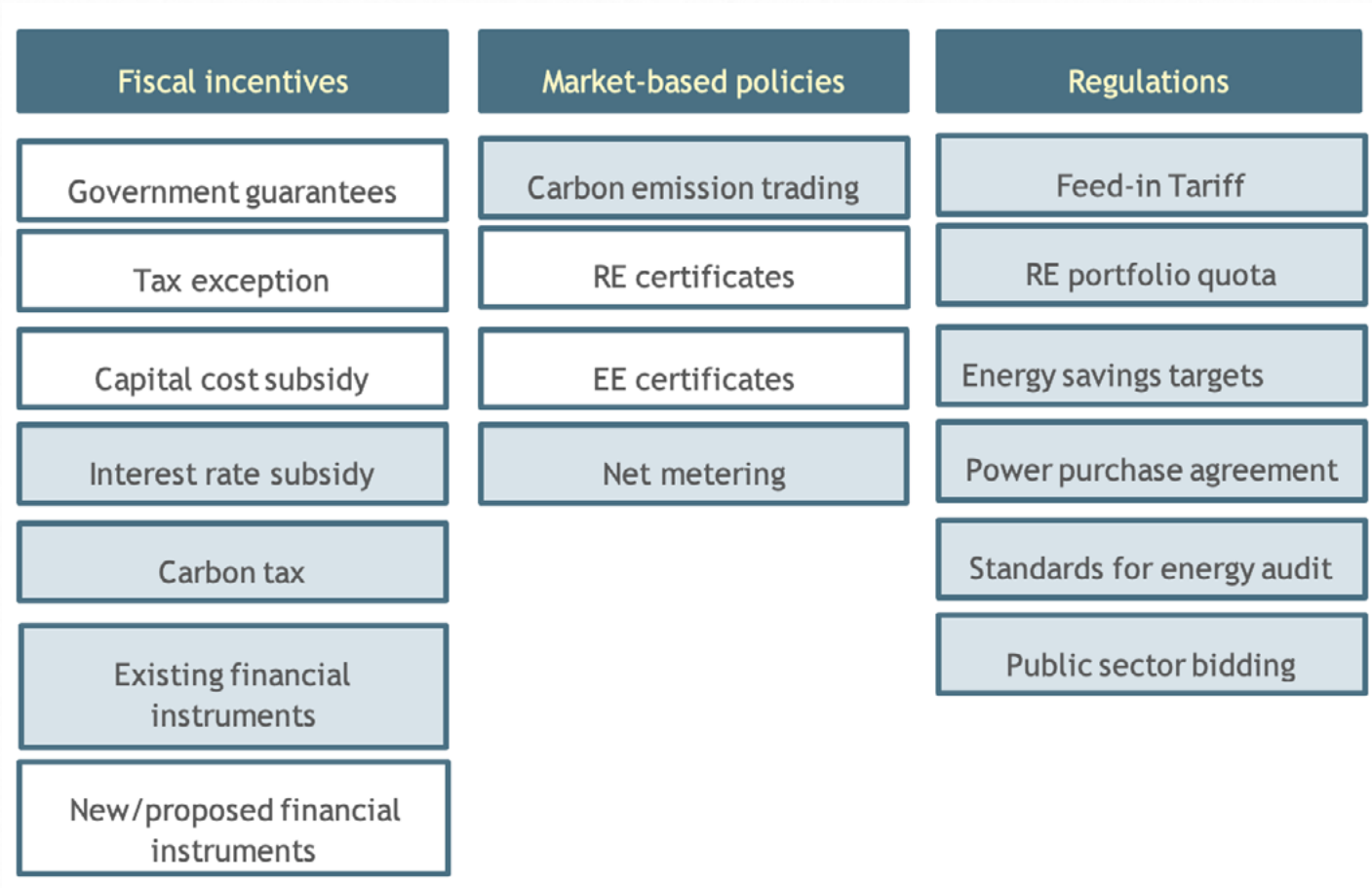


Figure 14. Existing (blue) and proposed (white) financial instruments supporting the investments for the ENDC

Republic of North Macedonia
Ministry of Environment and Physical Planning

NDC Implementation Roadmap for North Macedonia 2020-2030

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