REPUBLIC OF NORTH MACEDONIA
MINISTRY OF ENVIRONMENT AND PHYSICAL PLANNING

NDC 3.0
TECHNICAL BACKGROUND DOCUMENT

Evidence base for the **Republic** of North Macedonia's Third Nationally Determined Contribution

MITIGATION

ADAPTATION

FINANCE

JUST TRANSITION

VULNERABLE GROUPS

YOUTH

GENDER

OTHER ENABLING AREAS



Technical analysis • 2026

This document was prepared within the framework of the project “From Pledge to Impact” – NDC 3.0 of the Climate Promise initiative, implemented by the United Nations Development Programme (UNDP) and the Ministry of Environment and Physical Planning (MoEPP) of the Republic of North Macedonia. The project supports the revision of the Nationally Determined Contribution (NDC) in line with the obligations under the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement.

National Contact Person for the UNFCCC

Dr. Teodora Obradovic Grncarovska

UNDP Team

Jozhe Jovanovski, M.Sc. - Project Manager

Anita Kodzoman - Programme Officer

Darko Crvenkovski - Programme Associate

MANU Team

Academician Ljupcho Kocarev

Corresponding Member of MANU Prof. Mirko Todorovski, PhD

Senior Research Associate Aleksandar Dedinec, PhD

Senior Research Associate. Verica Taseska-Gjorgievska, PhD

M.A.. Vasko Popovski

Prof. Aleksandra Dedinec, PhD

PhD. Jana Prodanova

PhD. Tatjana Dzambazovska

M.Sc. Emilia Mihajloska Ivanoski

B.Sc. Eng. Onur Amet

Project Working Group on Climate Change established by the Ministry of Environment and Physical Planning

Office of the President of the Republic of North Macedonia

Prof. Vlado Spiridonov, Ph.D, member

Aleksandra Mihajlovska Stojanova, deputy member

Government of the Republic of North Macedonia - Office of the Prime Minister

Prof. Dame Dimitrovski, Ph.D, member

Elizabeta Pangovska, deputy member

Ministry of Energy, Mining and Mineral Resources

Mino Markovski, member

Marija Trpevska, deputy member

Ministry of Education and Science

Safet Neziri, member

Nadica Kostoska, deputy member

Ministry of Digital Transformation

Olivera Jaksic Trantalovska, member

Tomas Jamalov, deputy member

Ministry of Social Policy, Demography and Youth

Jasmina Ivanova, member

Svetlana Cvetkovska, deputy member

Ministry of Foreign Affairs and Foreign Trade

Ilir Islami, member

Ministry of Transport

Irena Jovanova Popovska, member

Ministry of Agriculture, Forestry and Water Economy

Frosina Simoska, member

Maja Lazareska Joveska, deputy member

Ministry of Culture and Tourism

Davcha Spasova, member

Elena Pavlova, deputy member

Ministry of Local Self-Government

Trajche Malov, member

Ibrahim Idrizi, deputy member

Ministry of European Affairs

Njomza Rochi Xheladini, member

Irena Marinova, deputy member

Ministry of Finance

Marina Stanojkova Arsovski, member

Elena Karanfiloska, deputy member

Spatial Planning Agency

Hristina Odzaklieska, member

Andriana Andreeva, deputy member

Agency for Innovation, Scientific and Technological Development and Entrepreneurship

Marija Janevska, member

Brankica Miladinova, deputy member

Regulatory Commission for Energy, Water and Municipal Waste Management Services of the Republic of North Macedonia

Katarina Mancheva, member

Bojana Stojchevska, deputy member

Institute for Standardization of the Republic of North Macedonia

Violeta Shareska-Djakovska, M.Sc., member

Ruzica Jovanovic Malinovska, PhD, deputy member

Hydrometeorological Directorate

Aleksandra Stevkov, member

Aleksandar Prodanov, deputy member

Crisis Management Center

Stevko Stefanoski, Ph.D, member

Oliver Ristevski, deputy member

Directorate for Protection and Rescue

Sevganija Ibrahimi, member

Dejan Stojanoski, deputy member

Civil Aviation Agency

Antun Belamaric, member

Marija Filipova Spremo, deputy member

Public Health Institute

Prof. Igor Spiroski, Ph.D, member

Dzhansun Bukovec, Ph.D, deputy member

PE Nacionalni Shumi

Vladimir Biboski, member

Blagoja Razmoski, deputy member

Association of Local Self-Government Units – ZELS

Vesna Nikolovska, member

Ivana Serafimova, deputy member

Red Cross of the Republic of North Macedonia

Biljana Zhurovska, member

Oliver Gichevski, deputy member

AD Elektrani na Severna Makedonija (ESM)

Tanja Kocareva, member

Mile Jakimovski, deputy member

Joint Stock Company for the Performance of Energy Activity and Transmission of Natural Gas in State Ownership – NOMAGAS, Skopje

Bojan Nikolovski, member

Dijana Boshkovska, deputy member

Union of Chambers of Commerce of Macedonia – SSKM

Zagorka Blazevska, member

Business Confederation of North Macedonia

Mile Boshkov, member

Bojan Todorovski, deputy member

Confederation of Trade Unions of Macedonia (SSM)

Igor Gjerasov, member

Elena Petrova Mihajlovska, deputy member

Confederation of Free Trade Unions of Macedonia (KSS)

Zharko Kraus, member

Vasko Perchakovski, deputy member

Chamber of Commerce of North-West Macedonia

Sefedin Mustafa, member

Employers' Organization of Macedonia (ORM)

Aleksandar Spasevski, member

Vesna Velichkovska, deputy member

Representatives of the NGO - the National Climate Coalition

Elena Nikolovska, member

Filip Stojanovski, deputy member

Representatives of youth organizations

Ankica Sokolic, member

Sofija Getova, deputy member

Preface

This Technical Background Document has been prepared as the analytical evidence base supporting the compilation of the Republic of North Macedonia's NDC 3.0. Its scope and methodological approach are derived from the Terms of Reference for the assignment *"Company for compilation of the Republic of North Macedonia National Determined Contribution 3.0"* and from the Technical Proposal submitted by the Macedonian Academy of Sciences and Arts (MANU). In line with these requirements, the work combines a systematic review of the most recent national evidence, integration of cross-cutting priorities, and synthesis of the findings required to support the formulation and validation of NDC 3.0.

The analysis draws on the most recent strategies, plans, reports, assessments and technical studies available for the Republic of North Macedonia, with particular attention to documents developed or updated after the Enhanced NDC of 2021. These include the First Biennial Transparency Report and its supporting inventory and mitigation analyses, the updated National Energy and Climate Plan, the Just Transition Roadmap, the National Development Strategy 2024–2044, the Climate Action Strategy, the Climate Public Finance Review, the Country Climate and Development Report, as well as relevant sectoral and thematic assessments. The review also incorporates the documentation and analytical inputs provided by UNDP, including assessments related to implementation of the Enhanced NDC, activities of UN agencies, and dedicated work on gender, youth, vulnerable groups and other cross-cutting dimensions. This corresponds directly to the evidence-review approach required by the Terms of Reference.

Rather than reproducing the individual source documents or developing parallel analytical frameworks, this Technical Background Document consolidates their most relevant and up-to-date findings into a single evidence base. Where different sources use different datasets, assumptions, methodologies or planning horizons, these differences are identified and assessed in the relevant chapters. Particular attention is given to consistency between the latest greenhouse-gas inventory, mitigation projections, sectoral policies, adaptation priorities, financing requirements and implementation capacities.

The document therefore provides the technical foundation from which the principal elements of NDC 3.0 can be derived and assessed. It presents the evidence required for target setting, mitigation and adaptation prioritisation, financing and investment assessment, technology and capacity needs, governance and transparency, and the integration of social and other cross-cutting considerations. In this way, it provides a transparent and traceable link between the most recent national evidence and the decisions to be reflected in the final NDC 3.0.

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Abbreviations and acronyms

AAL	Annual Average Loss
AFOLU	Agriculture, Forestry and Other Land Use
AI	Artificial Intelligence
AKIS	Agricultural Knowledge and Innovation System
AMI	Advanced Metering Infrastructure
AR5	Fifth Assessment Report (IPCC)
AR6	Sixth Assessment Report (IPCC)
BAU	Business as Usual
BESS	Battery Energy Storage System
BUR	Biennial Update Report
BUR1	First Biennial Update Report
BUR2	Second Biennial Update Report
BUR3	Third Biennial Update Report
BTR	Biennial Transparency Report
BTR1	First Biennial Transparency Report
BTR2	Second Biennial Transparency Report
CBAM	Carbon Border Adjustment Mechanism
CCDR	Country Climate and Development Report
CCUS	Carbon Capture, Utilisation and Storage
CEE	Central and Eastern Europe
CHP	Combined Heat and Power
CI	Critical Infrastructure
CMA	Conference of the Parties serving as the meeting of the Parties to the Paris Agreement
CMC	Center for Management of Crises
COP	Conference of the Parties
CORINE	Coordination of Information on the Environment
CPFR	Climate Public Finance Review
C-PIMA	Climate Public Investment Management Assessment
CR	Climate-relevant
CS	Climate-specific
DRR	Disaster Risk Reduction
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EEA	European Environment Agency
EFFIS	European Forest Fire Information System
EIA	Environmental Impact Assessment
EM-DAT	Emergency Events Database
EMEP	European Monitoring and Evaluation Programme
EnC	Energy Community
ETF	Enhanced Transparency Framework
ETS	Emissions Trading System
EU	European Union
EUR	Euro
Eurostat	Statistical Office of the European Union
EV	Electric Vehicle
EW4All	Early Warnings for All
EWS	Early Warning System

FAO	Food and Agriculture Organization of the United Nations
FDI	Foreign Direct Investment
FOLU	Forest and Other Land Use
FRLD	Fund for responding to Loss and Damage
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GFF	Green Finance Facility
GGA	Global Goal on Adaptation
GHG	Greenhouse Gas
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GWP	Global Warming Potential
ICT	Information and Communication Technology
ICTU	Information to facilitate Clarity, Transparency and Understanding
IEA	International Energy Agency
IFFM	Integrated Forest Fire Management
IFI	International Financial Institution
ILO	International Labour Organization
IMF	International Monetary Fund
INSTAT	Institute of Statistics of Albania
IOM	International Organization for Migration
IPARD	Instrument for Pre-accession Assistance for Rural Development
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
IRBM	Integrated River Basin Management
ISO	International Organization for Standardization
ITMOs	Internationally Transferred Mitigation Outcomes
JETIP	Just Energy Transition Investment Platform
JT	Just Transition
KSS	Confederation of Free Trade Unions of Macedonia
LCOY	Local Conference of Youth
L&D	Loss and Damage
LEAP	Low Emissions Analysis Platform
LFS	Labour Force Survey
LULUCF	Land Use, Land-Use Change and Forestry
MAFWE	Ministry of Agriculture, Forestry and Water Economy
MAKStat	Database of the State Statistical Office of the Republic of North Macedonia
MANU	Macedonian Academy of Sciences and Arts
MARKAL	MARKet ALlocation model
MASA	Macedonian Academy of Sciences and Arts
MEL	Monitoring, Evaluation and Learning
MKD	Macedonian Denar
MoEPP	Ministry of Environment and Physical Planning
MoF	Ministry of Finance
MoH	Ministry of Health
MoLSG	Ministry of Local Self-governance
MONSTAT	Statistical Office of Montenegro
MoTC	Ministry of Transport and Communications
MPGs	Modalities, Procedures and Guidelines

MRV	Measurement, Reporting and Verification
MRVA	Monitoring, Reporting, Verification and Accreditation
NAP	National Adaptation Plan
NACE	Nomenclature of Economic Activities
NBRNS	National Bank of the Republic of North Macedonia
NbS	Nature-based Solutions
NBSAP	National Biodiversity Strategy and Action Plan
NC	National Communication
NC3	Third National Communication
NC4	Fourth National Communication
NC5	Fifth National Communication
NCCC	National Council on Climate Change
NDC	Nationally Determined Contribution
NDS	National Development Strategy
NECP	National Energy and Climate Plan
NEEAP	National Energy Efficiency Action Plan
NGOs	Non-governmental Organizations
NO	Not Occurring
ORM	Employers' Organization of Macedonia
PaMs	Policies and Measures
PDNA	Post-Disaster Needs Assessment
PIM	Public Investment Management
PM10	Particulate matter with a diameter of 10 μm or less
PM2.5	Particulate matter with a diameter of 2.5 μm or less
PPPs	Public-Private Partnerships
PRD	Protection and Rescue Directorate
PV	Photovoltaic
RCP	Representative Concentration Pathway
R&D	Research and Development
RES	Renewable Energy Sources
SDG	Sustainable Development Goal
SEA	Strategic Environmental Assessment
SEE	South-East Europe
SMEs	Small and Medium-sized Enterprises
SSKM	Union of Chambers of Commerce of Macedonia
SSM	Confederation of Trade Unions of Macedonia
SSO	State Statistical Office
TACCC	Transparency, Accuracy, Completeness, Comparability and Consistency
TAP	Technology Action Plan
TCP	Technical Cooperation Programme
TNA	Technology Needs Assessment
ToR	Terms of Reference
TPP	Thermal Power Plant
UAE	United Arab Emirates
UHI	Urban Heat Island
UHMR	National Hydrometeorological Service
UK	United Kingdom
UN	United Nations
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe

UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
USA	United States of America
USAID	United States Agency for International Development
USD	United States Dollar
VET	Vocational Education and Training
VSD	Variable Speed Drive
WAM	With Additional Measures
WB	World Bank
WEM	With Existing Measures
WGIII	Working Group III (IPCC)
WOM	Without Measures
ZELS	Association of Local Self-Government Units

Chemical symbols

CH_4	Methane
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2-eq	Carbon dioxide equivalents
HFCs	Hydrofluorocarbons
N	Nitrogen
N_2O	Nitrous oxide
NF_3	Nitrogen trifluoride
NH_3	Ammonia
NMVOC	Non-methane volatile organic compounds
NOx	Nitrogen oxides
PFCs	Perfluorocarbons
SF_6	Sulfurhexafluoride
SO_2	Sulfur dioxide

Units and metric symbols

Unit	Name	Unit for		Metric symbols	Prefix	Factor
g	gram	table		P	heel	1015
W	watt	power		T	forces	1012
J	joule	energy		G	giga	109
m	meter	length		M	mega	106
What?	Watt-hour	energy		k	kilo	103
toe	tons of oil equivalents	energy		h	hecto	102
				yes	that	101
Mass conversion units				d	children	10-1
1g				c	cents	10-2
1kg	= 1 000 g			m	dear	10-3
1t	= 1 000 kg	= 1 Mg		µ	micro	10-6
1kt	= 1 000 tons	= 1 Gg		n	nano	10-9
1Mt	= 1 000 000 tons	= 1 Tg		p	pico	10-12

Unit convention used in the document: national and sectoral greenhouse-gas quantities are reported in Gg CO2-eq, consistent with national inventory and BTR reporting; marginal abatement costs remain expressed in EUR/t CO2-eq because they represent cost per unit of emissions reduced. Energy quantities are expressed in ktoe/Mtoe.

Chapter 1. Introduction

1.1 Scope and Methodological Basis of the Technical Background Document

This Technical Background Document has been prepared as the analytical evidence base supporting the compilation of the Republic of North Macedonia's Third Nationally Determined Contribution (NDC 3.0). Its scope and methodological approach are derived from the Terms of Reference for the assignment *"Company for compilation of the Republic of North Macedonia National Determined Contribution 3.0"* and from the Technical Proposal submitted by the Macedonian Academy of Sciences and Arts (MANU). In line with these requirements, the work combines a systematic review of the most recent national evidence, integration of cross-cutting priorities, and synthesis of the findings required to support the formulation and validation of NDC 3.0.

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The document therefore provides the technical foundation from which the principal elements of NDC 3.0 can be derived and assessed. It presents the evidence required for target setting, mitigation and adaptation prioritisation, financing and investment assessment, technology and capacity needs, governance and transparency, and the integration of social and other cross-cutting considerations. In this way, it provides a transparent and traceable link between the most recent national evidence and the decisions to be reflected in the final NDC 3.0.

1.2 Purpose of NDC 3.0

The Republic of North Macedonia is preparing its third NDC as the next step in the implementation of the Paris Agreement and as the principal national climate-policy framework for the period to 2035. NDC 3.0 is intended to translate the country's international commitments into a coherent domestic pathway for greenhouse-gas mitigation, climate adaptation, just transition, finance, technology, capacity development and transparency. It therefore serves not only as an international submission under the United Nations Framework Convention on Climate Change, but also as a strategic instrument for aligning national development, investment and sectoral policy with a low-emission and climate-resilient future.

Under Article 4 of the Paris Agreement, Parties are required to prepare, communicate and maintain successive nationally determined contributions and to communicate a new contribution every five years. Each successive NDC is expected to represent a progression beyond the previous contribution and to reflect the Party's highest possible ambition, taking account of national circumstances. NDC 3.0 therefore builds on the Enhanced NDC submitted in 2021, retains continuity with the existing 2030 commitment and extends the national mitigation and adaptation framework towards 2035. The contribution is being prepared in a manner consistent with the common time-frame arrangements under the Paris Agreement and with the requirements for clarity, transparency and understanding of NDCs.

The NDC cycle is closely connected with the Enhanced Transparency Framework. Implementation progress is measured through the national greenhouse-gas inventory, the tracking of policies and measures, projections, indicators and information on support, and is reported through Biennial Transparency Reports. This creates a continuous policy cycle in which the NDC establishes the direction of travel, implementation and investment deliver the measures, the BTR provides evidence on progress and emerging gaps, and the following NDC cycle responds to that evidence. For the Republic of North Macedonia, the preparation of NDC 3.0 therefore draws directly on the recalculated national

inventory and the mitigation analysis prepared for the First Biennial Transparency Report, together with the Updated National Energy and Climate Plan (NECP) and the broader national development and adaptation evidence base.

NDC 3.0 is also explicitly informed by the outcome of the first Global Stocktake. The first Stocktake concluded that collective progress remains insufficient to achieve the temperature and resilience goals of the Paris Agreement and called for stronger, economy-wide action during the present decade and beyond. Of particular relevance for the Republic of North Macedonia are the calls for economy-wide contributions covering all greenhouse gases and sectors; accelerated transition away from fossil fuels in energy systems; a rapid expansion of renewable-energy capacity and energy-efficiency improvement; faster deployment of low- and zero-emission technologies; stronger adaptation planning and implementation; and scaled-up finance, technology transfer and capacity-building.

These global signals are translated into the design of NDC 3.0 in a way that reflects the Republic of North Macedonia's circumstances. The mitigation component is economy-wide and linked to the transformation of the energy system, transport, buildings, industry, agriculture, land use and waste. Adaptation is treated as a component of equal strategic importance and is linked to the National Adaptation Plan process and the UAE Framework for Global Climate Resilience. For the first time adaptation is comprehensively included within the NDC 3.0 structure with targets for prioritized adaptation sectors: water, agriculture, forestry, biodiversity, health, infrastructure and human settlements. The contribution also gives explicit attention to the means of implementation by distinguishing measures that can be delivered through domestic and already committed resources from measures whose delivery requires additional international finance, technology and capacity support. In this way, NDC 3.0 is intended to function simultaneously as a climate commitment, an implementation framework and an investment signal.

1.3 National Context

The Republic of North Macedonia is a small, open, landlocked, upper-middle-income economy in South-East Europe with a population of approximately 1.8 million. Its economy is strongly integrated with European markets and is characterised by a combination of manufacturing, services, energy, construction and agriculture. Exports are predominantly oriented towards the European Union, making the competitiveness of domestic producers increasingly sensitive to European energy, climate and industrial policy, including carbon-pricing and carbon-border measures. At the same time, the country remains dependent on domestic lignite and imported fossil fuels, so the climate transition is closely linked to energy security, trade exposure and the modernisation of productive capacity.

The development context creates both opportunities and constraints for climate policy. National development projections foresee continued economic convergence and investment needs across energy infrastructure, buildings, transport, industry and public services. Private investment and foreign direct investment are therefore expected to play an increasingly important role in the transition, alongside public finance and international support. However, relatively limited fiscal space, energy poverty, infrastructure gaps and the high upfront cost of several transition measures mean that climate ambition must be supported by credible financing and implementation arrangements. The more detailed macroeconomic, labour-market, foreign-investment and business-environment analysis is presented in Section 1.4.

Demographic trends are an equally important part of the national context. The population is declining and ageing as a result of low fertility, demographic ageing and sustained emigration. These trends affect the size and structure of the labour force and can constrain the availability of skilled workers needed for renewable-energy deployment, building renovation, grid modernisation, sustainable transport, environmental services and climate-resilient infrastructure. They also reinforce the importance of a just transition that combines decarbonisation with skills development, regional economic diversification and protection of vulnerable and energy-poor households.

The European Union (EU) accession process is one of the strongest structural drivers of national climate and energy policy. The Republic of North Macedonia has been an EU candidate country since 2005 and accession negotiations were formally launched in 2022. Progressive alignment with the EU climate and energy acquis is therefore not a parallel process to NDC implementation, but one of its main delivery mechanisms. The Updated NECP, development of the national MRV/MRVA framework, energy-market reform, renewable-energy and energy-efficiency legislation, carbon-pricing preparedness and gradual alignment with the EU Emissions Trading System (EU-ETS) and related reporting requirements all contribute simultaneously to the implementation of the NDC and to the accession process.

The Republic of North Macedonia is also a Contracting Party to the Energy Community, which provides the regional legal and policy framework for progressive integration with the EU energy and climate acquis. The Energy Community obligations are particularly relevant for integrated energy and climate planning, renewable energy, energy efficiency, energy-market integration, security of supply, greenhouse-gas monitoring and reporting, and the gradual decarbonisation of the power sector. The NECP and its implementation reporting therefore constitute a central bridge between the NDC and the country's European obligations. For NDC 3.0, this means that targets, policies and monitoring arrangements should be designed to minimise parallel systems and maximise the reuse of common assumptions, datasets and implementation instruments across the Paris Agreement, the Energy Community framework and the EU accession process.

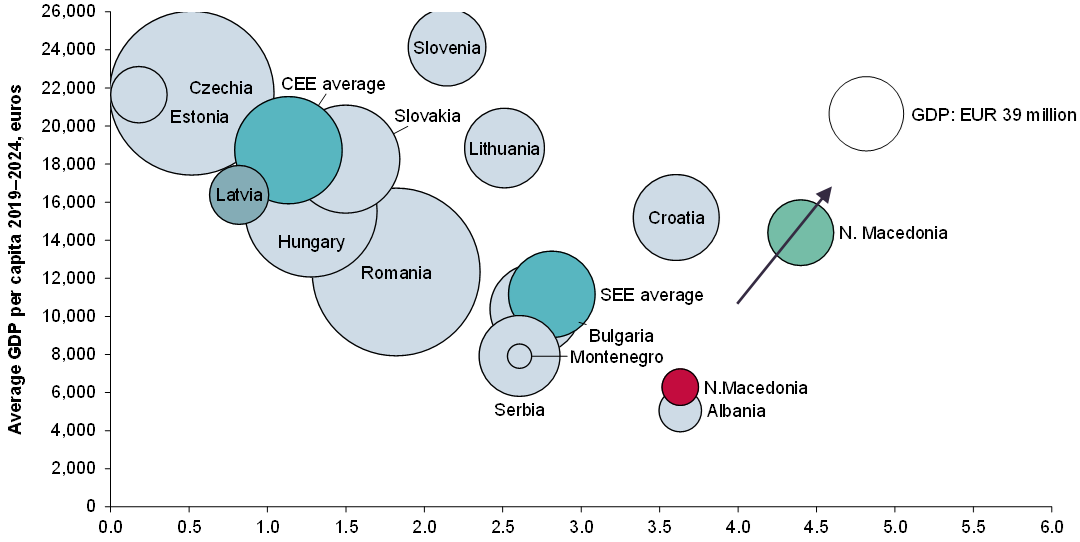
1.4 Macroeconomic Context

The Republic of North Macedonia, as a Contracting Party to the Energy Community and a candidate country for membership in the EU, is committed to following European energy policy and is obliged to transpose and implement EU directives and regulations in the fields of energy and climate. The EU accession process offers an opportunity to align national climate and energy policies with the EU's, thereby serving as an important driver of decarbonisation and the implementation of climate change mitigation measures.

1.4.1 Economic Growth, Labour Market and Business Environment

Long-term economic growth projections indicate that, by 2030, the Republic of North Macedonia will gradually converge towards the reformed economies of Central and Eastern Europe (CEE). Gross domestic product (GDP), a key indicator of the level and dynamics of economic activity, shows that, at its current level of economic development, the Republic of North Macedonia lags behind the averages of both the South-Eastern European (SEE) and CEE economies. Based on the available macroeconomic projections developed within the National Development Strategy, real GDP in the Republic of North Macedonia is expected to grow at an average annual rate of approximately 4.4%. Such growth dynamics are characteristic of developing economies and, if sustained, may, in the long term, lead to gradual real convergence towards the current GDP per capita levels of the more developed CEE countries (Figure 1). The projected economic growth dynamics have direct implications for future energy demand, the structure of production and consumption, and long-term trends in greenhouse gas emissions.

Figure 1 GDP Trends in CEE and SEE



Note: SEE includes Albania, Bulgaria, Croatia, the Republic of North Macedonia, Montenegro, Serbia, Slovenia and Romania, while CEE includes Hungary, Latvia, Lithuania, Czechia, Estonia and Slovakia. The GDP growth projections for the Republic of North Macedonia assume an annual growth rate of 4.4%. GDP per capita data for Albania are not available for 2023 and 2024.
Source: Eurostat; GDP projections used in the National Development Strategy; team analysis.

The Republic of North Macedonia has a relatively high unemployment rate, placing the country among the economies with higher unemployment levels in the region and above levels observed in developed countries, where unemployment has generally trended downward (Figure 2 and Figure 3). At the same time, the labour market structure remains unfavourable, particularly in terms of gender representation. The gender gap has persisted over a long period and is linked to the structural characteristics of the labour market, economic and social conditions, and the mismatch between labour supply and demand. According to the available labour force data, the employment rate among women was 49.6% (approximately 292,000 persons), while the employment rate among men was 66% (approximately 392,000 persons) among the working-age population aged 15–64.

Figure 2 Unemployment Rate in the Republic of North Macedonia, 2019–2024, %

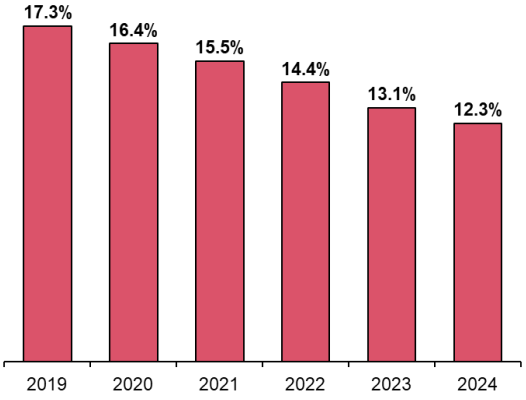
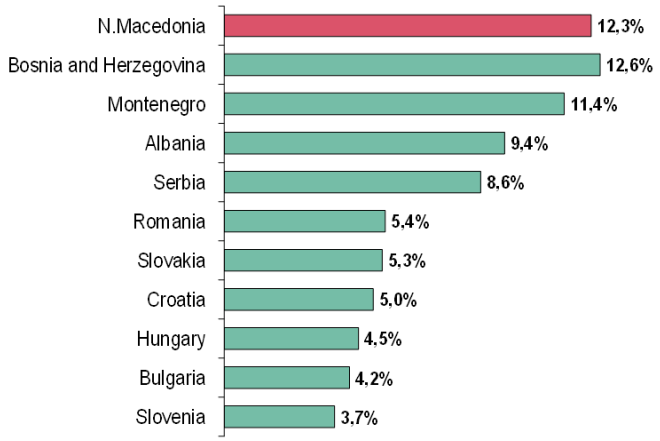


Figure 3 Unemployment Rate in CEE and SEE, 2024, %



Source: Eurostat, INSTAT and MONSTAT; team analysis.

The results of the Business Ready 2024 index indicate that the Republic of North Macedonia has a relatively favourable business environment, particularly with regard to the availability of infrastructure services and the conditions for establishing businesses, thereby creating favourable prospects for attracting private investment (Figure 4). However, the identified weaknesses in areas such as international trade, the labour market and financial services point to the need for further institutional and regulatory improvements. Improving the business climate is essential for mobilising the private capital required to finance climate change mitigation and adaptation measures.

Figure 4 Business Environment by Category, 2024

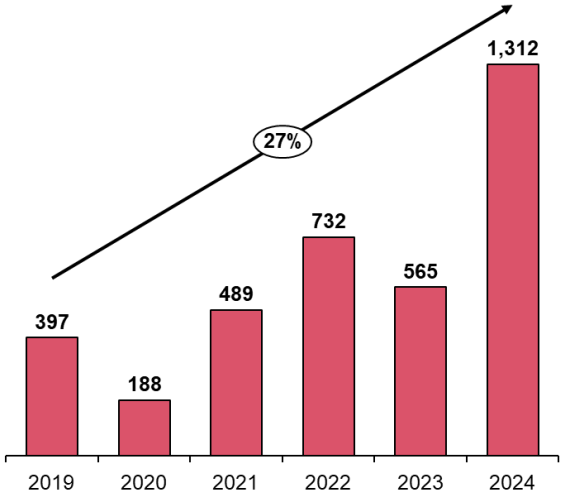
Category	Description	Performance (0 – 100)
Establishment of business entities	Assesses regulations, digital services, and operational efficiency related to business entry	90.83
Location of business entities	Assesses regulations, governance, and the efficiency of procedures for selecting a business location	55.68
Infrastructure services	Key services supporting business operations: electricity, water, and internet	78.44
Labour force	Assesses good practices in employment regulations from the perspective of companies and employees	70.4
Financial services	Assesses regulations, availability of information, and efficiency	73.42
International trade	Assesses regulations, the quality of public services, and operational efficiency for import and export	65.34
Tax system	Fiscal system and private sector support	46.84
Dispute resolution mechanisms	Resolution of business disputes through court proceedings and alternative dispute resolution mechanisms, such as arbitration and mediation	61.1
Market competition	Assesses the quality of regulations, the quality of public services, and the implementation of key services for promoting market competition	62.26
Insolvency	Assesses the quality of regulations, the quality of institutional and operational infrastructure, and the operational efficiency of resolving insolvency proceedings through courts	60.09

Source: World Bank, Business Ready 2024 report; team analysis.

1.4.2 Foreign Direct Investment

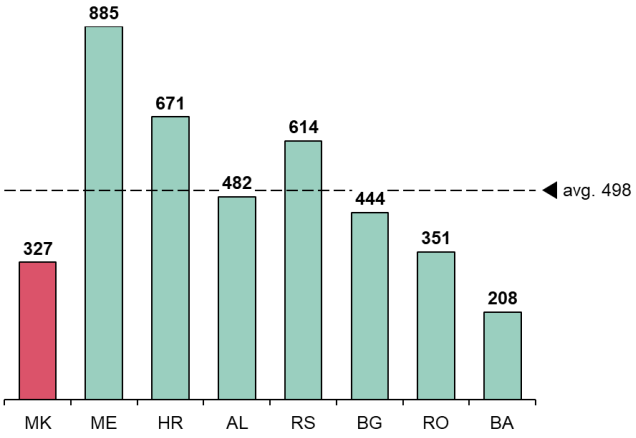
The energy sector has significant potential to attract foreign direct investment (FDI), which is a key driver of economic development and an important source of financing for climate change mitigation and adaptation measures. Globalisation has increased the importance of foreign direct investment, particularly for developing countries such as the Republic of North Macedonia. Given their limited domestic financial and investment capacities, developing countries seek to establish a favourable investment climate and better business conditions. Furthermore, the entry of new foreign companies can stimulate the modernisation of domestic companies, improve their performance, and enhance economic development and the competitiveness of the economy. In the long term, such economic trends generate positive externalities. Foreign direct investment inflows into the Republic of North Macedonia amounted to EUR 1,312 million in 2024 (*Figure* 5), indicating increased confidence among foreign investors in the country's macroeconomic stability and business environment. The average per capita amount during the 2019–2024 period was EUR 327, significantly below the levels recorded in other countries in the region and the regional average (*Figure* 6).

Figure 5 Foreign Direct Investment Inflows into the Republic of North Macedonia, 2019–2024, EUR million



Source: United Nations, World Investment Report 2025; team analysis.

Figure 6. Foreign Direct Investment per Capita – Regional Average, 2019–2024, EUR

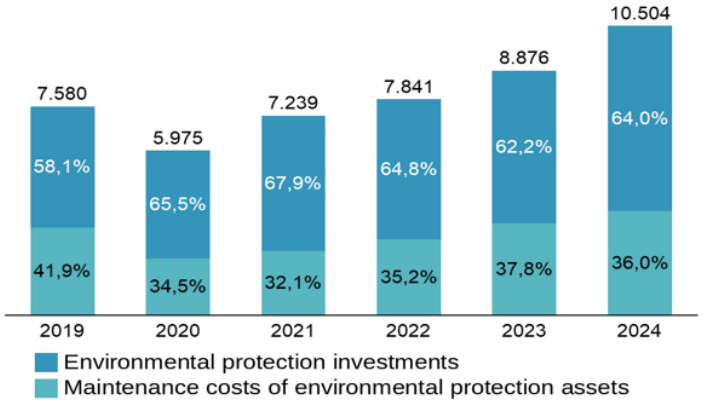


Note: The countries included in the regional analysis are the Republic of North Macedonia, Montenegro, Croatia, Albania, Serbia, Bulgaria, Romania, and Bosnia and Herzegovina.
Source: United Nations, World Investment Report 2025; Eurostat; team analysis.

1.4.3 Business Sector Investment in Environmental Protection and Climate Policies

The private sector's commitment to environmental protection is reflected in investments and expenditure aimed at preventing, reducing and eliminating the degradation of natural resources and environmental pollution. Environmental protection expenditure comprises investment and current expenditure related to activities undertaken to protect the environment. Environmental expenditure includes the following categories: protection of ambient air; soil protection; water protection; wastewater and waste management; noise abatement; biodiversity protection; protection against radiation; environment-related research and development (R&D); and other investment and current expenditure related to environmental protection. Such expenditure and investment also partly reflect measures related to decarbonisation and the development of a circular economy, which are key pillars of the Green Agenda for the Western Balkans. The data indicate an upward trend in this type of investment by the Macedonian business sector, with approximately MKD 10,540 million (EUR 171.4 million) allocated to environmental protection in 2024 (*Figure* 7). These data indicate that the Macedonian business sector is already contributing to the reduction of adverse environmental impacts, thereby creating a basis for further investment in green technologies and climate change adaptation and mitigation measures.

Figure 7 Investment and Expenditure on Environmental Protection, MKD million



Source: State Statistical Office (MAKStat database); team analysis.

1.5 Relationship with Existing National Documents

NDC 3.0 is not being developed as a stand-alone climate document. Its role is to integrate and update the direction already established by national climate, energy, development, adaptation, just-transition and financing frameworks, while resolving inconsistencies revealed by newer inventories, modelling results and implementation experience. The documents reviewed below therefore provide the policy, analytical and investment foundation for NDC 3.0.

1.5.1 Climate Policy Framework

The Enhanced NDC submitted in 2021 remains the principal reference for continuity of ambition. It established the 2030 economy-wide mitigation framework, including gross and net greenhouse-gas reduction targets and a portfolio of 63 policies and measures. NDC 3.0 builds on that architecture but updates it using the recalculated national inventory, BTR1 and NECP findings and the latest sectoral projections. The Long-term Climate Action Strategy and Action Plan provide the longer-term decarbonisation direction, while the more recent national legal and planning framework strengthens the endpoint towards climate neutrality by 2050. On adaptation, the NDC draws on the Climate Action Strategy, National Communications and the ongoing National Adaptation Plan process, with the objective of linking national climate-risk evidence to sectoral adaptation priorities, measurable outcomes and a continuous monitoring, evaluation and learning framework.

1.5.2 Energy and Development Planning Framework

The Updated National Energy and Climate Plan is the principal implementation framework linking energy-system transformation with the 2030 climate, renewable-energy and energy-efficiency agenda. It provides the sectoral policy package, technology and infrastructure assumptions and investment direction that must be reflected in NDC implementation, while differences between NECP and BTR modelling are treated transparently rather than forced into artificial numerical alignment. The National Development Strategy 2024–2044 provides the wider development anchor through its emphasis on green transformation, a safe and resilient society and demographic revitalisation. The National Strategy for Energy Development to 2040 and relevant sectoral plans complement this framework by guiding the sequencing of energy infrastructure, renewable deployment, energy efficiency, transport, industry, waste, agriculture, forestry and regional development measures.

1.5.3 Socio-Economic and Financing Framework

The Just Transition Roadmap ensures that decarbonisation is linked to regional economic diversification, worker protection, skills development, land rehabilitation and new investment in coal-dependent regions. The Climate Public Finance Review demonstrates that the transition cannot be financed through the state budget alone and highlights the need for stronger climate budgeting, investment planning, expenditure tracking and mobilisation of private and international capital. The World Bank Country Climate and Development Report complements this analysis by quantifying major mitigation, adaptation and human-capital investment needs and by demonstrating that delayed climate action would impose substantial economic costs. Together, these documents provide the basis for defining a credible mix of domestic, private and international financing for NDC 3.0.

1.5.4 International Support and Development Cooperation

International cooperation has been an important enabling factor for the Republic of North Macedonia's climate-policy development and implementation. The national evidence base includes a broad portfolio of climate-related activities supported by United Nations agencies, the European Union, the Global Environment Facility, the Green Climate Fund,

bilateral partners and international financial institutions. Support has covered greenhouse-gas inventories and transparency, renewable energy and energy efficiency, just transition, climate finance, adaptation and disaster-risk reduction, biodiversity, water management, agriculture, local resilience and institutional capacity. NDC 3.0 should use this accumulated experience to move from a project-by-project approach towards a coordinated programme pipeline in which international support is explicitly connected with national priorities, implementation responsibilities, measurable results and the conditional component of the contribution.

1.5.5 Identification of Entry Points for NDC 3.0

The review of existing national and international frameworks identifies a set of practical entry points for NDC 3.0. These entry points are not separate policy agendas; they are areas where stronger alignment can convert existing strategies and projects into a more coherent and implementable national contribution.

- Mitigation: accelerate the most mature and cost-effective measures in energy efficiency, renewable electricity, grids and storage, while addressing the harder structural challenges in transport, industry, waste and the permanence of the land-use sink.
- Adaptation: translate the National Adaptation Plan process and the UAE Framework for Global Climate Resilience into sectoral priorities and measurable 2030/2035 outcomes for water, agriculture and food systems, forestry, biodiversity, health, infrastructure and human settlements.
- Finance: create an investable pipeline that combines domestic public resources, private capital, EU and donor support, climate funds and concessional finance, with stronger climate-budget tagging, project preparation and finance tracking.
- Institutions and transparency: strengthen permanent inter-ministerial coordination, local-government capacity, the national MRV/MRVA system, data-sharing arrangements and digital reporting so that the same validated evidence supports NDC, BTR, NECP and Energy Community reporting.
- Policy gaps: address implementation delays in transport and waste infrastructure, uncertainty and climate sensitivity of forest removals, energy-security constraints during the coal transition, limited administrative capacity and the fragmentation of climate finance and project preparation.
- Enhanced ambition: use the recalculated inventory and BTR/NECP evidence to define a credible post-2030 progression towards 2035 and climate neutrality by 2050, while clearly distinguishing what can be delivered domestically from the additional ambition that depends on substantial international financial, technological and capacity-building support.

Taken together, these entry points position NDC 3.0 as the integration framework for the next phase of the Republic of North Macedonia’s climate transition. Its added value is therefore not the creation of another parallel strategy, but the consolidation of existing national objectives into a single, measurable and financeable pathway that can be implemented through domestic institutions, the EU accession process, Energy Community obligations and structured cooperation with international partners.

Chapter 2. National Greenhouse Gas Profile

The national greenhouse gas inventory represents the foundation of climate policy in every country and a key instrument for fulfilling obligations under the Paris Agreement. It provides a comprehensive overview of the amount of greenhouse gases emitted or removed in the Republic of North Macedonia, the sectors from which these emissions originate, how they have changed over time, the main sources and trends, and the role of land and forests in balancing greenhouse gas emissions and removals. The inventory is not merely a statistical compilation; it also helps explain the key drivers of change, including transformations in the energy system, developments in industry, changes in agriculture, and the influence of forestry on the national greenhouse gas balance. In addition, it serves as an important basis for decision-making, for the development of mitigation measures related to climate change, and for defining the national contributions towards achieving the country's greenhouse gas reduction targets. This document covers the greenhouse gas emissions and removals of the Republic of North Macedonia for the period **1990–2022**, representing the longest time series prepared so far.

With the submission of this inventory, the Republic of North Macedonia fulfils its obligation for transparent reporting, while the preparation process involved all relevant institutions, scientific organizations, public enterprises and experts at the national level. The preparation process included the Ministry of Environment and Physical Planning as the coordinating institution, technical teams from the Macedonian Academy of Sciences and Arts and Goce Delchev University, the State Statistical Office, the Ministry of Agriculture, Forestry and Water Economy, and numerous other institutions. Although the new climate action legislation has not yet been formally adopted, the established practice and the long-standing experience of the involved expert teams enabled the process to proceed without major obstacles and ensured the availability of the necessary data and expertise. This cooperation is particularly important because the quality of the inventory depends on the availability and accuracy of data related to energy, industry, agriculture, forestry, waste and emission precursors.

This inventory was prepared in accordance with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories and their 2019 Refinement, using the latest versions of the official IPCC Inventory Software. Since the 2025 software version contained certain technical inconsistencies, the calculations were also performed in parallel using the previous 2020 software version. This dual approach enabled additional verification of the results and the identification of errors that were subsequently corrected. In order to ensure full consistency, the entire time series from 1990 to 2022 was recalculated using updated activity data, improved emission factors, and the global warming potential values for a 100-year time horizon from the IPCC Fifth Assessment Report (AR5 GWP). Nevertheless, the results presented in this inventory were generated using the IPCC Inventory Software version 2.98 (June 2025), with the exception of the reference approach in the Energy sector, where the reported results were generated using the IPCC Inventory Software version 2020.

The inventory covers the five main sectors: Energy; Industrial Processes and Product Use (IPPU); Agriculture; Forestry and Other Land Use (AFOLU); and Waste. In addition, the emission precursors CO, NOx, NMVOC, SO_2 and NH_3 are also estimated. Although these are not direct greenhouse gases, they have indirect effects on the atmosphere and are included in accordance with the reporting requirements of the IPCC.

2.1 Overview of National Greenhouse Gas Emissions and Removals (1990–2022)

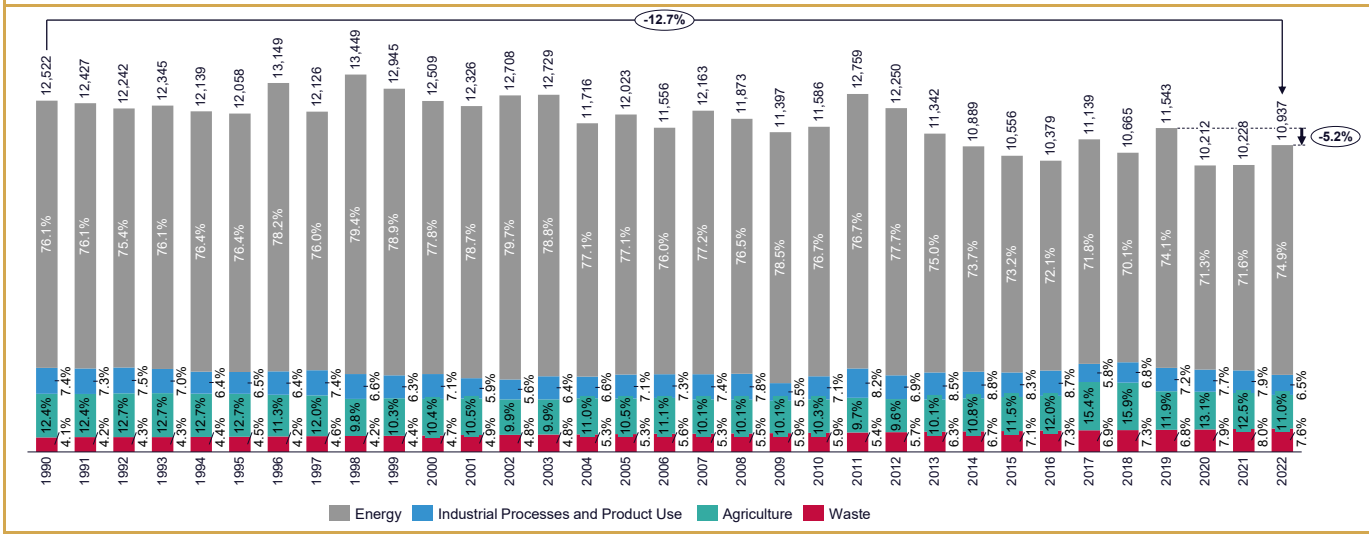
The trend of total greenhouse gas emissions (excluding the Forestry and Other Land Use sector) indicates that the country started in 1990 with approximately 12,500 Gg CO_2-eq, while in 2022 they amount to around 10,900 Gg CO_2-eq (Figure 8). This represents a moderate reduction of about 13%, although the decline does not occur in a linear manner. The time series shows increases during years of economic expansion, as well as declines associated with industrial restructuring, reductions in coal use, improvements resulting from the increasing share of natural gas and renewable energy sources, but also an increase in electricity imports. It should be noted that the level of greenhouse gas emissions is not highest in 1990, but rather in 1998, when greenhouse gas emissions reached a maximum of 13,449 Gg CO_2-eq, while in the last 15 years the maximum occurred in 2011, when emissions amounted to 12,759 Gg CO_2-eq (*Figure* 8), a level that is also higher than the level in 1990 (12,522 Gg CO_2-eq).

At the same time, total emissions (when the Forestry and Other Land Use sector is included) show even larger variations. In certain years, forestry acts as a strong sink, reducing the national balance by more than 3,000 Gg CO_2-eq (Figure 9) , as observed in 2022, while in other years the same sector may become a source of emissions, particularly when large forest fires occur. For this reason, the national carbon balance as a whole is highly sensitive to variations in the forestry sector, which confirms its structural importance in climate policy.

The sectoral distribution of emissions shows that the Energy sector dominates throughout the entire time series, with its share rarely falling below 70% of the national total (*Figure* 9). This means that trends in electricity generation, fuel

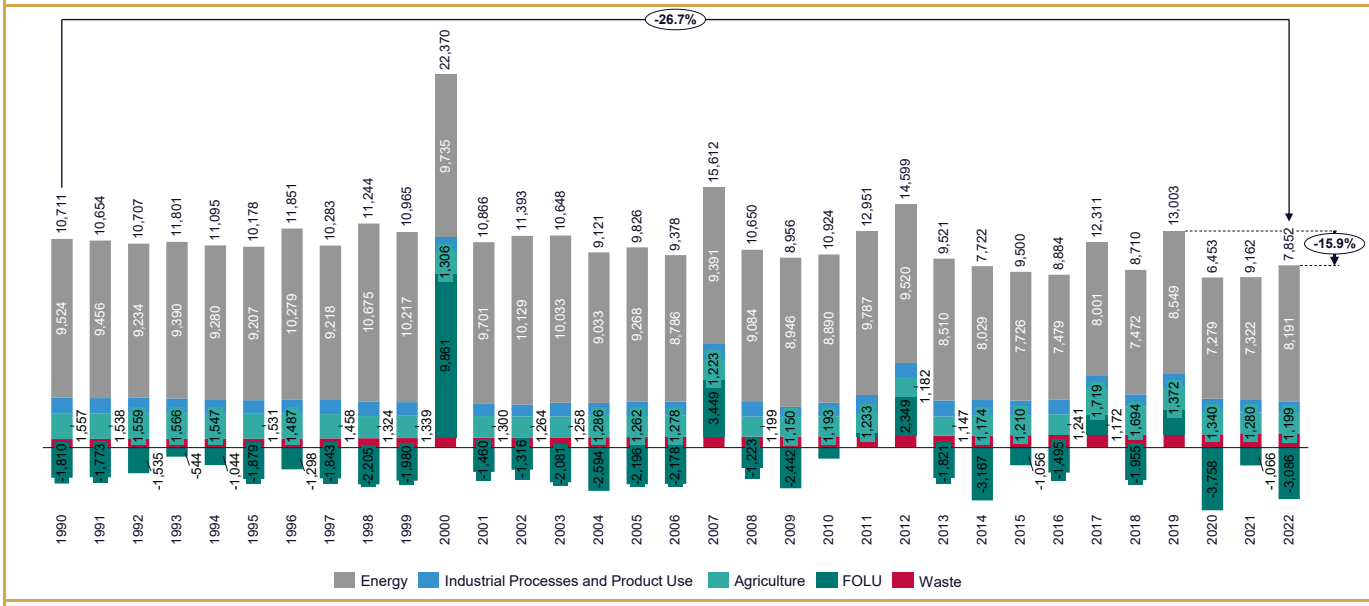
consumption, the structure of the vehicle fleet and the efficiency of district heating systems practically define the country's climate profile. Agriculture, on the other hand, has a relatively stable level of emissions, but its internal structure changes significantly: the reduction in cattle numbers decreases emissions from enteric fermentation, while the increased use of mineral fertilizers, as well as changes in manure management and mechanization, create new sources of N_2O emissions. Industrial Processes and Product Use (IPPU) have a moderate share, most often between 7% and 8%. In the Waste sector, however, a stable and continuous increase in methane emissions is observed, which is particularly pronounced after 2000 due to the increased quantity of municipal waste and the insufficient implementation of mechanical-biological treatment systems. This makes the waste sector one of the few sectors with a long and consistent growth in emissions, which in the future will require targeted measures, such as improving landfill standards, landfill gas capture, and the introduction of regional waste management centres.

Figure 8. Total greenhouse gas emissions by sectors excluding Forestry and other land use (in Gg CO2-eq)



Source: IPCC software, team analysis

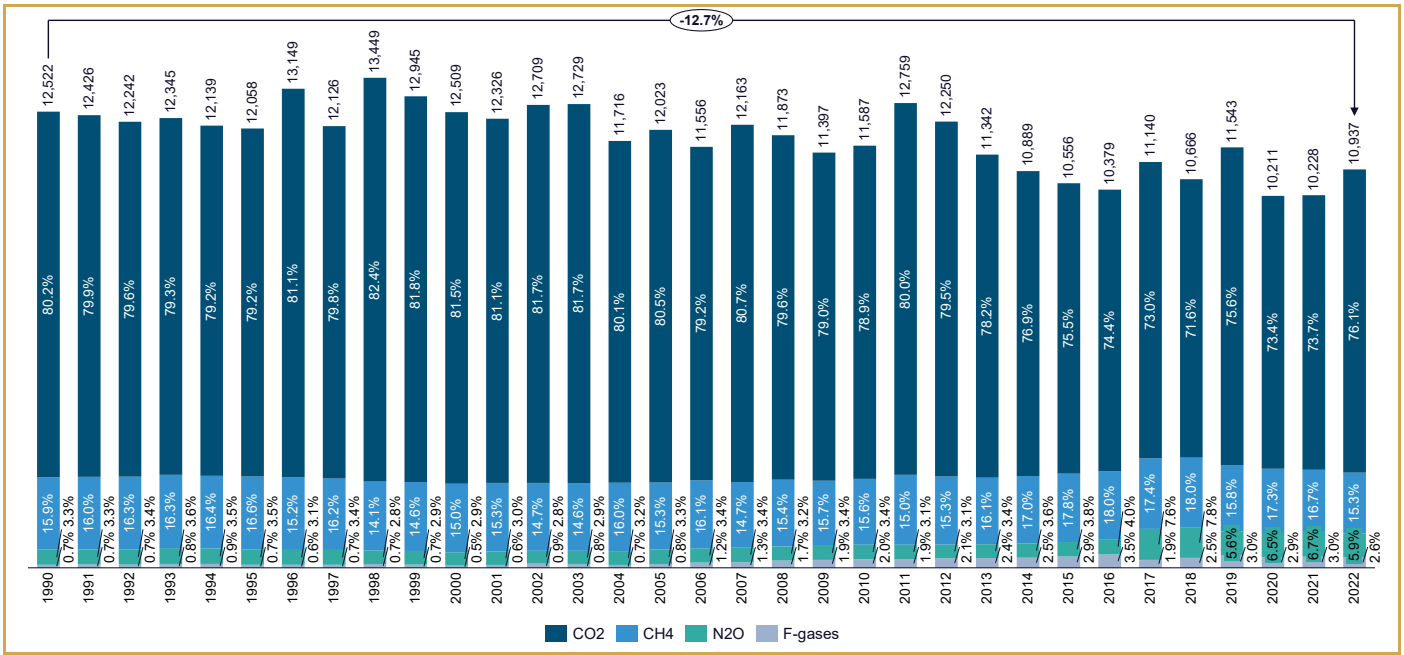
Figure 9. Greenhouse gas emissions and sinks by sector (in Gg CO2-eq)



Source: IPCC software, team analysis

When emissions are analysed individually by gas, the dominance of CO_2 is clearly visible, accounting for around 75–80% in each year of the time series (Figure 10). This is not surprising considering the country's dependence on fossil fuels, particularly coal. CH_4 remains the second most significant gas, although its structure changes over time: in 1990, the majority of emissions originated from agriculture, while in 2022 the waste sector becomes the dominant source. In this way, CH_4 emissions become an indicator not only of agricultural practices, but also of the degree of urbanisation and the efficiency of waste management systems. Fluorinated gases, although representing a small share, are increasing at the fastest rate, reflecting the growing use of air-conditioning and refrigeration systems in households, commerce and industry.

Figure 10. Total greenhouse gas emissions by sectors excluding Forestry and other land use (in Gg CO2-eq)

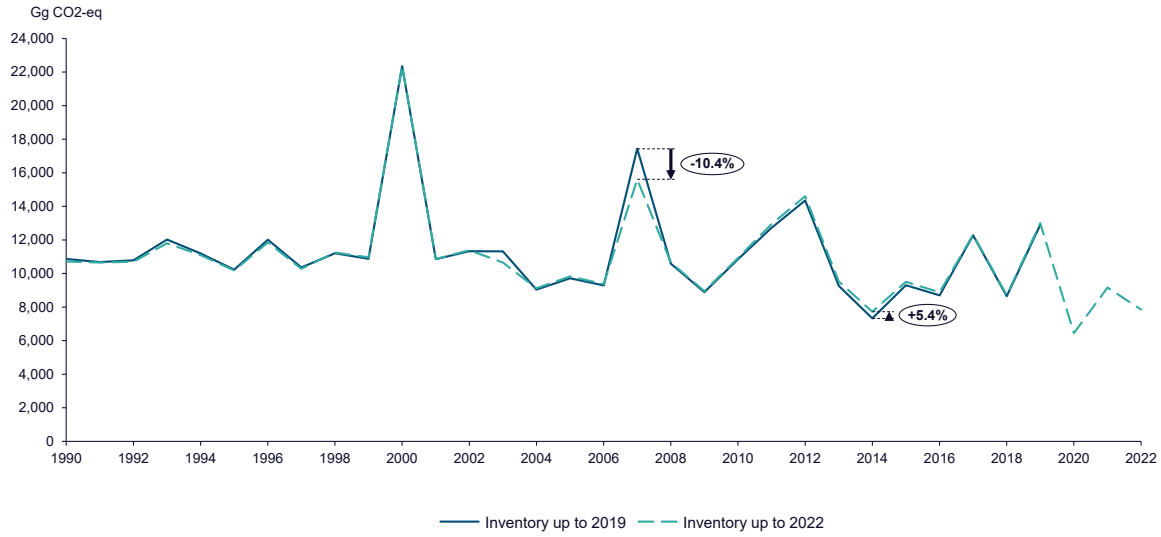


Source: IPCC software, team analysis

When the entire time series is considered, three distinct periods can be identified: 1990–2001, which is characterised by a decline in industrial activity and reduced electricity generation, leading to a decrease in emissions; 2002–2011, which brings stabilisation and moderate growth associated with economic recovery; and 2012–2022, when the country gradually reduces its carbon intensity, while at the same time the use of transport fuels increases, stabilising the overall trend and creating a slow trajectory of emission reductions.

The comparison between the previous greenhouse gas inventory (with a time series up to 2019) and the new inventory (with a time series up to 2022) shows that the overall trend of national emissions remains consistent, while the differences observed in certain individual years are the result of recalculations, methodological improvements, and the use of updated activity data. For total emissions including the Forestry and Other Land Use sector, larger variations are observed in certain years, with the most significant difference occurring around 2007 (a decrease of approximately 10.4%), while in the period around 2014–2015 a moderate increase of about 5.4% is observed (Figure 11). The pronounced peak in total GHG emissions in 2000 is mainly attributable to exceptionally extensive forest fires, which resulted in a substantial increase in emissions from the Forestry and Other Land Use sector in that year. When only emissions excluding the Forestry and Other Land Use sector are analysed, the differences between the two inventories are relatively small and in most years remain within a range of a few percent (for example around 2.2% and 3.5% in certain years), indicating a high level of consistency of the time series. These changes mainly result from improvements in data quality and methodology in key sectors, whereby the new inventory provides a more complete and more accurate emissions time series for the period 1990–2022.

Figure 11. Comparison of greenhouse gas emissions and sinks in the greenhouse gas inventory by 2019 with the greenhouse gas inventory by 2022



Source: Team Analysis

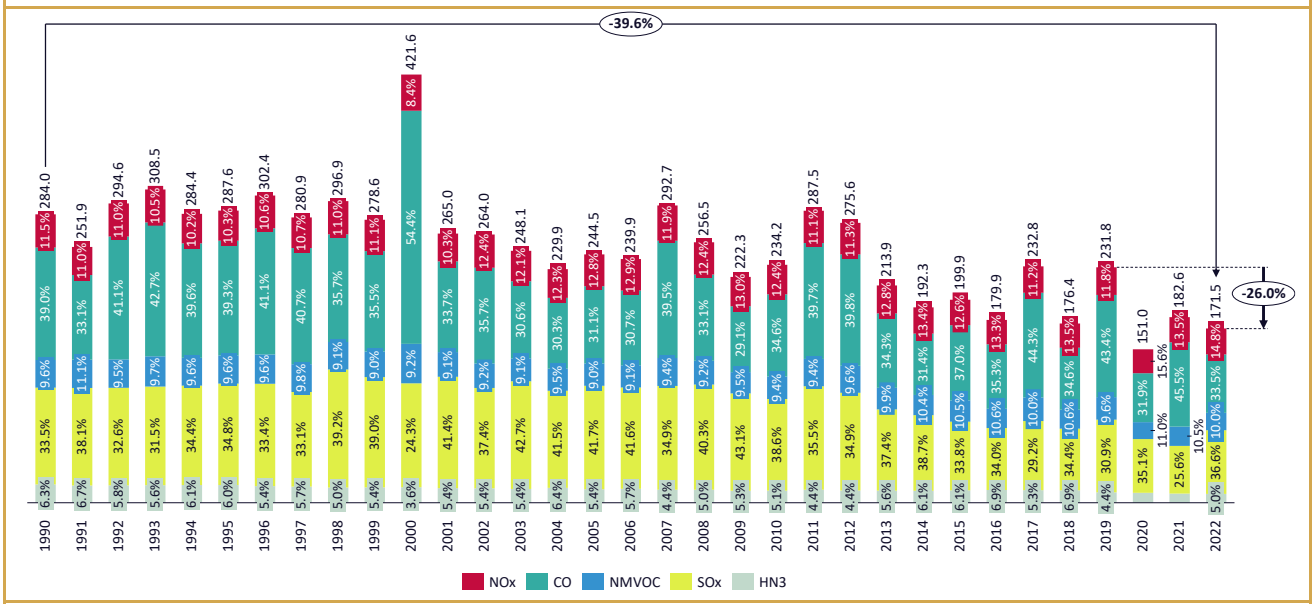
2.2 Precursors and indirect emissions

Precursors and indirect greenhouse gases represent a group of substances which, although they are not direct greenhouse gases, have a significant indirect influence on climate change through their participation in atmospheric chemical processes. The most important among them are carbon monoxide (CO), nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOC), sulfur oxides (SO_2), and ammonia (NH_3). These gases contribute to the formation of tropospheric ozone and aerosols, which can have both warming and cooling effects on the atmosphere. Although they are not reported as direct greenhouse gases in national inventories, their monitoring is important for a better understanding of the relationship between air pollution and climate change, as well as for the development of more effective air quality policies.

In the Republic of North Macedonia, the assessment of these emissions has been gradually developed in accordance with international guidelines. The first systematic assessments were prepared within the framework of BUR2 (Biennial Update Report 2) for the period 1990–2014, while BUR3 included additional data for 2015 and 2016 and introduced a revision of part of the historical data through the application of the EMEP/EEA methodology. In the most recent update, the inventory has been expanded with estimates for the period 2020–2022, and an additional revision of data for the period 1990–2019 has been carried out in order to ensure time-series consistency and alignment with contemporary international reporting standards.

The analysis shows that the energy sector is the dominant source of precursor emissions, particularly for NO_x, CO and SO_2, although in recent decades its share has gradually declined. In 1990, more than 95% of NO_x and CO emissions and over 99% of SO_2 emissions originated from the energy sector, reflecting the structure of the energy system at that time, which relied heavily on coal and heavy fuel oil, as well as an older vehicle fleet. By 2022, the structure of emissions becomes somewhat more diversified, with an increasing share of other sectors, particularly in the case of CO emissions. Overall, during the period 1990–2022, a reduction of approximately 40% in total precursor and indirect emissions can be observed, representing a positive trend and indicating a gradual improvement in air quality and a reduction in the use of high-sulfur fuels (Figure 12). However, the trend is not entirely linear, as in certain years temporary increases in emissions are observed, most often associated with large forest fires and variations in activity levels in specific sectors.

Figure 12. Emissions of NOx, CO, NMVOC, SO2 and NH3 in the period 1990 – 2022 (in Gg)



Source: Developed Excel model by the team and team analysis

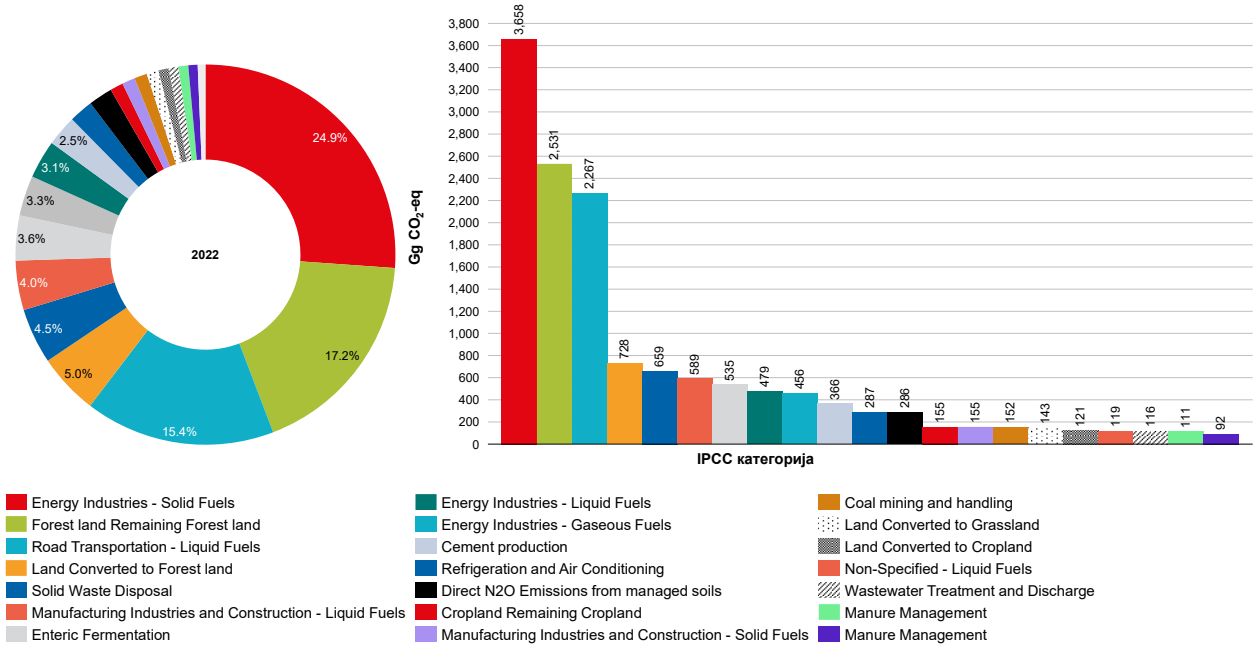
2.3 Key Category Analysis

The key category analysis represents one of the most important methodological elements of the national inventory, as it provides a focus on the sectors and subcategories that have the greatest influence on total emissions, removals, and the national emissions trend. The IPCC methodology requires countries to conduct the identification of key categories as a mandatory task in every cycle of preparing national greenhouse gas inventories, applying two approaches: level assessment and trend assessment. In the Macedonian inventory, this analysis has been conducted in detail and is based on calculations performed using the IPCC Inventory Software. The level assessment shows that in most years five to seven categories account for more than 85% of total emissions excluding forestry. At the top of this list are fuel combustion in energy industries (mainly coal-fired thermal power plants), transport, manufacturing industries and construction (industrial combustion), enteric fermentation, and solid waste disposal. These categories are considered “structural categories”, as they not only contribute the largest share of emissions but are also among the most difficult to decarbonize.

The analysis reveals that coal combustion in large thermal power plants almost without exception has the largest impact, accounting for about 25% of emissions (Figure 13). The second most significant category on the list is “Forest land remaining forest land”, with 17.2%. The fact that forestry appears so high on the list of key categories indicates that forest management, fire prevention, restoration of degraded areas, and biomass monitoring are crucial elements of climate policy. This is followed by the category “Road transport – liquid fuels” with 15.4%, which is one of the most dynamic and fastest-growing sources of emissions. The increase in the vehicle fleet, urbanization, growth in mobility, and continued dependence on diesel and gasoline are the main drivers of this high share. As a result, transport becomes one of the most difficult categories to manage, as emission reduction measures require large investments, changes in behavioral patterns, and long-term technological transformations.

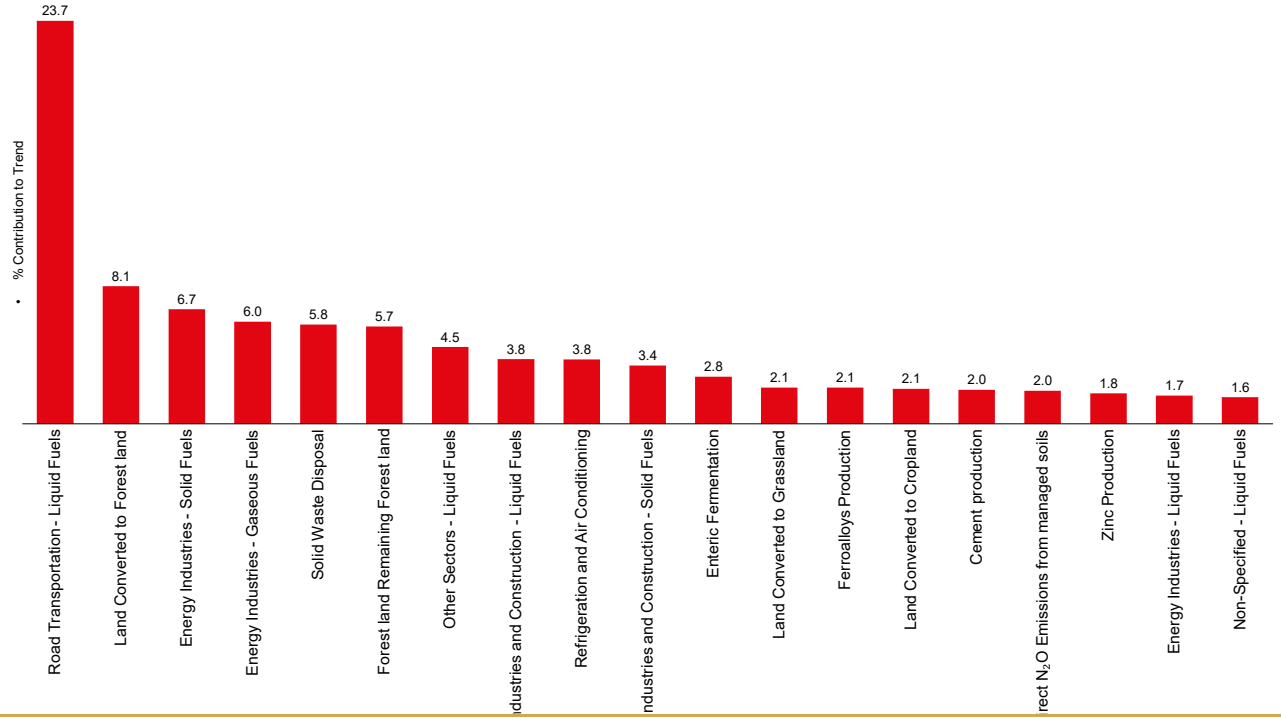
The role of transport is also confirmed by the trend analysis, where transport ranks first with approximately 24% (*Figure* 14), because it shows the largest change in emissions between 1990 and 2022. The growth of transport emissions occurs in parallel with economic expansion, higher levels of mobility, and urban development. This trend is particularly important because it demonstrates that, unlike the energy sector, where trends fluctuate over time, transport is a sector with a consistent growth in emissions, and therefore its importance in future climate policies will continue to increase.

Figure 13. Assessment of the level of contribution of key categories and their share in emissions in 2022



Source: IPCC software, team analysis

Figure 14. Contribution of key categories to emissions trend (1990, 2022) in percent



Source: IPCC software, team analysis

Chapter 3. Assessment of NDC 2.0 Implementation

The objective of this chapter is to evaluate the implementation of the Republic of North Macedonia's Enhanced Nationally Determined Contribution (eNDC), identify achievements and challenges, assess the effectiveness of implemented policies and measures, and derive lessons for the preparation of NDC 3.0. The assessment draws upon information from greenhouse gas inventories, Biennial Transparency Report (BTR1), sectoral policy implementation, stakeholder consultations, and national development planning processes.

This chapter also draws on the Rapid Assessment of the Implementation of the Macedonian Enhanced Nationally Determined Contributions on Climate Change. The assessment combines a top-down indicator-based review, aligned with SDG-linked indicators, with a bottom-up measure-level scoring approach and uses official data available through 2024; the bottom-up grading explicitly does not cover 2025. This provides a common evidence base for assessing implementation progress, bottlenecks and priorities for NDC 3.0.

3.1 Original NDC Commitments

The Enhanced Nationally Determined Contribution submitted in 2021 (NDC 2.0) established an economy-wide mitigation target for 2030 expressed against a 1990 base year, in two forms: a 51% reduction in gross GHG emissions and an 82% reduction in net GHG emissions, the difference between the two reflecting the inclusion of the Forestry and Other Land Use (FOLU) sector. Expressed against the without-measures scenario, the economy-wide reduction target for 2030 corresponded to 78%. The indicative trajectory anticipated that approximately 56% of the total reduction would be achieved by 2020 and 93% by 2025.

The gross target corresponded to approximately 6.06 Mt CO_2-eq of gross emissions in 2030. Re-expressed against other reference years, the 2030 gross target represented reductions of 48% relative to 2005, 47% relative to 2010, 43% relative to 2014 and 40% relative to 2016; for net emissions the corresponding reductions were 78%, 79%, 69% and 73%.

Sectoral objectives for 2030 relative to 1990 were set as follows:

- Energy – 66% reduction (6,321 Gg CO_2-eq), driven principally by the decommissioning of the coal-fired TPP Oslomej in 2021 and TPP Bitola by 2027;
- Industrial Processes and Product Use – 45% increase (420 Gg CO_2-eq), reflecting projected industrial growth;
- Agriculture – 29% reduction (435 Gg CO_2-eq);
- Forestry and Other Land Use – an eighteen-fold increase in removals (2,647 Gg CO_2-eq);
- Waste – 21% reduction (84 Gg CO_2-eq).

The pathway was underpinned by 63 policies and measures covering energy supply and end-use, transport, agriculture, LULUCF, waste and enabling measures. The marginal abatement cost curve prepared for the 2030 target year quantified a total reduction of approximately 5.6 Tg CO_2-eq from the proposed measures, of which around 70% was available at negative specific cost and a further 20% at costs of up to EUR 5/t CO_2-eq. The largest single contributions were expected from large hydropower (741 Gg CO_2-eq in 2030) and landfill-gas flaring (490 Gg CO_2-eq), while advanced mobility and increased use of railway ranked among the measures with the lowest specific costs. The contribution also quantified social co-benefits, estimating up to 9,895 green jobs in 2035 under the with-additional-measures scenario, approximately 77% of them in energy efficiency.

3.2 Progress Achieved

Progress under NDC 2.0 should be interpreted relative to the adoption of the Enhanced Nationally Determined Contribution (eNDC) in 2021 and its 2030 target. Data from earlier years are used in this section only to establish the policy and statistical baseline; they are not counted as implementation progress achieved after adoption of the eNDC.

3.2.1 Pre-eNDC implementation context

When the eNDC was prepared in 2021, implementation of a number of energy-efficiency measures was already under way. The Fourth National Energy Efficiency Action Plan (NEEAP), covering 2015–2019, reported 41 energy-efficiency policies and measures, many of which were subsequently reflected in the mitigation portfolio of the eNDC. Reported final-energy savings reached 180 ktoe in 2018, around 20% above the target set in the Third NEEAP, while approximately 100 ktoe of final-energy savings were achieved during 2016–2018; a further 212 ktoe of savings were reported at primary-energy level. These results demonstrate that the eNDC built on an existing implementation base, particularly in energy efficiency, but they should not be interpreted as progress achieved under the eNDC itself because they pre-date its 2021 adoption.

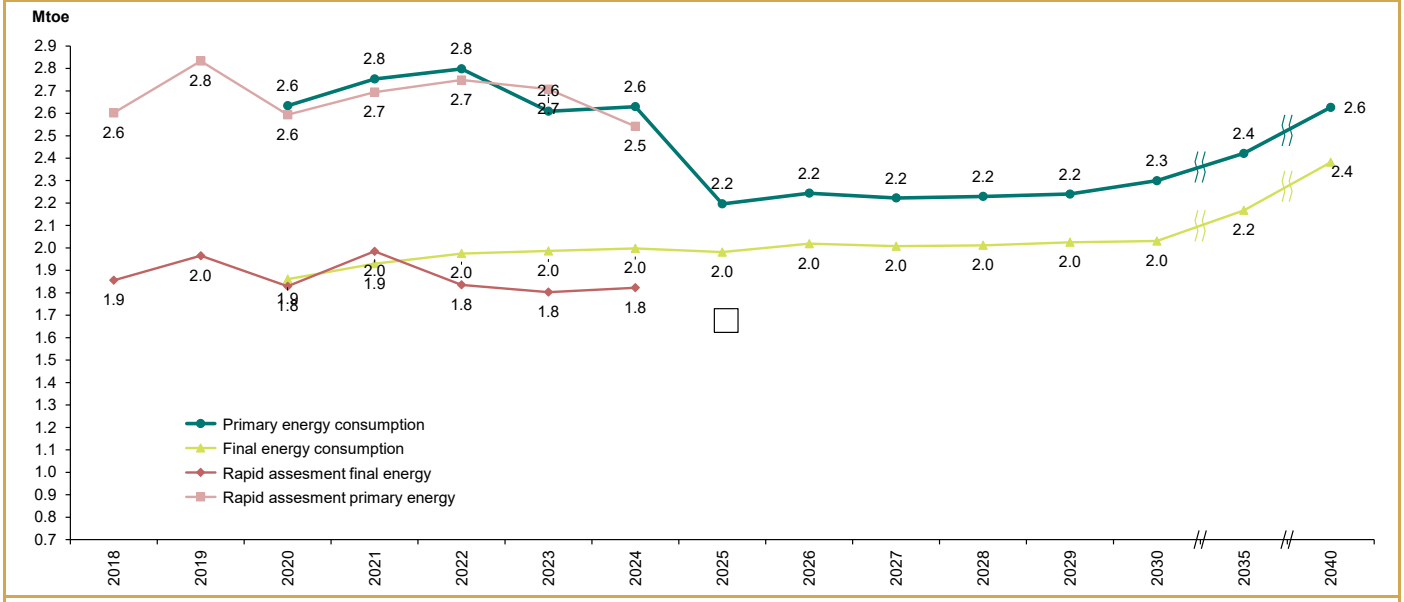
3.2.2 Progress since adoption of the Enhanced NDC (2021)

The assessment of eNDC implementation therefore focuses on developments after 2021. The 2025 Rapid Assessment of the Implementation of the Macedonian Enhanced Nationally Determined Contributions combines two complementary approaches. The top-down approach compares observed indicators with the trajectories and values used in the eNDC

scenarios, while the bottom-up approach evaluates the implementation status of individual policies and measures. Observed data generally extend through 2023 and, for selected indicators, through 2024. The earlier years shown in the figures below provide the historical baseline needed to interpret the post-2021 trend.

Energy-use indicators show that actual primary and final energy consumption remained below the corresponding projected trajectory. The Rapid Assessment reports primary-energy consumption of around 2.60 Mtoe in 2018 and 2.50 Mtoe in 2024, while final-energy consumption reached 1.79 Mtoe in 2024 compared with a projected value of approximately 1.99 Mtoe. For the purpose of tracking the eNDC, the relevant observation is the post-2021 part of this series: energy demand remained below the modeled trajectory in 2021–2023. This is consistent with improved energy efficiency and structural or behavioural changes, although the difference cannot be attributed exclusively to eNDC measures because energy prices, economic activity and other external factors also affect consumption.

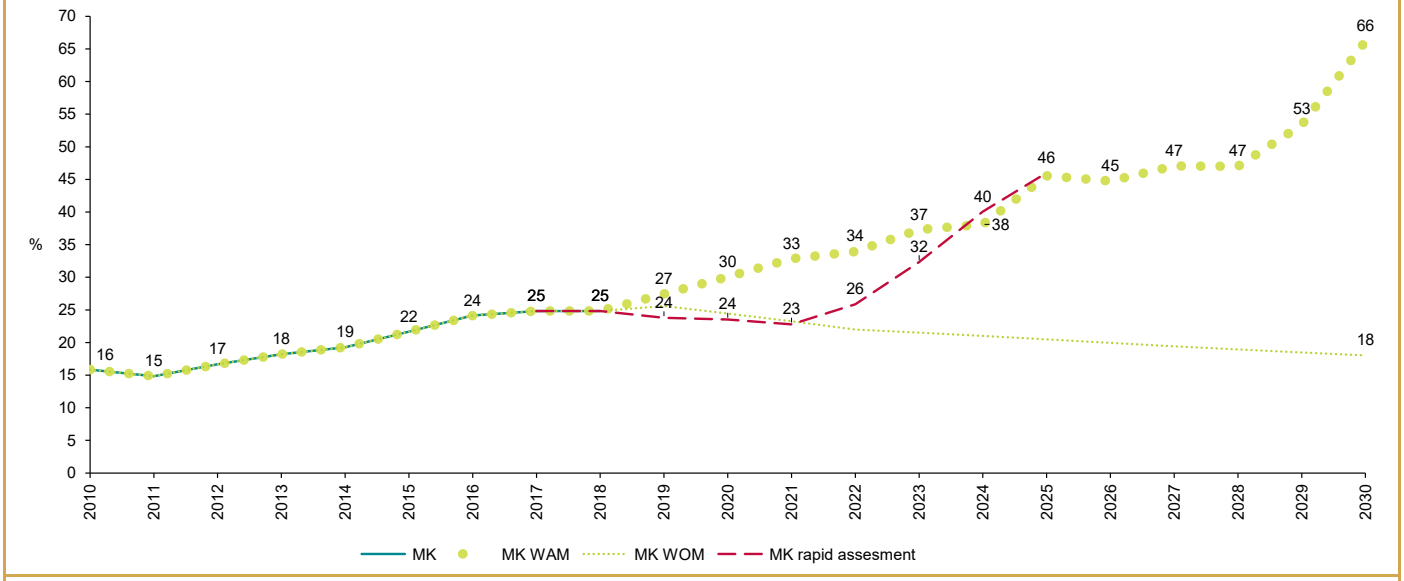
Figure 15. *Primary and final energy consumption*



Source: Source: Rapid Assessment of the Implementation of the Macedonian Enhanced NDC (2025)

Renewable-electricity deployment provides a clearer indication of implementation progress. According to the Rapid Assessment, the renewable share in electricity generation was 23% in 2021, increased to 26% in 2022 and reached 46% in 2025. This was above the WOM projection for 2023 (21.5%) and in line with WAM trajectory (46%). The assessment further notes that solar-electricity production exceeded 800 GWh in 2024, almost 500 GWh more than in 2023, and preliminary estimates indicated that the renewable share in gross final electricity consumption could exceed 37% in 2024. At the same time, incomplete statistical coverage of rooftop PV, heat pumps and other decentralised technologies means that part of the actual renewable-energy uptake is not yet fully captured in official statistics.

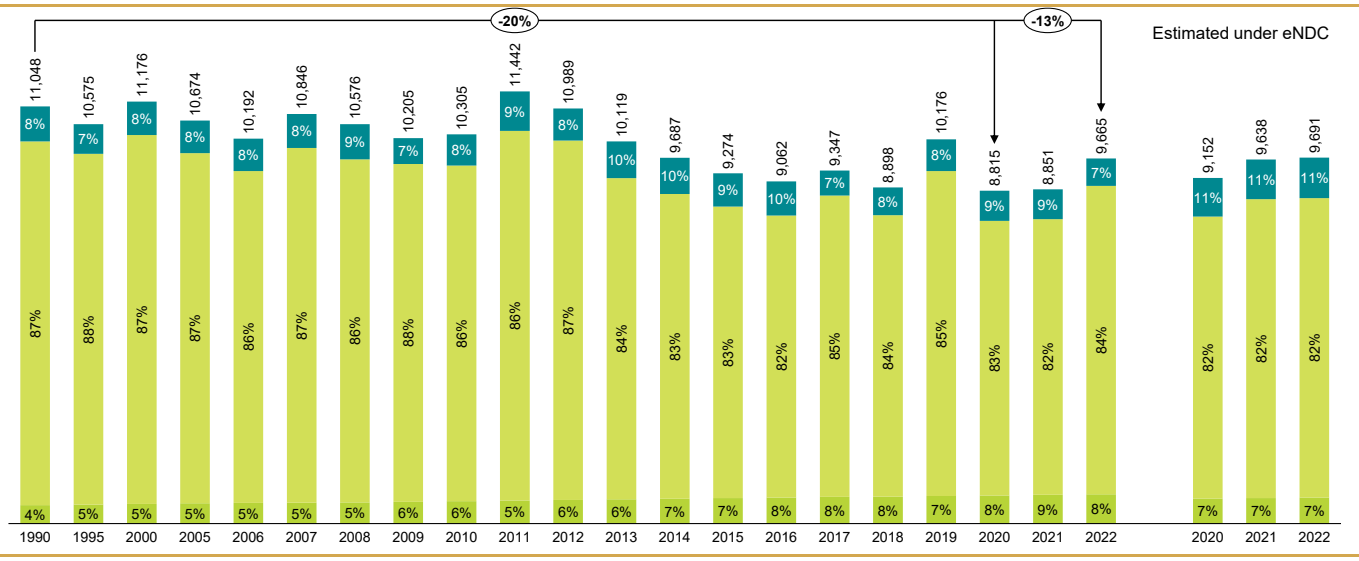
Figure 16. *Electricity generation from renewable energy sources (in %)*



Source: Source: Rapid Assessment of the Implementation of the Macedonian Enhanced NDC (2025)

For GHG emissions, the Rapid Assessment used the available MANU sectoral data for Energy, Waste and Industrial Processes and Product Use because the full national inventory was still being finalised at the time of the assessment. Emissions fell in 2020 and 2021, reflecting the temporary reduction in economic activity and energy demand during the COVID-19 period, and increased again in 2022 during the energy crisis, when coal-fired generation and petroleum-product consumption rose. Importantly, for the sectors covered by the assessment, the 2022 observed values were close to the corresponding eNDC estimates. This suggests that the aggregate trajectory for these sectors was broadly consistent with the eNDC projection over 2020–2022, while also showing the sensitivity of emissions to external shocks and energy-system choices. The comparison should therefore be interpreted as a trajectory check rather than as proof that all individual measures were implemented as planned.

Figure 17. GHG emissions



Source: Source: Rapid Assessment of the Implementation of the Macedonian Enhanced NDC (2025)

The bottom-up assessment confirms that implementation has been uneven across the measure portfolio. Energy-sector measures show average implementation progress of approximately 65%, with the strongest progress in renewable-energy measures such as rooftop solar PV and solar thermal systems and more moderate progress in energy-efficiency and large infrastructure measures. Waste-sector measures show average progress of approximately 55%, reflecting advances in planning but slower implementation because of legal and institutional barriers, limited municipal capacity, financing needs and local opposition to some regional waste facilities. Additional and cross-cutting measures show progress of just under 60%. The 400 kV transmission line to Albania is highlighted as one of the most delayed measures, with a grade of 1 because of administrative, procurement and coordination problems.

Overall, the evidence since 2021 points to a positive but uneven implementation trajectory. Renewable-electricity deployment and several energy-efficiency measures have advanced, while transport, waste, major infrastructure and some cross-cutting measures require acceleration. The Rapid Assessment identifies stronger inter-institutional coordination, regulatory certainty, targeted financing, improved data systems and a more robust MRV framework as priority needs for closing the remaining implementation gap. These findings provide the principal implementation evidence used in NDC 3.0; pre-2021 NEEAP results are retained only as context on the policy foundation already in place when the eNDC was adopted.

3.3 Barriers Encountered

Implementation of NDC 2.0 was constrained by a combination of institutional, financial, infrastructural and data-related barriers.

- Absence of a formal MRV system. No dedicated national monitoring, reporting and verification framework for climate action was established during the period, so progress tracking relied on the NEEAP reporting cycle and the GHG inventory, whose methodologies are only partly comparable with the MARKAL-based NDC calculations.
- Delayed transformation of the electricity system. Security-of-supply considerations required the continued operation of units at REK Bitola well beyond the timeline assumed in NDC 2.0, which envisaged the decommissioning of TPP Oslomej in 2021 and TPP Bitola by 2027. Emissions from energy transformation are consequently projected at 1.72 Mt rather than 0.50 Mt CO_2-eq in 2030.
- Slow deployment of transport alternatives. The original pathway assumed that electricity would substitute approximately 10% of road-transport energy demand by 2030; actual renewable and electric penetration in transport remained below 0.1% during 2021–2023, against a 19% renewable-energy target for the sector.

- Waste-management infrastructure gaps. The pathway assumed regional sanitary landfills with mechanical-biological treatment in operation by 2030. Slower permitting, financing and construction have raised the 2030 waste projection from approximately 0.32 Mt to 0.66 Mt CO_2-eq.
- Vulnerability of the LULUCF sink. Forest fires, drought and forest degradation — most visibly the 2024 fire season — make removals highly variable, and the projected 2030 sink has been revised down from approximately 3.86 Mt to 1.95 Mt CO_2-eq.
- Scale of investment relative to fiscal capacity. The identified energy-sector measures alone imply an indicative investment requirement of approximately EUR 24.57 billion, with substantial additional needs for transmission, distribution, storage and just-transition measures; mobilised public and concessional finance has remained well below this level.
- Institutional and data fragmentation. Responsibilities for energy, transport, agriculture, forestry and waste data are dispersed across institutions, and limited human and analytical capacity at national and municipal level has slowed both measure implementation and the reporting on which progress assessment depends.

3.4 Lessons Learned

The experience of the NDC 2.0 cycle points to several lessons that shape the design of NDC 3.0.

- Sequence measures by cost-effectiveness. The marginal abatement cost analysis showed that around 70% of the assessed potential was available at negative cost and a further 20% below EUR 5/t CO_2-eq. Prioritising this portfolio — energy efficiency, renewable electricity, building renovation, heat pumps — delivers the largest reductions per unit of public expenditure and should structure the unconditional component of the new contribution.
- Set implementation-realistic timelines. The largest deviations between plan and outcome arose where the pathway assumed infrastructure or fleet turnover that had not yet been financed or permitted. Targets for waste treatment capacity, charging infrastructure and railway investment should be tied to procurement and financing milestones rather than to end-year outcomes alone.
- Do not rely on the sink to carry the target. The distance between the 51% gross and 82% net reduction in NDC 2.0 was largely attributable to projected LULUCF removals that proved variable and vulnerable to fire and drought. Gross and net targets should therefore be communicated separately, and forest-fire prevention treated as a mitigation measure in its own right.
- Treat transport as a structural priority, not a residual. Transport was the only major sector in which emissions grew consistently over the assessment period, and its share of energy-sector emissions is projected to approach one third by 2030. Modal shift, fleet renewal and electrification require dedicated instruments rather than reliance on general economic trends.
- Build the MRV system alongside the target. The absence of a functioning national MRV framework during the NDC 2.0 period meant that progress had to be reconstructed from NEEAP reporting and inventory submissions, using methodologies that are not fully comparable. NDC 3.0 should be accompanied by the indicator framework and institutional responsibilities set out in Chapter 10.
- Harmonise the NDC with the NECP from the outset and with other relevant National Development Plans, including the NBSAP and NAP. Differences between the BTR1 and NECP results stem from methodology — full-system cost optimisation versus a sector-specific approach with exogenous parameters — rather than from divergent policy intent. Agreeing assumptions on electricity trade, REK Bitola operation and LULUCF accounting before the target is fixed avoids two parallel official pathways.
- Capture and communicate co-benefits. The NDC 2.0 analysis estimated up to 9,895 green jobs in 2035 under the WAM scenario, of which approximately 77% in energy efficiency and at least 27% attributable to women. More recent labour-market data show that unemployment in the Republic of North Macedonia has continued to decline, reaching 11.5% in 2025, while employment increased by 1.5%. However, youth unemployment remained significantly higher, at 23.0%. Presenting employment, air-quality and energy-security benefits alongside the emission target strengthens the case for implementation and links mitigation to the just-transition agenda.

3.5 Implications of BTR1 Findings

BTR1 changes the quantitative basis on which the NDC 2.0 target was constructed. Following recalculation of the national inventory, gross emissions in 2022 amounted to approximately 10.94 Mt CO_2-eq, with Energy contributing 8.19 Mt, Agriculture 1.20 Mt, Waste 0.83 Mt and IPPU 0.72 Mt CO_2-eq, while the FOLU sink of approximately 3.09 Mt CO_2-eq resulted in net emissions of some 7.85 Mt CO_2-eq. The 1990 reference level has also been revised, to approximately 10.93 Mt CO_2-eq of gross emissions.

When the NDC 2.0 pathway is re-expressed against this updated baseline and the projections of the Updated NECP, the 2030 outcome is materially different from the level assumed in 2021. Projected gross emissions in 2030 increase from approximately 6.06 Mt to 7.21 Mt CO_2-eq (a 42.2% rather than a 51% reduction from 1990), and net emissions

increase from approximately 2.20 Mt to 5.26 Mt CO_2-eq (a 51.9% rather than an 82% reduction). The upward revision is concentrated in energy transformation (+1.49 Mt CO_2-eq), transport (+0.77 Mt CO_2-eq) and waste (+0.34 Mt CO_2-eq), while the projected LULUCF sink is approximately 1.91 Mt CO_2-eq lower than originally assumed.

At the same time, the BTR1 mitigation analysis shows that a deep-reduction pathway remains available: under the With Additional Measures scenario, net emissions fall to approximately 2,800 Gg CO_2-eq in 2030, 2,621 Gg CO_2-eq in 2035 and 2,400 Gg CO_2-eq in 2040, corresponding to a reduction of approximately 74% relative to 1990 and closely aligned with the 2023 NECP and Energy Community targets.

Three implications follow for NDC 3.0. First, the target must be recalibrated against the recalculated inventory and the revised 2030 projections rather than restated from NDC 2.0. Second, the gross and net components should be presented separately and transparently, so that the contribution of a variable and climate-sensitive LULUCF sink is visible and does not mask the level of gross-emission reduction. Third, the 2035 target should be anchored in the WAM pathway and supported by the sectoral measures whose potential is quantified in Chapter 4, with explicit treatment of conditionality where implementation depends on international finance and technology transfer.

Chapter 4. National Mitigation Assessment

4.1 Modelling Framework

The mitigation assessment for NDC 3.0 uses the modelling framework applied in the First Biennial Transparency Report (BTR1), which combines an integrated energy-system optimisation model with the IPCC Inventory Software for the non-energy sectors. This ensures methodological consistency between the historical inventory, the projections and the assessment of individual policies and measures.

Energy-sector projections are prepared with the MARKAL (MARKet ALlocation) model, a full energy-system planning model covering production, transformation and final consumption. MARKAL meets projected energy-service demand by selecting the least-cost combination of technologies, taking into account investment costs, fixed and variable operation and maintenance costs, fuel costs and the cost of imported electricity, and balancing both energy and electricity production. Because emissions from fuel combustion in all subsectors — including industry, agriculture and transport — are reported under the Energy sector in line with the IPCC methodology, the model results are mapped to inventory categories to avoid double counting with the IPPU and AFOLU sectors.

For the Industrial Processes and Product Use sector, projections are built on the projected industrial production index and on physical production volumes for cement, lime and ferroalloys, replacing the earlier practice of correlating emissions directly with GDP that was applied in the Fourth National Communication. Emissions from products used as substitutes for ozone-depleting substances are projected on the basis of a correlation with GDP and the macroeconomic projections. Agriculture and Forestry and Other Land Use projections are prepared with the IPCC Inventory Software to maintain full consistency with the national inventory time series. For the Waste sector, a dedicated model was developed within the IPCC Inventory Software, with separate databases for the WOM and WEM scenarios, retaining the regional approach, activity structures and emission factors used in the inventory and allowing results to be analysed by region and by individual measure.

The principal framework assumptions are drawn from the updated Strategy for Energy Development to 2040 and include an average GDP growth rate of 4.4%, a population decline of approximately 10%, domestic fuel prices for 2012–2023 from the Energy Regulatory Commission, international gas, coal and oil prices from the IEA World Energy Outlook editions 2017–2023, and CO_2 price trajectories based on the 2021 UNDP study on a CO_2 tax in the Republic of North Macedonia and the same World Energy Outlook editions.

The framework differs from that of the Updated National Energy and Climate Plan (NECP) in its modelling logic. BTR1 uses MARKAL to optimise the entire energy system - production, transformation and final consumption - at system level under cost and capacity constraints, whereas the NECP uses the LEAP model and applies optimisation principally to the electricity system, with several parameters, including electricity production and trade, specified exogenously. During parallel preparation, key assumptions were progressively harmonised to improve comparability. Remaining differences are concentrated mainly in electricity trade and in FOLU/LULUCF accounting, including the treatment of removals from perennial plantations and burned areas. These differences should therefore be interpreted as methodological and scenario-design differences rather than as evidence of divergent climate-policy direction.

The resulting NDC 3.0 mitigation assessment uses MARKAL as the integrated energy-system optimisation engine, the IPCC Inventory Software for non-energy sectors, and the recalculated BTR1 inventory as the common historical accounting basis. The LEAP-based Updated NECP is used as a policy-consistency and sensitivity benchmark. Comparisons of percentage reductions are made only after reconciling the inventory vintage and the 1990 reference value, because revisions of FOLU removals materially affect net-emissions percentages even when the absolute target-year emissions level is unchanged.

4.2 Scenario Development

Three scenarios are used to assess the possible development of greenhouse gas emissions: a Without Measures (WOM) scenario, a With Existing Measures (WEM) scenario and a With Additional Measures (WAM) scenario. All three are constructed on common assumptions regarding economic development, demographic trends and technological progress, so that differences between them reflect policy content rather than divergent framework conditions.

WOM excludes climate policy altogether and serves as the analytical baseline. WEM includes policies and measures already adopted and initiated. WAM assumes enhanced and coordinated implementation of the broader mitigation portfolio and is used as the principal technical reference for assessing the mitigation potential available to NDC 3.0. The final NDC target, however, must also reflect the reconciled inventory basis, implementation feasibility, technology sequencing and the distinction between domestically deliverable and internationally supported measures.

The difference between the scenarios arises primarily in the energy and forestry sectors; identical assumptions and values are applied in the IPPU and agriculture sectors. In energy, WAM incorporates the full portfolio of mitigation measures and consequently achieves markedly deeper decarbonisation than WEM. In forestry, the scenarios differ in fire management and the pace of afforestation: WEM assumes a reduction in the average burned area from 9,000 ha to 6,000 ha by 2030, while WAM assumes a more ambitious reduction to 3,000 ha by 2030 together with additional afforestation. In both scenarios the area of transitional woodland decreases from 95,000 ha to 80,000 ha by 2030, with a further reduction of 5,000 ha every five years, while the area of deciduous forest increases, particularly through afforestation with oak.

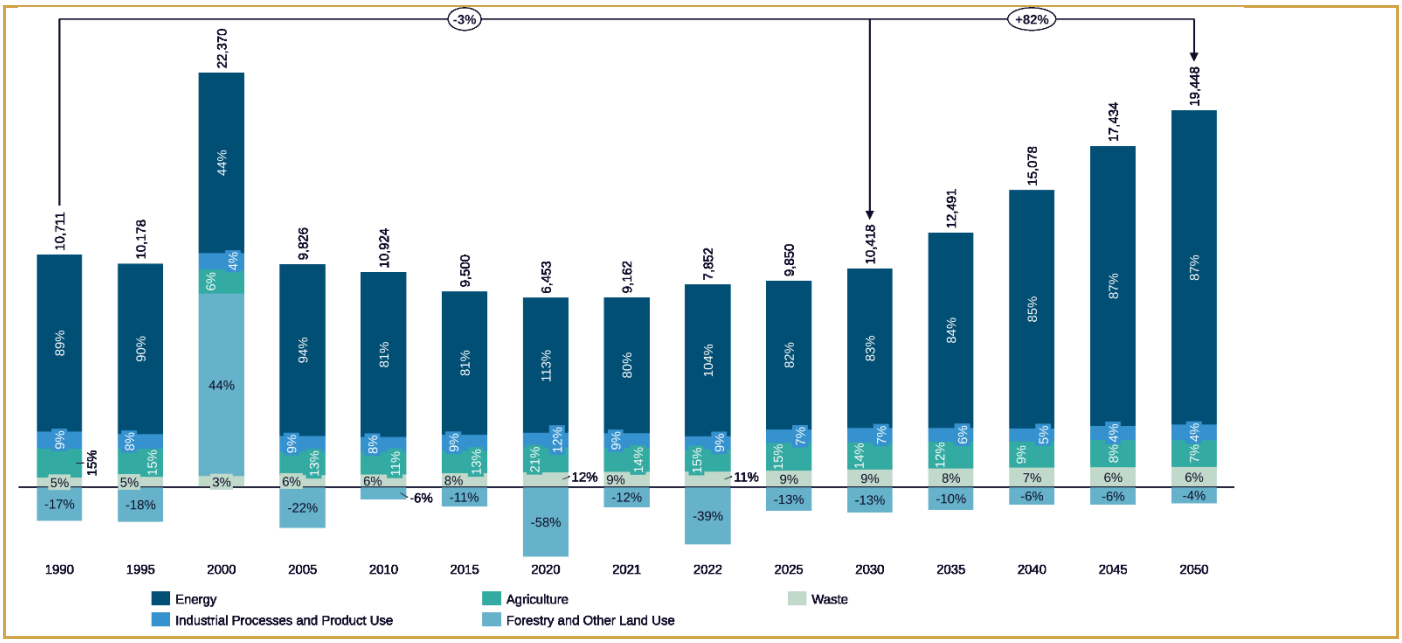
4.2.1 WOM

The WOM scenario describes emission development in the absence of climate change mitigation policies and measures and serves as the reference against which the effect of measures is assessed.

Total emissions remain relatively stable through 2030, some 3% below the 1990 level, with energy dominating the emissions structure across both the historical and the projection period, and agriculture, IPPU and waste contributing significantly smaller but structurally stable shares. After 2030 the trend reverses: emissions grow substantially, reaching approximately 82% above the 1990 level by the end of the projection period, with the energy sector increasing its share to around 87% of the total (Figure 18).

The scenario therefore represents a path of limited progress to 2030 followed by accelerated emission growth. Structural dependence on fossil fuels remains the principal driver, and the natural sink from forestry is not sufficient to offset emission growth. WOM is retained as the analytical reference point for quantifying the mitigation effect of individual measures and for expressing the economy-wide reduction target relative to a no-policy baseline.

Figure 18 Total greenhouse gas emissions by sector - WOM scenario (in Gg CO2-eq)



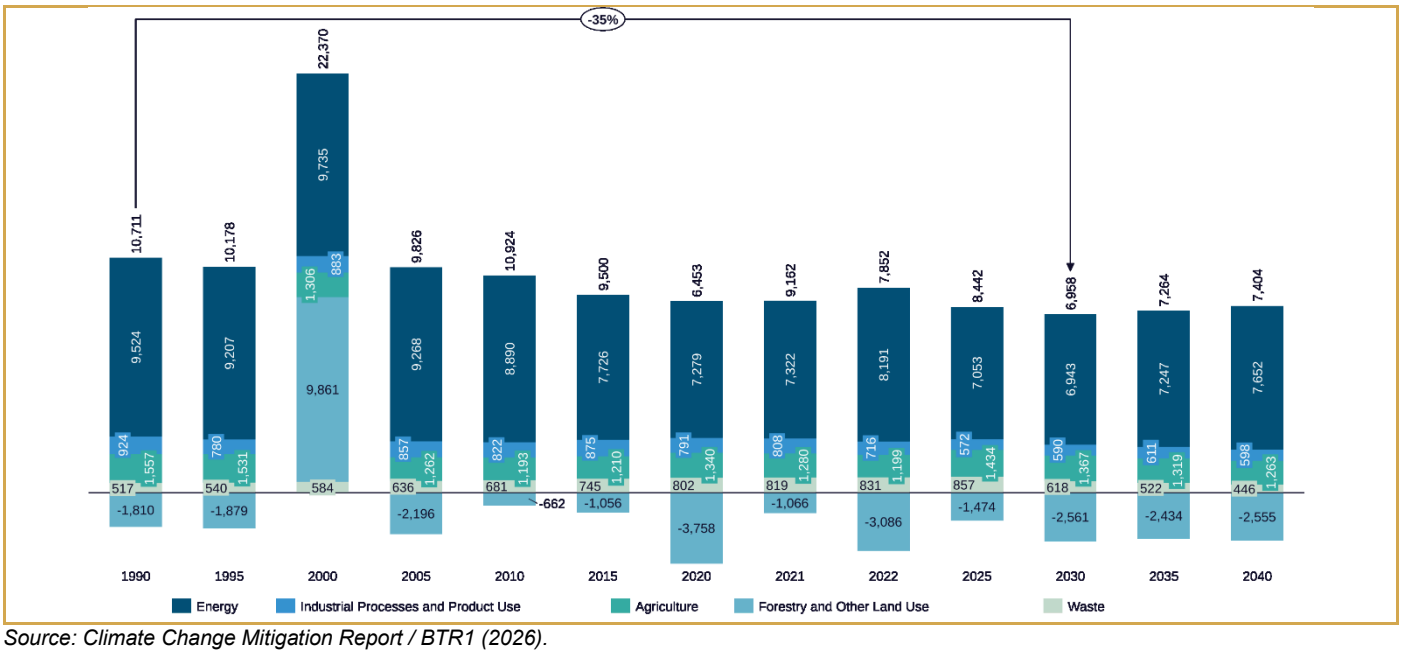
Source: Climate Change Mitigation Report / BTR1 (2026).

4.2.2 WEM

The With Existing Measures (WEM) scenario reflects only those policies and measures that have already been adopted and whose implementation has commenced. Emission reductions therefore occur gradually and remain limited in scale, driven by ongoing regulatory activity, investments already committed and natural technology replacement. WEM serves as the reference against which the additional effect of WAM is quantified. During BTR1 preparation it was also progressively harmonised with the NECP assumptions to improve comparability, although the two frameworks retain different modelling logic.

Under BTR1, WEM produces a gradual decline in net national GHG emissions through 2040, corresponding to roughly one third below the recalculated 1990 level, but it does not generate the transformational reduction required for the NDC 3.0 and 2050 climate-neutrality pathway (Figure 19). Energy remains the dominant source. The BTR WEM modelling retains the operation of two units at REK Bitola as a security-of-supply assumption during the transition. This should be read as a BTR scenario assumption rather than as an identical representation of the final Updated NECP pathway, which envisages a faster coal phase-out and one additional gas-fired CHP unit around 2030 to support system stability.

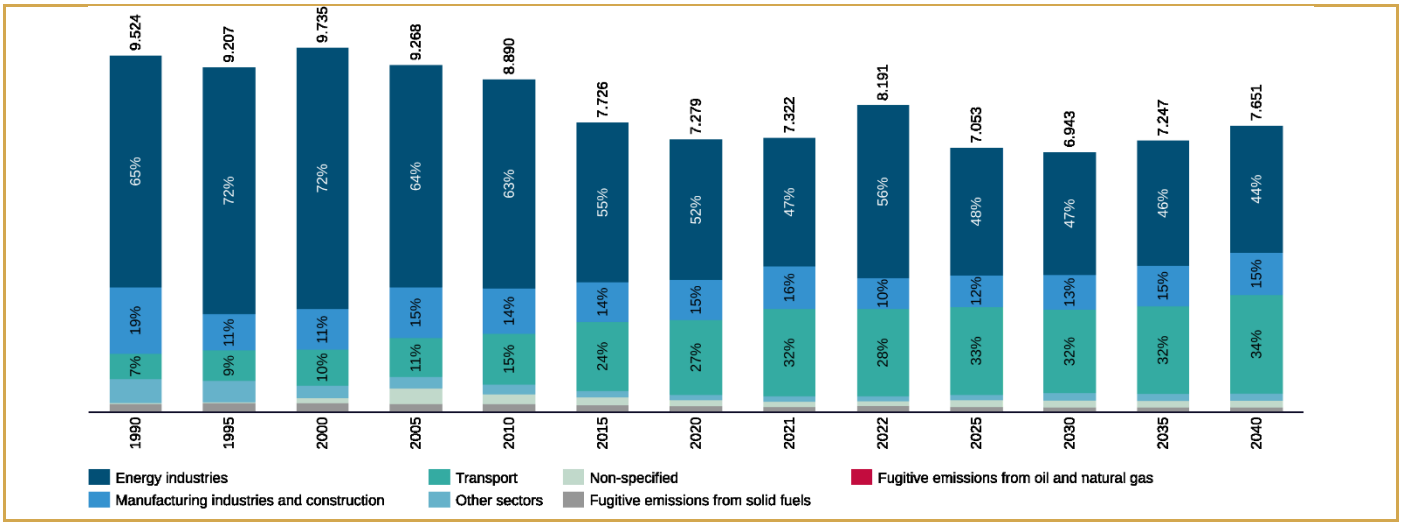
Figure 19 Total greenhouse gas emissions by sector - WEM scenario (in Gg CO2-eq)



Source: Climate Change Mitigation Report / BTR1 (2026).

Within the energy sector, the internal structure of emissions shifts markedly. The share of energy industries falls from approximately 65–72% in the initial years to about 47% in 2030 and around 44% in 2040, while the share of transport rises to approximately 33% in 2030 and the share of industry averages around 14% over the period (Figure 20). This shows that, despite the reduction in emissions from electricity generation, the transformation of energy-consuming sectors is not sufficiently strong: the structure of energy-sector emissions merely moves away from production towards a greater contribution from transport and other end-use sectors. The implication for NDC 3.0 is that measures targeting final energy consumption — above all in transport — are the binding constraint under a continuation of current policy.

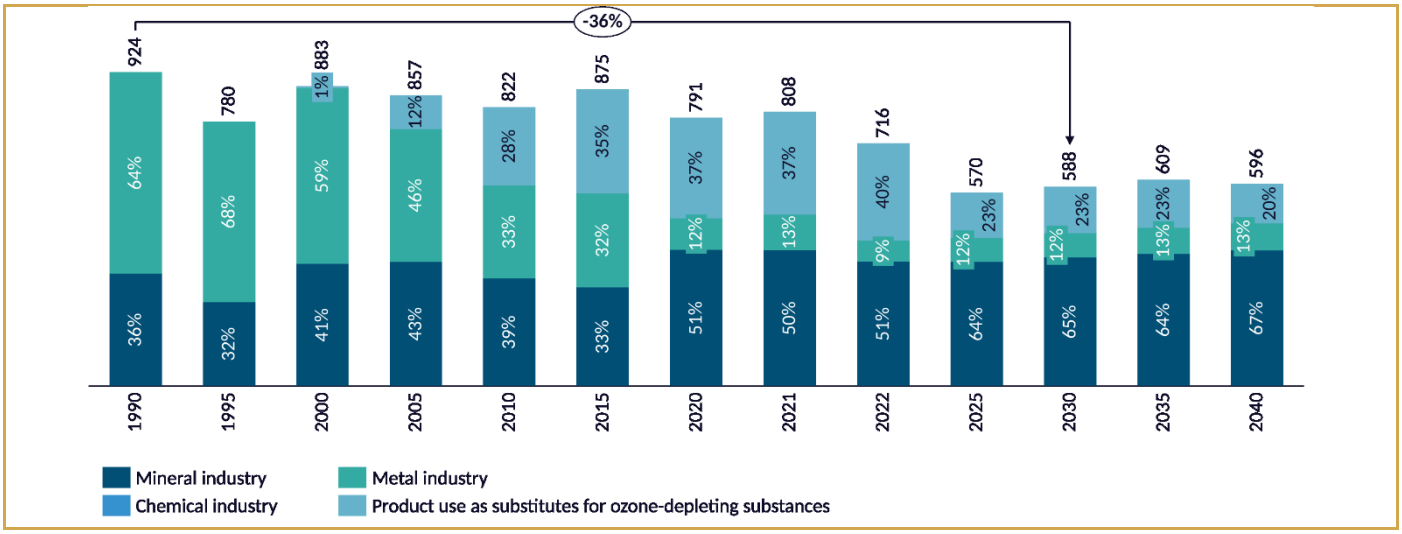
Figure 20 Total greenhouse gas emissions, Energy sector - WEM scenario (in Gg CO2-eq)



Source: Climate Change Mitigation Report / BTR1 (2026).

Emissions from Industrial Processes and Product Use remain relatively stable, with minor variations around 800–900 Gg CO_2-eq. Over the projection period a moderate decline is observed, to approximately 571 Gg CO_2-eq by 2025, after which emissions remain at around 600 Gg CO_2-eq through 2040. This indicates that more efficient technologies are being introduced in industry, but that their effect is insufficient to produce a substantial reduction, so industry remains an important longer-term source of emissions (Figure 21).

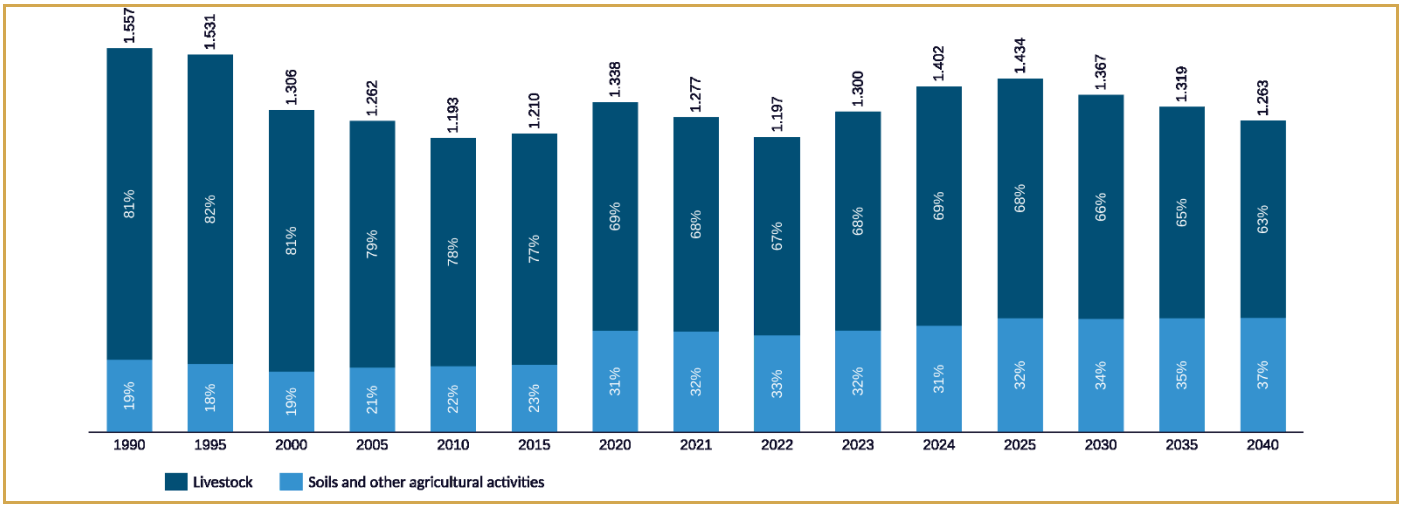
Figure 21 Total greenhouse gas emissions, IPPU sector - WEM scenario (in Gg CO2-eq)



Source: Climate Change Mitigation Report / BTR1 (2026).

Agricultural emissions increase slightly through 2025 and then stabilise at approximately 1,260 $GgCO_2$-eq through 2040, remaining almost unchanged relative to 2022 levels. This reflects the fact that these emissions arise from biological processes and production practices that are more difficult to change. Without additional targeted measures, agriculture remains a persistent source of emissions (Figure 22).

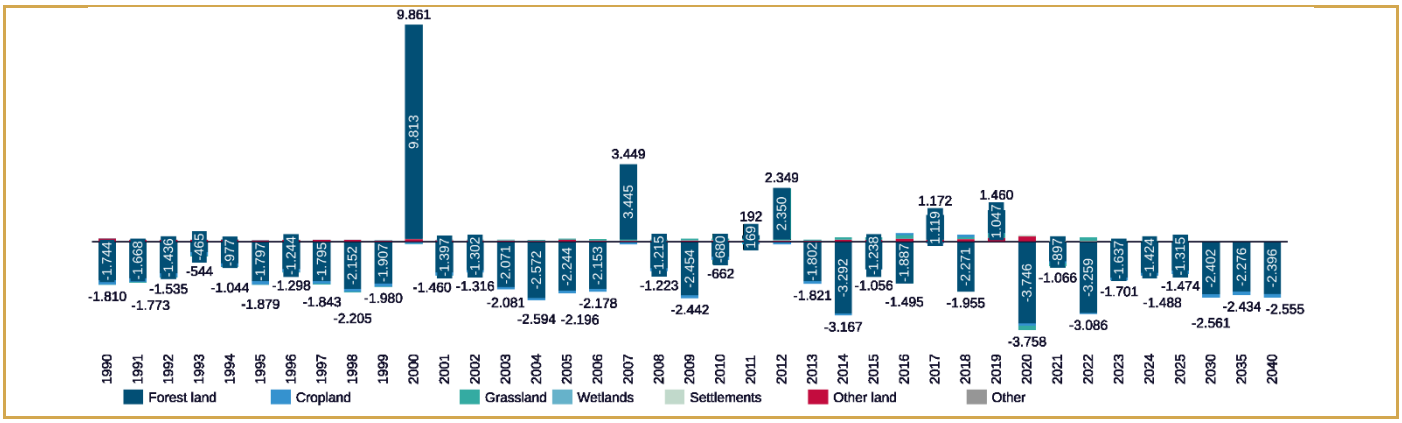
Figure 22 Total greenhouse gas emissions, Agriculture sector - WEM scenario (in Gg CO2-eq)



Source: Climate Change Mitigation Report / BTR1 (2026).

The Forestry and Other Land Use sector remains a net CO_2 sink throughout the period, although its contribution varies over time with the balance between removals and emissions across land categories. During the historical period the net sink generally ranges from approximately −1,800 to −2,600 Gg CO_2-eq. The higher emissions from the FOLU sector observed in 2000, 2007, 2011, 2012, 2017 and 2019 are largely associated with extensive forest fires and the resulting loss of forest biomass. These years correspond to particularly severe fire seasons, with approximately 46,236 ha burned in 2000, 35,248 ha in 2007, 17,813 ha in 2011, 16,716 ha in 2012, 13,316 ha in 2017 and 15,675 ha in 2019, substantially increasing emissions from the FOLU sector. In the projection period it remains negative, reaching approximately −2,500 Gg CO_2-eq in 2030 and holding at that level through 2040 (Figure 23). The WEM assumptions include livestock-related measures and a reduction in the average area affected by fire from 9,000 ha to 6,000 ha by 2030, together with a decrease in transitional woodland from 95,000 ha to 80,000 ha by 2030 and a further 5,000 ha every five years.

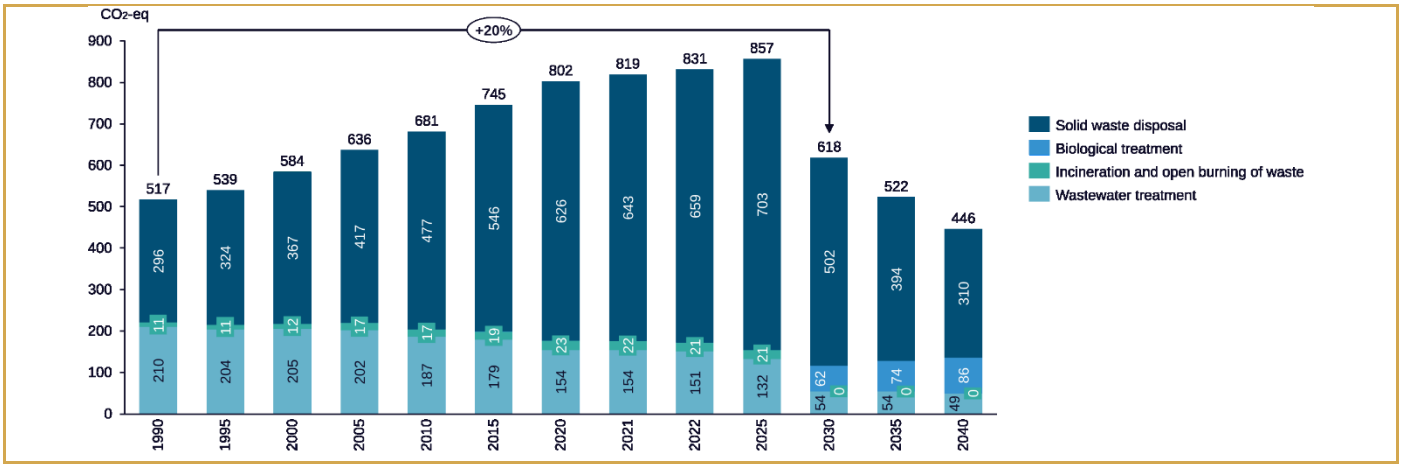
Figure 23 Total greenhouse gas emissions, Forestry and Other Land Use sector - WEM scenario (in Gg CO2-eq)



Source: Climate Change Mitigation Report / BTR1 (2026).

The waste sector shows the clearest downward trend of the non-energy sectors. From approximately 800–850 Gg CO_2-eq in recent years, emissions decline gradually to around 600 Gg CO_2-eq in 2030 and approximately 450 Gg CO_2-eq in 2040 (Figure 24). This reflects continuing improvement in waste management through reduced landfilling, improved treatment and lower emissions from wastewater, and provides a positive indication of the effectiveness of the measures already adopted in this sector.

Figure 24 Total greenhouse gas emissions, Waste sector - WEM scenario (in Gg CO2-eq)



Source: Climate Change Mitigation Report / BTR1 (2026).

The co-benefit profile of WEM is correspondingly limited. PM2.5 emissions fall only from approximately 8.2 kt in 2020 to around 6.0 kt in 2040, compared with 3.2 kt under WAM, so the air-quality and health gains available from the additional measures are largely forgone.

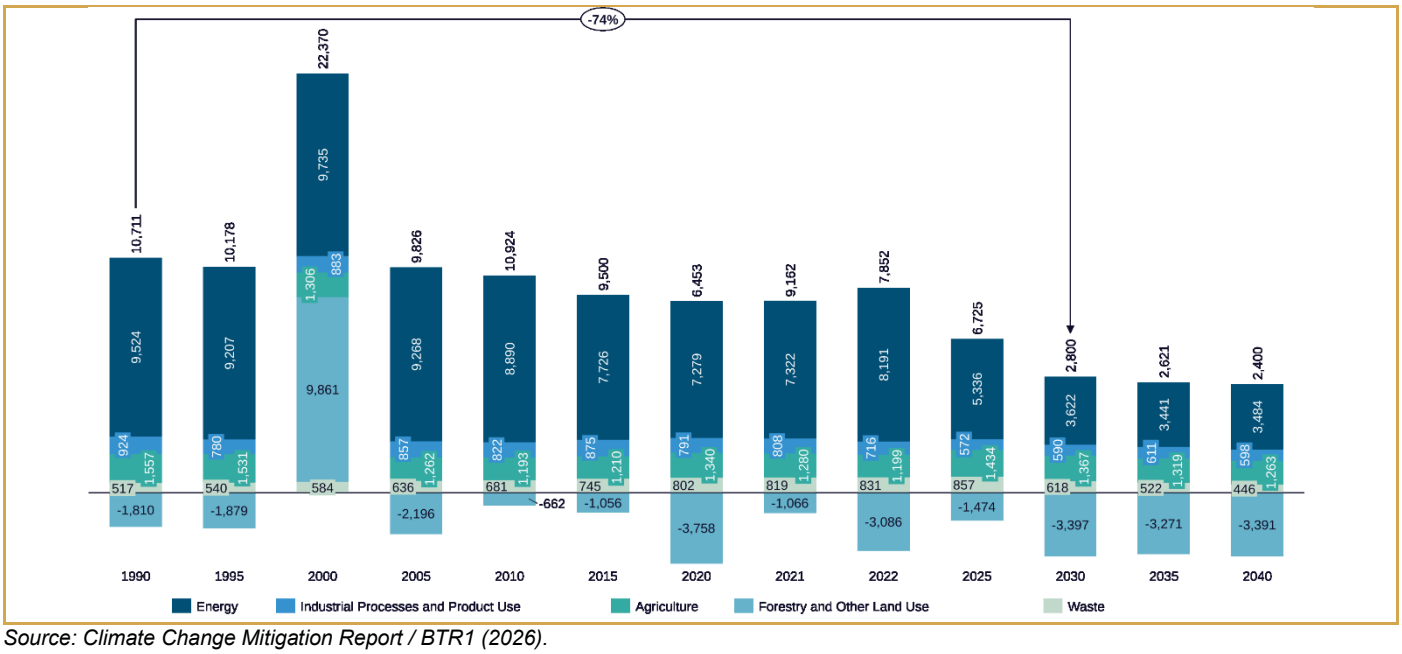
Overall, WEM is a useful current-policy counterfactual: it confirms that existing measures bend the emissions trajectory downward, but also that deeper and more systemic decarbonisation requires the additional measures assessed under WAM. WEM should therefore be used to quantify the incremental effect of additional policies rather than as the ambition benchmark for NDC 3.0.

4.2.3 WAM

The With Additional Measures (WAM) scenario assumes enhanced and coordinated implementation of the full portfolio of mitigation measures across all relevant sectors. It is the principal technical mitigation-potential scenario for NDC 3.0 and provides the most recent integrated estimate of what can be achieved if the identified measures are implemented. It should not, however, be interpreted automatically as the unconditional NDC target: the conversion of WAM potential into a formal commitment depends on implementation readiness, political support, financing and international support.

Under WAM, net national GHG emissions decline to approximately 2,800 Gg CO2-eq in 2030, 2,621 Gg CO2-eq in 2035 and 2,400 Gg CO2-eq in 2040. Relative to the recalculated BTR1 1990 net level of approximately 10,711 Gg CO2-eq, this corresponds to reductions of about 74% in 2030, 75.5% in 2035 and 77.6% in 2040. Most of the reduction originates in the energy sector through lower fossil-fuel use, renewable-energy deployment, energy efficiency and electrification, while FOLU remains a substantial but climate-sensitive net sink. The trajectory demonstrates a technically credible deep-reduction pathway through 2040, but further acceleration after 2040 is required to reach the national climate-neutrality objective for 2050 (Figure 25).

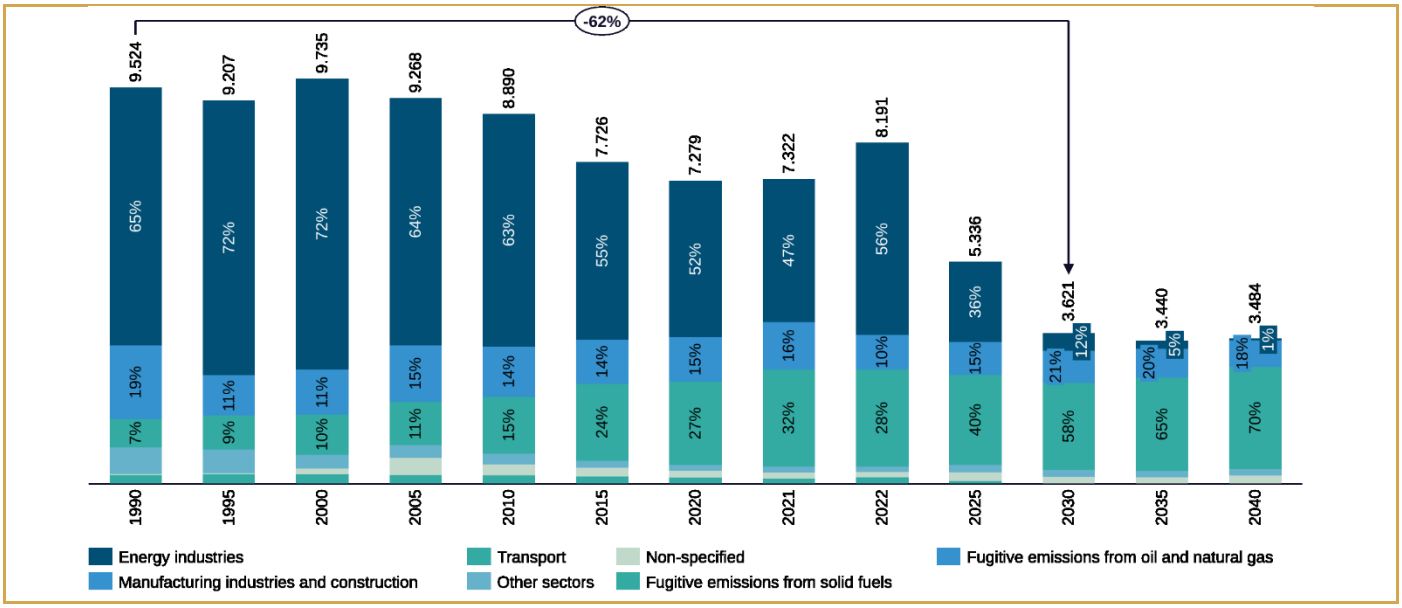
Figure 25 Total greenhouse gas emissions by sector - WAM scenario (in Gg CO2-eq)



Source: Climate Change Mitigation Report / BTR1 (2026).

In the energy sector, WAM emissions fall from 8,191 Gg CO2-eq in 2022 to 5,336 Gg in 2025, 3,622 Gg in 2030 and 3,441 Gg in 2035, before remaining broadly stable at 3,484 Gg in 2040. This represents a structural shift in the emissions profile and reflects the combined effect of electricity-sector decarbonisation, energy efficiency, electrification and changes in fuel use. The residual energy emissions after 2030 are important for target design because part of the longer-term transition - including the possible conversion of gas-based generation and industrial use towards low-emission hydrogen and/or the deployment of carbon capture - may materialise mainly after 2035 (Figure 26).

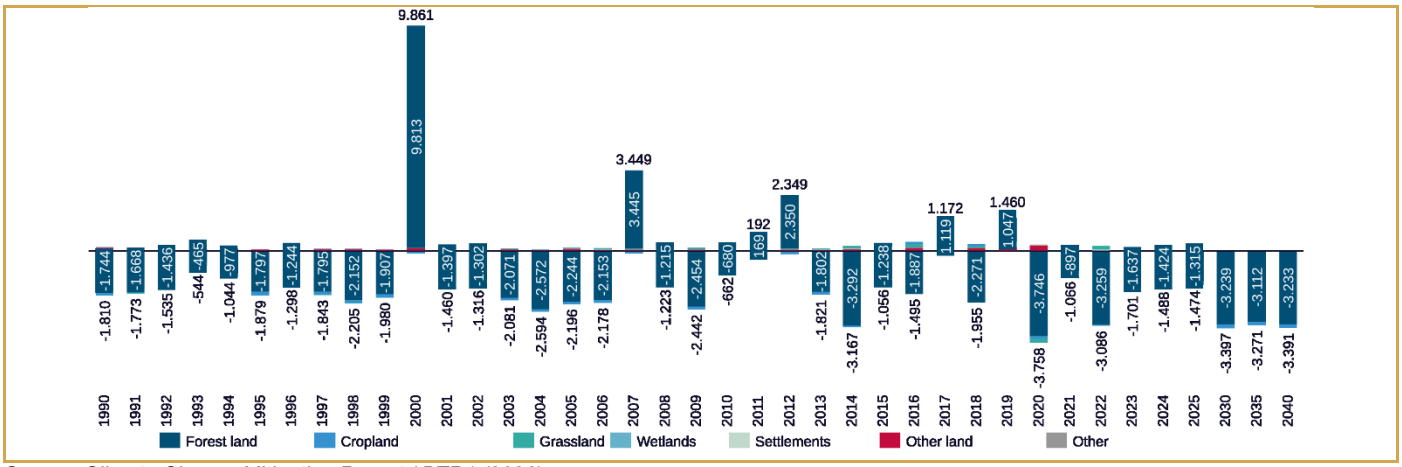
Figure 26 Total greenhouse gas emissions, Energy sector - WAM scenario (in Gg CO2-eq)



Source: Climate Change Mitigation Report / BTR1 (2026).

In FOLU, the net sink is -3,086 Gg CO2-eq in 2022 and, under WAM, reaches approximately -3,397 Gg in 2030, -3,271 Gg in 2035 and -3,391 Gg in 2040 (Figure 27). Relative to WEM, WAM assumes stronger fire management and afforestation, including a reduction in average burned area to 3,000 ha by 2030 and additional afforestation. Because the sink is highly sensitive to wildfire, drought, forest management and inventory methodology, it must be treated as a mitigation contribution with explicit permanence and uncertainty risks rather than as a fixed offset.

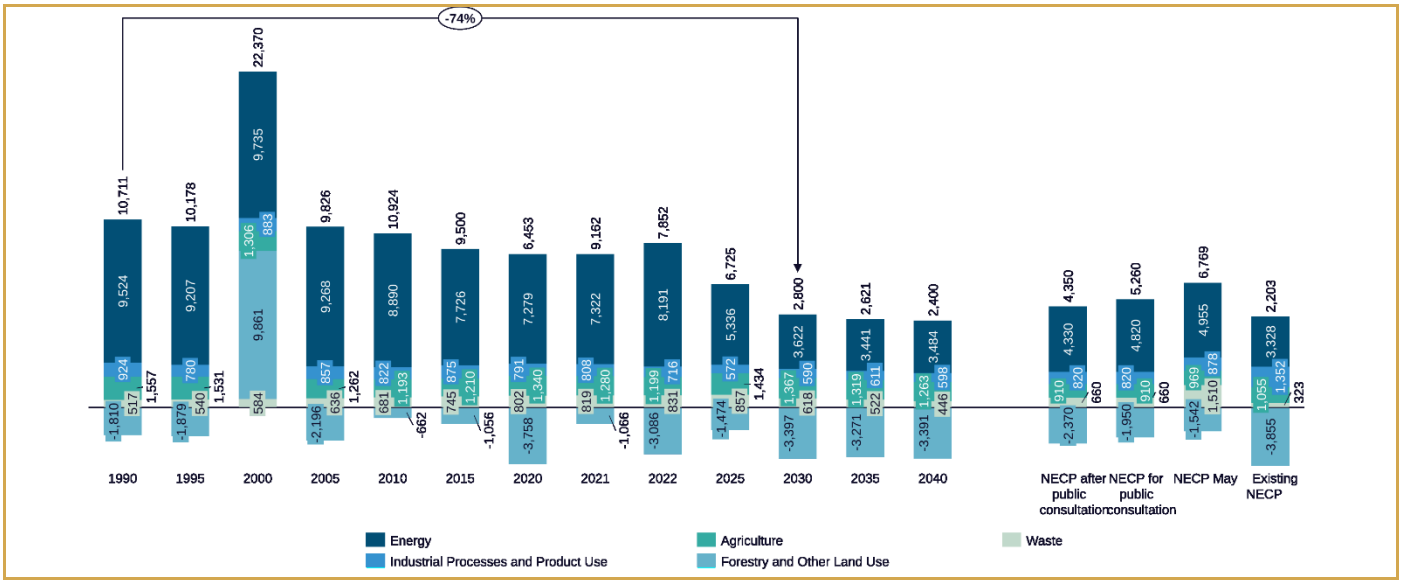
Figure 27 Total greenhouse gas emissions, Forestry and Other Land Use sector - WAM scenario (in Gg CO2-eq)



Source: Climate Change Mitigation Report / BTR1 (2026).

Expressed in net terms, BTR1 WAM is materially more ambitious than the final Updated NECP 2030 pathway: approximately 2.80 Mt CO2-eq under WAM compared with 4.35 Mt CO2-eq in the Updated NECP after public consultation. Earlier NECP versions were higher still (), while the existing 2023 NECP benchmark was approximately 2.203 Mt.[1] The gap between WAM and the Updated NECP is therefore not negligible. It reflects different modelling architectures, different assumptions on electricity production and trade, and different treatment of FOLU/LULUCF. For NDC 3.0, WAM should be treated as the principal technical mitigation-potential envelope, while the Updated NECP provides an implementation and policy-consistency test (Figure 28).

Figure 28 Total greenhouse gas emissions by sector - WAM scenario compared with the NECP (in Gg CO2-eq)

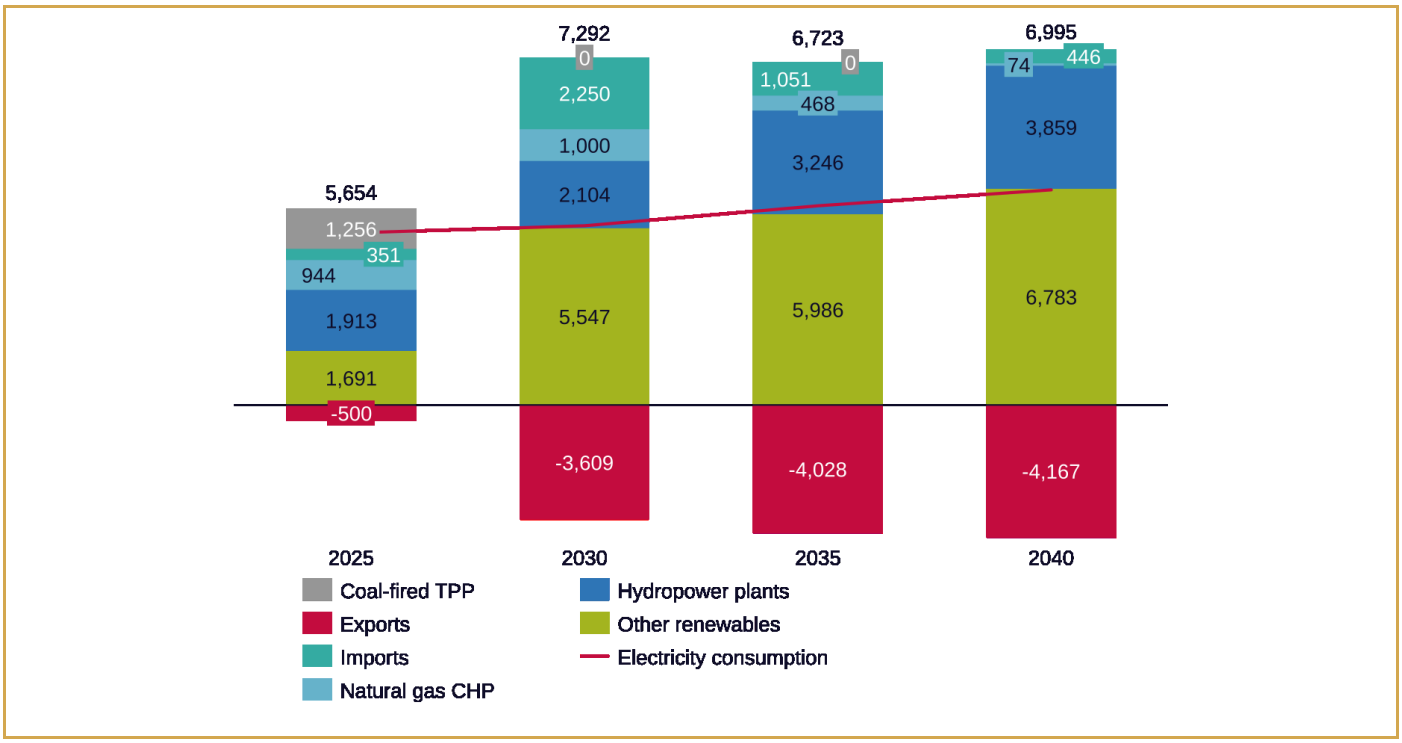


Source: Climate Change Mitigation Report / BTR1 (2026).

The largest remaining divergences between BTR1 WAM and the Updated NECP arise in the energy sector and in FOLU. In FOLU, the BTR1 retains inventory improvements including removals from perennial plantations, while the NECP uses different assumptions and explicitly incorporates recent forest-fire information. In the energy sector, the NECP projects domestic electricity production above 13,000 GWh by 2040 and assumes high exports, whereas the BTR1 WAM determines production and trade endogenously through whole-system cost optimisation and reaches approximately 10,000 GWh of production in 2040, of which around 6,783 GWh is renewable. Higher export-driven generation in the NECP increases utilisation of gas-fired capacity and therefore raises emissions relative to the BTR1 optimisation solution. These differences should be retained transparently in NDC 3.0 rather than forced into a single identical model result (Figure 29 and Figure 30).

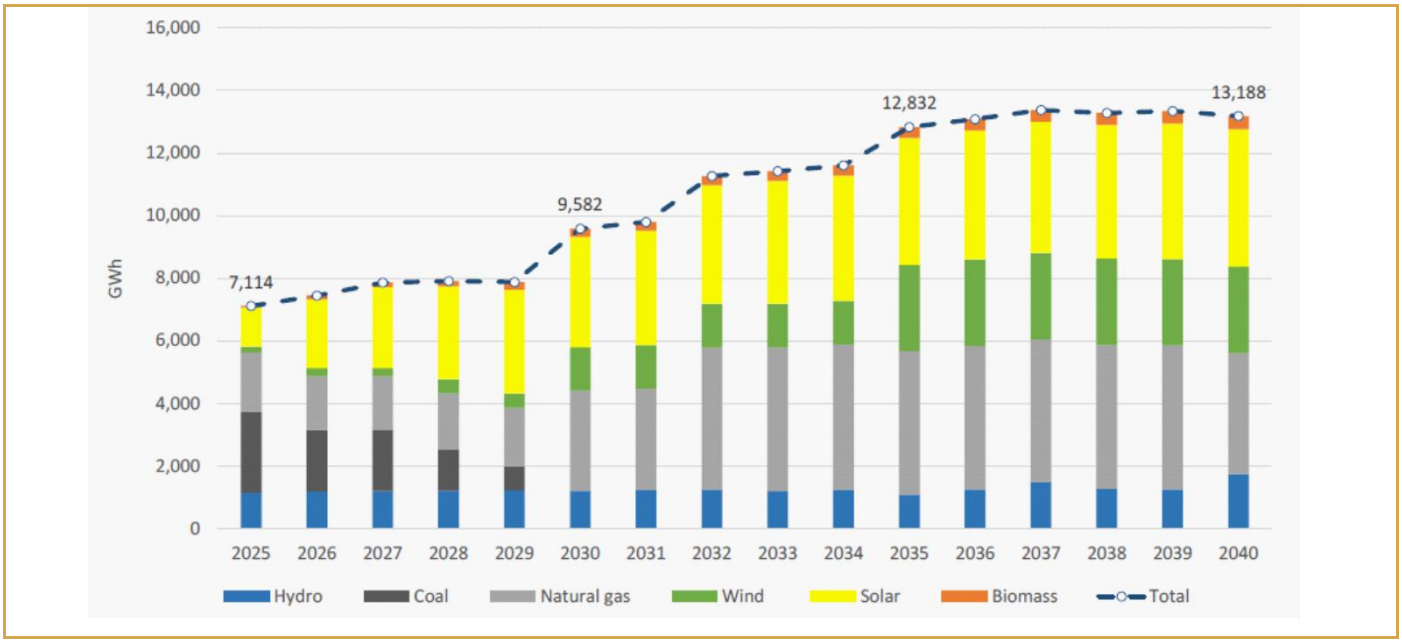
[1] Updated National Energy and Climate Plan of North Macedonia 2025-2030 adopted in April 2026.

Figure 29 Electricity needs and supply, WAM scenario (in GWh)



Source: Climate Change Mitigation Report / BTR1 (2026).

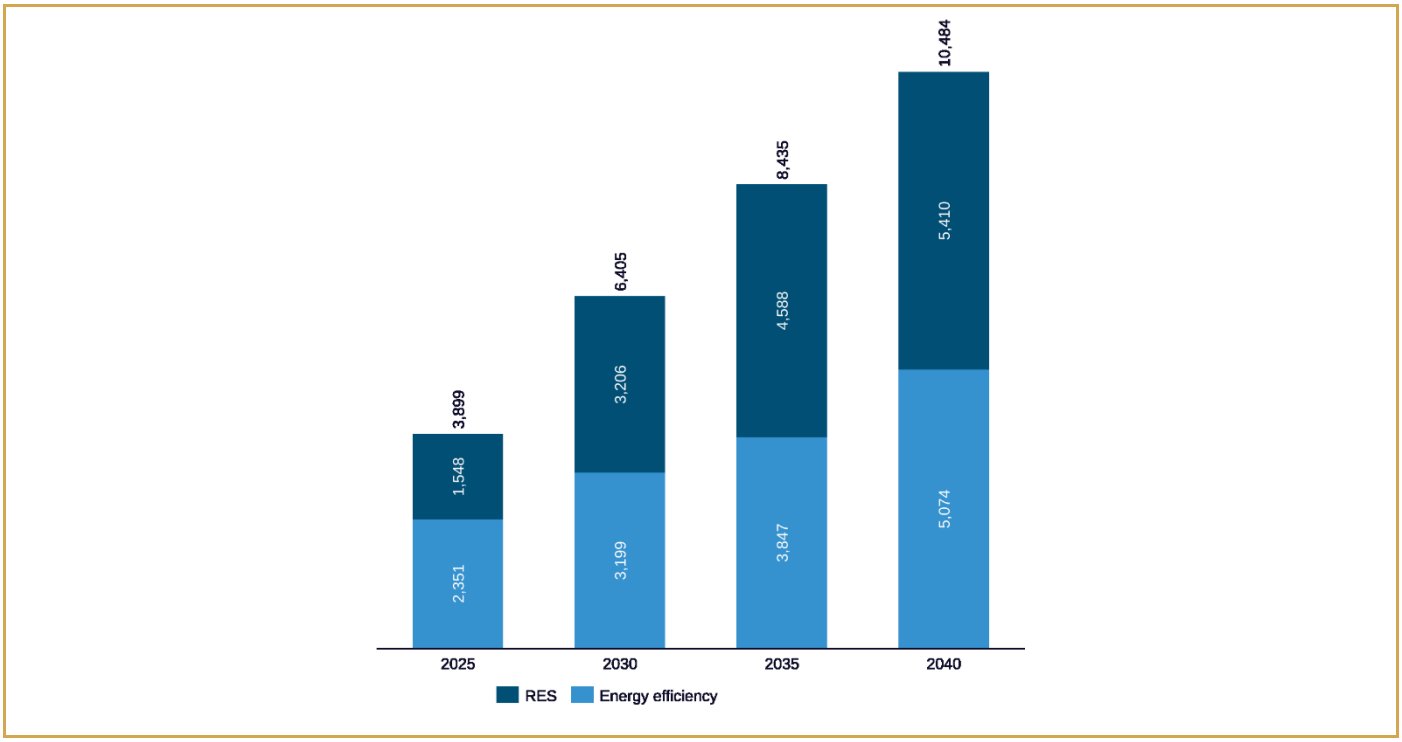
Figure 30 Electricity production, updated NECP



Source: Updated NECP, reproduced in the Climate Change Mitigation Report / BTR1 (2026).

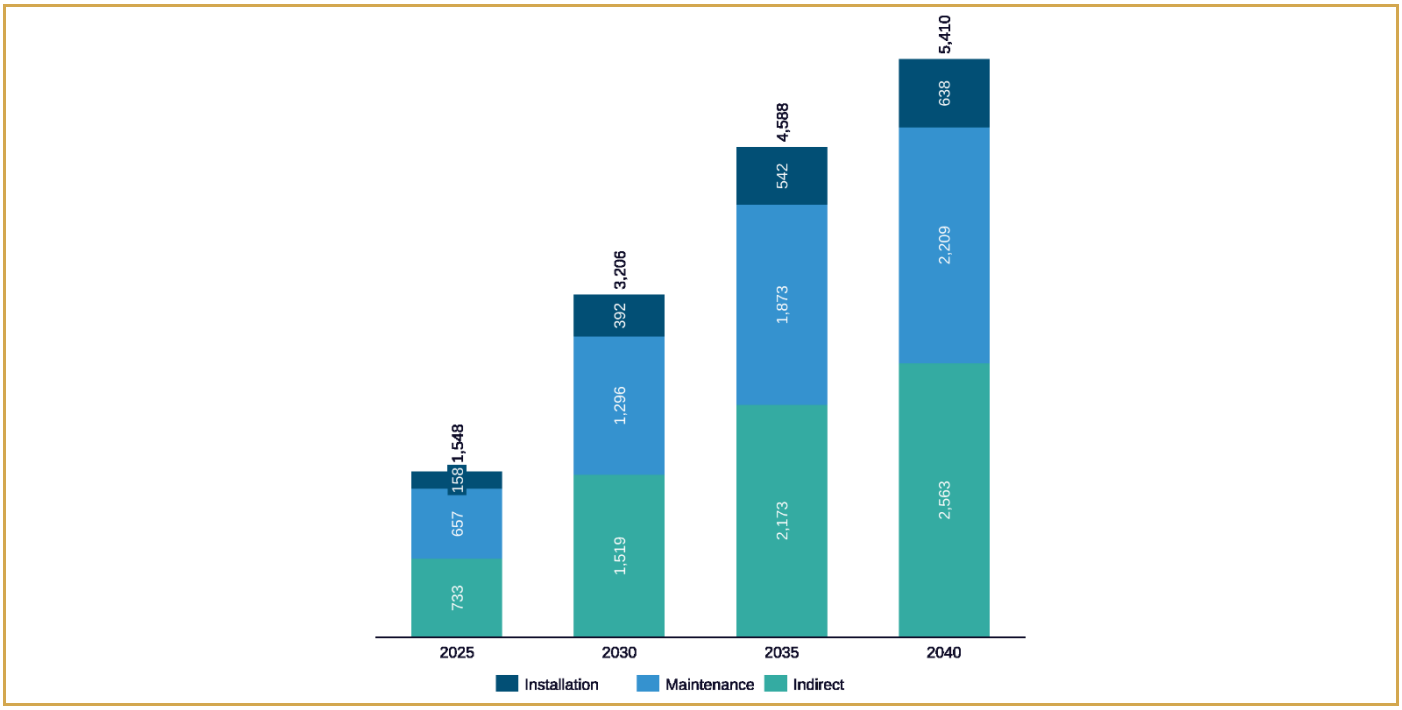
The employment effects of WAM are substantial. Total jobs increased from 3,899 in 2025 to 6,405 in 2030 and 10,484 in 2040 — an almost threefold increase over the period. The structure shifts over time: in 2025 approximately 2,351 jobs are associated with energy efficiency and 1,548 with renewable energy; by 2030 the contributions are almost equal (3,206 from renewables against 3,199 from energy efficiency); after 2035 renewables dominate with 4,588 jobs against 3,847; and by 2040 the figures are 5,410 and 5,074 respectively (Figure 31). Within renewable energy, indirect activities account for the largest share (733 jobs in 2025, rising to 1,519 in 2030), followed by maintenance (657 rising to 1,296) and installation (158 rising to 392), showing that long-term maintenance and support services become increasingly important as the sector matures (Figure 32).

Figure 31 Total new jobs in the WAM scenario



Source: Climate Change Mitigation Report / BTR1 (2026).

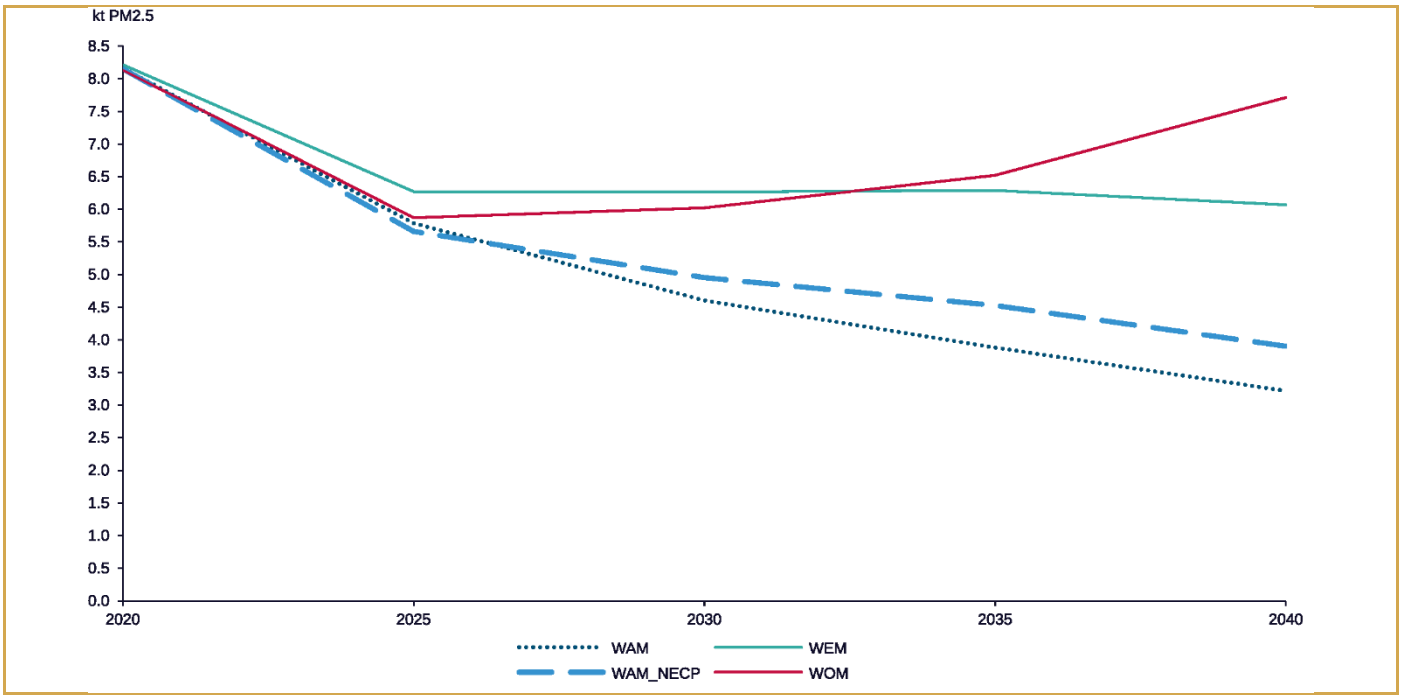
Figure 32 Distribution of RES jobs in the WAM scenario



Source: Climate Change Mitigation Report / BTR1 (2026).

Air-quality co-benefits are significant and provide an indirect indicator of health gains. Under WAM, PM2.5 emissions decline from approximately 8.1 kt in 2020 to around 5.7 kt in 2025 and approximately 3.2 kt in 2040. The WAM_NECP variant follows a similar but less pronounced trend, reaching approximately 3.9 kt in 2040, while under WEM the reduction is limited (from about 8.2 kt in 2020 to 6.0 kt in 2040) and under WOM emissions rise again after 2025 to approximately 7.7 kt in 2040. The reduction under WAM originates principally in households, through the replacement of inefficient heating systems and a shift to cleaner energy carriers, followed by industry, energy production and the commercial sector (Figure 33).

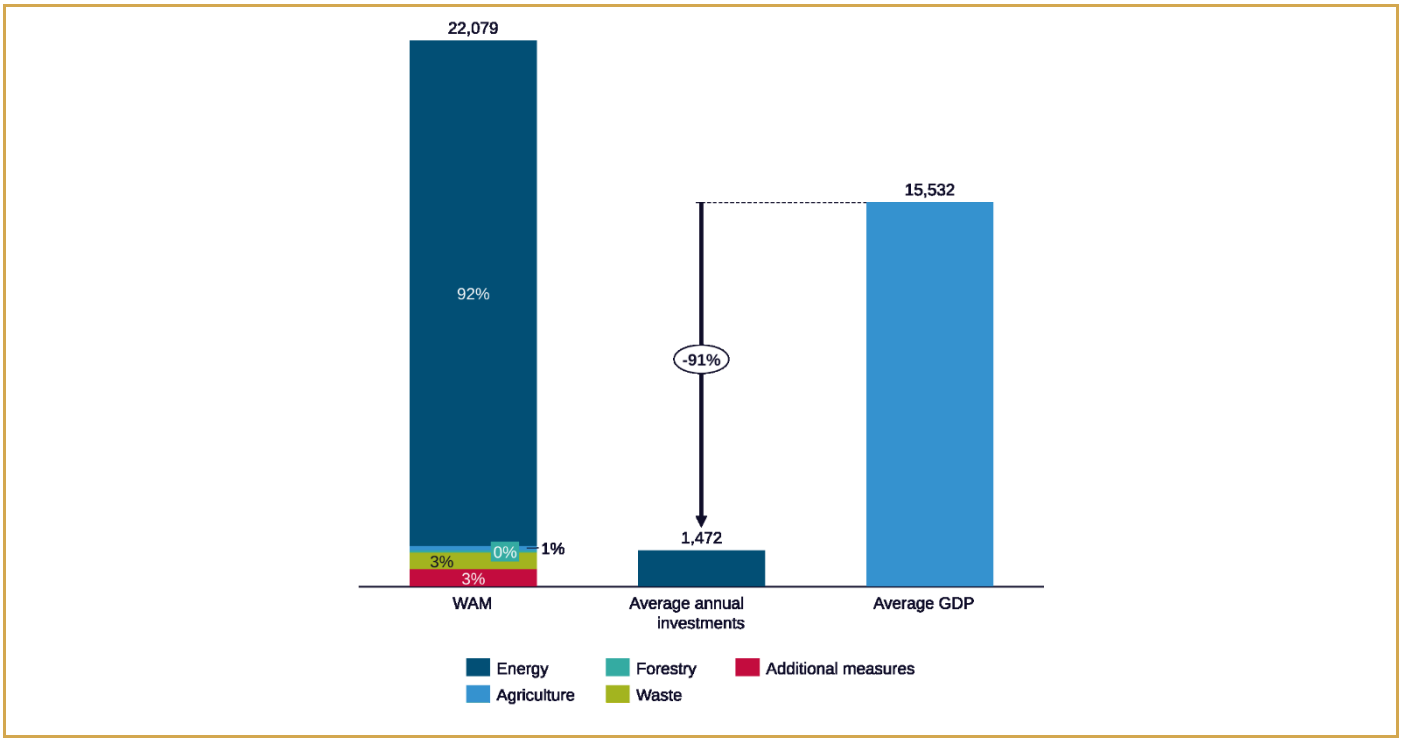
Figure 33 PM2.5 emissions (kt PM2.5)



Source: Climate Change Mitigation Report / BTR1 (2026).

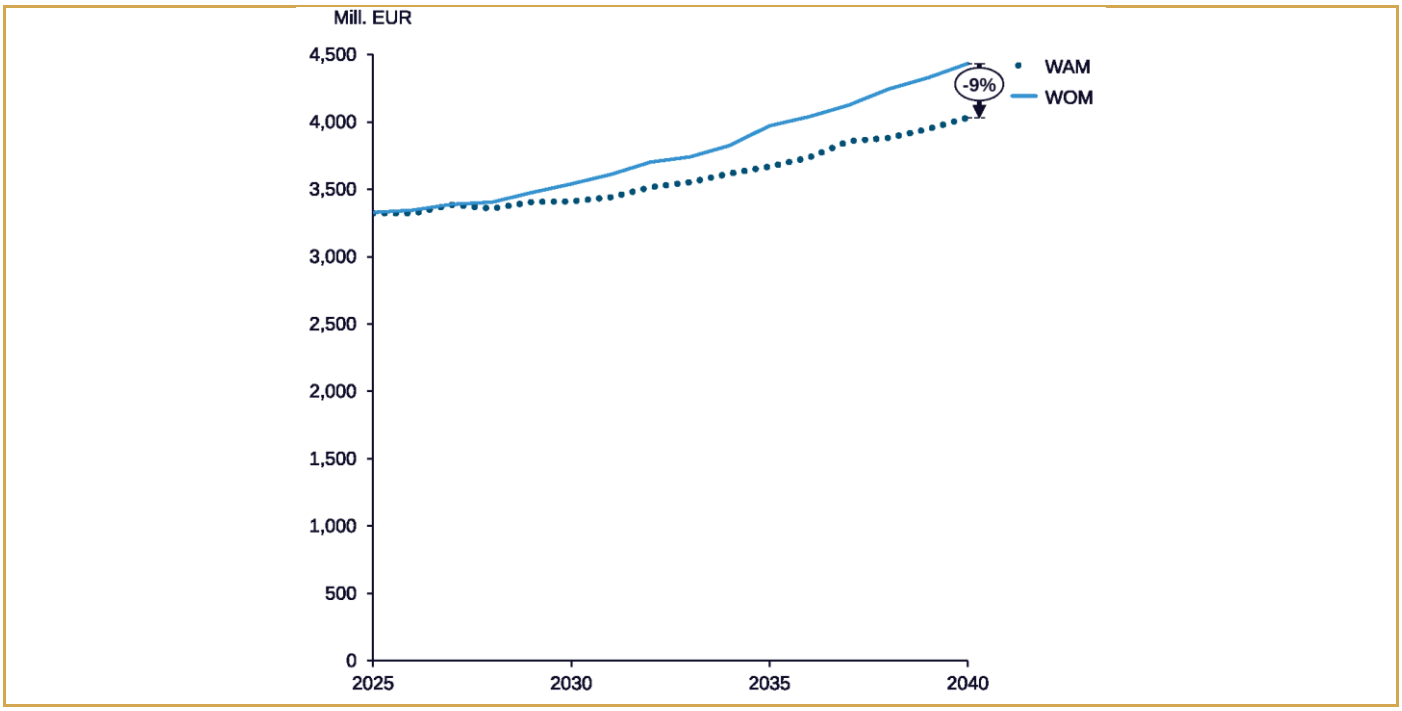
Implementation of WAM requires substantial financial resources. BTR1 estimates approximately EUR 22.1 billion of incremental investment relative to WOM over the analysed period, with more than 92% concentrated in the energy sector. Annualised investment is about EUR 1.47 billion, close to 9% of the average annual GDP used in the analysis (Figure 34). At the same time, the BTR1 indicates that total energy-system costs under WAM are around 9% lower in 2040 than under WOM because higher upfront capital expenditure is offset by lower fuel imports, higher efficiency and greater use of renewables (Figure 35). The financing requirement is therefore central to the interpretation of WAM: converting the full technical potential into a higher NDC commitment requires strong and sustained domestic political support and, for a substantial share of capital-intensive measures, significantly increased international climate finance, concessional financing, technology transfer and implementation support.

Figure 34 Investments for the implementation of the WAM scenario



Source: Climate Change Mitigation Report / BTR1 (2026).

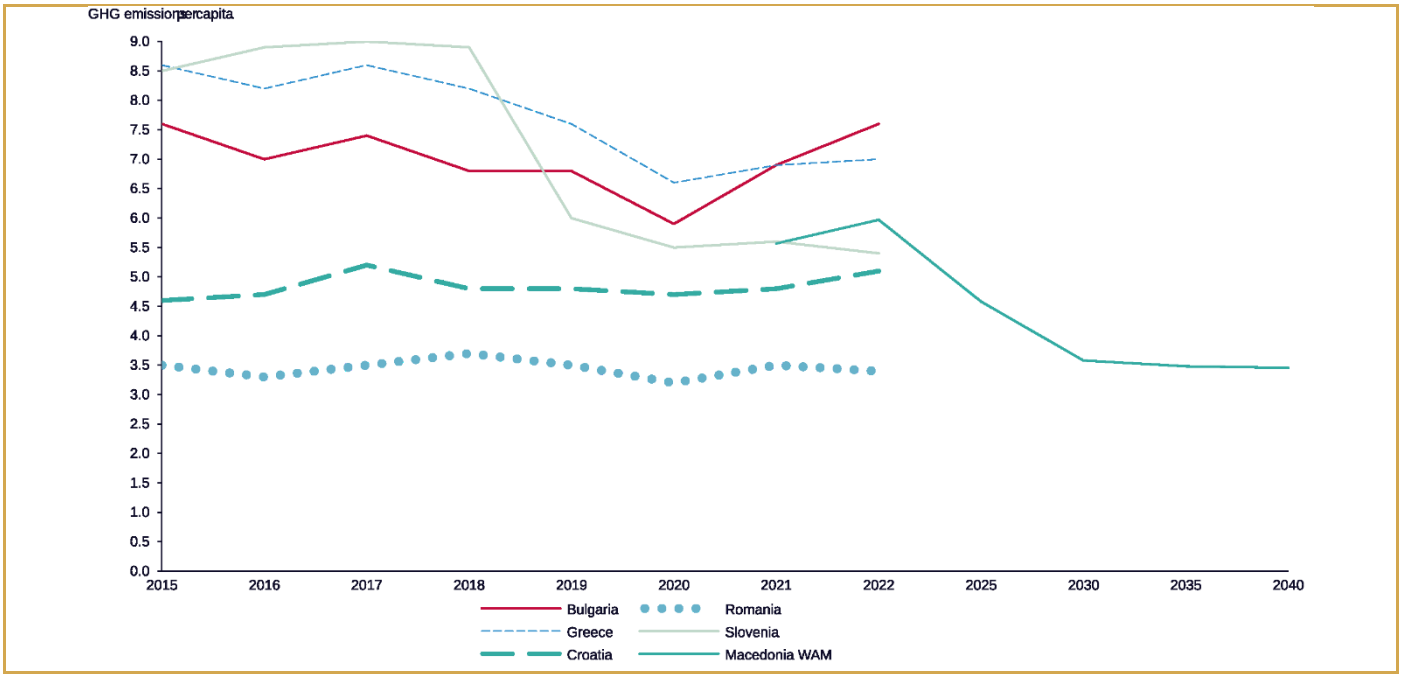
Figure 35 Comparison of total costs in the WOM and WAM scenarios in the energy sector



Source: Climate Change Mitigation Report / BTR1 (2026).

In comparative terms, WAM brings per-capita emissions down to approximately 3.5 t CO_2-eq per capita in 2030, stabilising at a similar level through 2040. This positions the Republic of North Macedonia below several countries in the region, including Bulgaria and Greece, and in certain years close to Croatia, while remaining above Romania but within the range of other South-East European countries (Figure 36).

Figure 36 Greenhouse gas emissions per capita



Source: Climate Change Mitigation Report / BTR1 (2026).

WAM therefore defines the upper technical mitigation envelope currently quantified in BTR1, rather than an automatic unconditional commitment. Its results show that deep decarbonisation is technically and economically defensible over the longer term, but delivery depends on coordinated policy implementation, grid and infrastructure investment, technology readiness, protection of the FOLU sink and adequate financing. This distinction is critical for NDC 3.0: the unconditional component should reflect measures that can be credibly delivered with domestic resources and already committed support, while any higher ambition should be explicitly linked to additional international financial and technical support.

4.3 Mitigation Potential by Sector

The mitigation assessment for NDC 3.0 builds on the mitigation measures and emission pathways established in the Enhanced Nationally Determined Contribution (NDC 2.0), while incorporating the updated projections of the Updated National Energy and Climate Plan (NECP) 2025–2030 and the latest national GHG inventory reported in the First Biennial Transparency Report (BTR1). Together, these documents provide a basis for assessing changes in sectoral emissions, progress towards previously established mitigation targets and the remaining mitigation potential.

The NDC 2.0 mitigation pathway was based on 63 policies and measures (PAMs) covering energy supply and end-use sectors, agriculture, LULUCF, waste and enabling measures. Around 70% of this mitigation potential was estimated to have negative costs, while a further 20% was associated with relatively low costs of up to EUR 5/t CO_2-eq. NDC 2.0 established a target to reduce gross GHG emissions by 51% by 2030 compared with 1990, corresponding to approximately 6.06 Mt CO_2-eq of gross emissions in 2030. When LULUCF removals are included, the target corresponded to an 82% reduction in net emissions. The sectoral pathway established under NDC 2.0 shows a particularly strong contribution from the energy sector, while IPPU emissions were projected to increase with economic growth. Relative to 1990, the pathway corresponds to a 66% reduction in energy emissions, a 29% reduction in agriculture, a 21% reduction in waste and a 95% increase in LULUCF removals, while IPPU emissions were projected to increase by approximately 45%. These projections provide an important reference point for assessing the mitigation potential that can be achieved through the updated policy framework and for identifying further opportunities for emission reductions towards 2030 and beyond.

The final Updated NECP establishes a revised 2030 pathway of 6.72 Mt CO2-eq of gross emissions, equal to a 46.1% reduction relative to its AR5-restated 1990 gross reference of 12.48 Mt CO2-eq. Including removals, net emissions are 4.35 Mt CO2-eq, corresponding to a 60.2% reduction relative to the Updated NECP's 1990 net reference of 10.93 Mt CO2-eq. The revision reflects more recent information on energy demand, technology deployment, infrastructure delivery, transport trends, waste-management implementation and FOLU, including the effects of the 2024 forest-fire season.

BTR1 provides the most recent historical emissions baseline, covering the period 1990–2022. Following recalculation of the national inventory, total GHG emissions excluding LULUCF amounted to approximately 10.94 Mt CO_2-eq in 2022. Energy accounted for 8.19 Mt CO_2-eq, IPPU for 0.72 Mt CO_2-eq, Agriculture for 1.20 Mt CO_2-eq and Waste for 0.83 Mt CO_2-eq. LULUCF represented a net sink of approximately 3.09 Mt CO_2-eq, resulting in net emissions of approximately 7.85 Mt CO_2-eq.

Inventory-base reconciliation is essential when comparing these pathways. BTR1's recalculated 1990 inventory gives approximately 12.522 Mt CO2-eq of gross emissions, a FOLU balance of -1.810 Mt CO2-eq and approximately 10.711 Mt CO2-eq of net emissions. The Updated NECP, by contrast, uses the Fourth National Communication restated to AR5, with 12.48 Mt gross, -1.55 Mt of sinks and 10.93 Mt net. Consequently, absolute emissions should be compared first and percentage reductions only after the inventory vintage has been stated explicitly; a change in the 1990 denominator is an accounting revision, not a mitigation action.

Against NDC 2.0, the final Updated NECP raises the projected 2030 gross level from about 6.06 Mt to 6.72 Mt CO2-eq and the net level from about 2.20 Mt to 4.35 Mt CO2-eq. The largest upward sectoral revisions are in Energy (3.33 to 4.33 Mt CO2-eq), including transport (1.40 to 2.17 Mt), and Waste (0.32 to 0.66 Mt). These are partly offset by lower IPPU emissions (1.35 to 0.82 Mt), lower non-energy agricultural emissions (1.06 to 0.91 Mt) and lower industrial and building energy use. The projected land-sector sink is also weaker: Land + Other removals are revised from -3.86 Mt to -2.37 Mt CO2-eq. The updated evidence therefore confirms that mitigation potential is unevenly distributed across sectors and that the gross and net pathways must be assessed separately.

4.3.1 Energy

Energy is the largest source of GHG emissions in the Republic of North Macedonia and represents the largest component of the national mitigation potential. NDC 2.0 identified a broad portfolio of measures covering renewable electricity generation, coal phase-out, energy efficiency, electrification, fuel switching and improvements in the electricity system. The mitigation portfolio included 32 energy-related policies and measures where emissions were targeted to decline by 66% relative to 1990 by 2030. The energy transition was expected to be driven primarily by the retirement of coal-fired capacity, particularly Oslomej and Bitola, together with increased renewable-energy deployment, energy efficiency and fuel switching. The combined indicative investment requirement for the identified measures is approximately EUR 24.57 billion. The measures are estimated to deliver 4,035.5 Gg CO_2-eq of emission reductions in 2030, increasing to 12,667.1 Gg CO_2-eq by 2040. These values represent the aggregated mitigation potential of the identified measures and should not be interpreted as additional reductions to be added to the economy-wide NDC target.

The Updated NECP reinforces this direction and contains 26 decarbonisation and 20 energy-efficiency measures within a total portfolio of 61 measures. Its 2030 sector table gives approximately 4.33 Mt CO2-eq for Energy, compared with 3.33 Mt under the initial pathway. The increase is concentrated in energy transformation, which rises from 0.50 Mt to

about 1.23 Mt CO2-eq, largely because one additional gas-fired CHP unit is introduced to support security of supply after lignite exit. In end-use sectors, household emissions fall from 0.20 to 0.08 Mt, services from 0.20 to 0.11 Mt, industrial energy emissions from 1.00 to 0.69 Mt, and agricultural energy demand from 0.10 to 0.04 Mt, while transport rises from 1.40 to 2.17 Mt. Renewable-energy deployment has nonetheless progressed: the share in gross final energy consumption increased from 17.8% in 2021 to 20.2% in 2023, while the Updated NECP sets a 31.6% target for 2030, including 51.2% renewable electricity, 38.9% in heating and cooling and 19.0% in transport.

BTR1 records energy emissions of approximately 8.19 Mt CO_2-eq in 2022, compared with 9.52 Mt CO_2-eq in 1990, corresponding to a reduction of approximately 14%. Despite this decline, energy accounted for more than 75% of national emissions excluding LULUCF in 2022. Energy industries using solid fuels represented approximately 24.9% of national GHG emissions, highlighting the continued importance of the electricity-generation mix.

The sectoral mitigation pathway therefore combines power-sector decarbonisation with lower final energy demand, electrification, grid reinforcement, storage and system flexibility. Natural gas is treated as a transitional security-of-supply option rather than the end state of decarbonisation. The Updated NECP's post-2030 outlook envisages a later shift from natural gas towards hydrogen and, where technically and economically viable, carbon capture, use and storage. This sequencing matters for the 2035 horizon: the full mitigation effect of these technologies cannot be assumed to materialise before 2035, and a significant part of the additional reduction required for climate neutrality is likely to occur thereafter.

4.3.2 Buildings

Buildings represent a major component of energy-related mitigation potential, particularly through reductions in energy demand for heating, cooling and other building services. NDC 2.0 identified building renovation, improved thermal insulation, efficient heating and cooling, heat pumps, solar thermal systems, rooftop PV, efficient lighting and improved energy management as important mitigation measures. The NDC 2.0 assessment estimated that increased use of heat pumps could deliver approximately 369.5 Gg CO_2-eq of emission reductions in 2030, together with 139.3 ktoe of final energy savings and 186.1 ktoe of primary energy savings. The indicative budget associated with this measure was EUR 474.4 million.

The Updated NECP projects a significant reduction in emissions from buildings compared with the initial pathway. Household emissions in 2030 decline from 0.20 Mt to 0.08 Mt CO_2-eq, while emissions from services decline from 0.20 Mt to 0.11 Mt CO_2-eq. The projected reductions are associated with building renovation, improved building performance, electrification, heat pumps, efficient equipment and lighting measures. The Updated NECP also includes measures targeting the renovation of residential, public and commercial buildings, minimum energy-performance requirements and energy-efficiency obligations. The resulting pathway reflects a gradual shift from direct fossil-fuel use towards electricity and more efficient heating and cooling technologies.

BTR1 does not identify buildings as a separate inventory sector. Emissions associated with buildings are primarily included under Energy, particularly residential and services categories. The BTR1 inventory therefore provides the historical emissions baseline, while the Updated NECP provides the sectoral projections and policy framework for future reductions.

Building-related mitigation in NDC 3.0 is consequently associated with reducing the energy intensity of the existing building stock, increasing renovation rates and depth, improving building envelopes, replacing inefficient heating systems, expanding heat-pump use and increasing electrification. However, the main barriers are high upfront investment costs, fragmented ownership in multi-apartment buildings, limited household financing capacity and energy poverty. Investment needs should be calculated based on the required annual renovation rate and cost per square metre, with a particular focus on deep renovation packages and targeted financing for vulnerable households. Nonetheless, interaction with electricity-sector decarbonisation is particularly important, since the mitigation effect of electrification depends on the carbon intensity of electricity generation.

4.3.3 Transport

Transport is one of the sectors with the strongest increase in emissions over the historical period and represents a significant challenge for the achievement of the 2030 mitigation pathway. NDC 2.0 identified fleet renewal, railway development, advanced mobility, modal shift and transport electrification as principal mitigation measures. The NDC 2.0 implementation roadmap estimated approximately 236.5 Gg CO_2-eq of reductions by 2030 from the transport mitigation package. Major contributions included 66.4 Gg CO_2-eq from renewal of the road fleet and 61.6 Gg CO_2-eq from transport electrification. The investment requirements associated with transport mitigation are significant. The NDC 2.0 roadmap identified approximately EUR 2.17 billion for road-fleet renewal and more than EUR 8.29 billion for transport electrification under the corresponding measures.

The Updated NECP revises the 2030 transport projection from 1.40 Mt CO_2-eq to 2.17 Mt CO_2-eq, an increase of approximately 0.77 Mt CO_2-eq. The higher projection reflects increased diesel consumption and slower-than-anticipated deployment of electric vehicles. The initial pathway assumed that electricity would substitute approximately 10% of road-

transport energy demand, while actual deployment has remained significantly below this level. The Updated NECP establishes a 19% renewable-energy target for transport by 2030. This compares with a renewable share of less than 0.1% during 2021–2023. Achieving the target relies on increased electrification, renewable fuels, biofuels and the development of alternative-fuel infrastructure.

BTR1 confirms the upward trend in transport emissions based on more disaggregated and updated input data on fuel consumption, vehicle numbers, vehicle types and transport activity. Emissions increased from approximately 679 Gg CO_2-eq in 1990 to 2,328 Gg CO_2-eq in 2022. Road transport using liquid fuels accounted for approximately 15.4% of national GHG emissions in 2022, demonstrating the importance of road transport within the national emissions profile.

The revised pathway places increased emphasis on transport electrification, fleet renewal and the associated charging infrastructure, together with public transport, railway development and modal shift. The updated 2030 baseline of 2.17 Mt CO_2-eq represents a significantly higher mitigation challenge than anticipated under the original pathway. The key implementation barriers remain the high cost of low-emission vehicles, an ageing vehicle fleet, limited charging infrastructure and insufficient public and rail transport infrastructure.

4.3.4 Industry

Industrial emissions are considered through both energy-related emissions and emissions from IPPU. This distinction is important because the two components have different emission drivers and mitigation options.

NDC 2.0 identified industrial energy efficiency, technological improvements, fuel switching and process improvements among the principal mitigation measures. Under the WAM pathway, emissions from industrial processes and product use (IPPU) were projected to increase from 932 Gg CO_2-eq in 1990 to 1,352 Gg CO_2-eq in 2030, equivalent to a 45% increase. The WAM pathway nevertheless includes efficiency and technological measures in energy-intensive industries. The distinction between energy-related industrial emissions and process emissions is important. Energy-related emissions can be reduced through electrification, renewable electricity, energy efficiency, waste-heat recovery and fuel switching, while process emissions require technological changes in production processes. The introduction of more advanced industrial technologies was estimated to provide approximately 206.0 Gg CO_2-eq of emission reductions in 2030, together with 59.4 ktoe of final energy savings and 62.5 ktoe of primary energy savings, with an indicative investment requirement of EUR 438.6 million.

The Updated NECP projects lower industrial energy-related emissions than the initial pathway. Emissions decline from approximately 1.00 Mt to 0.69 Mt CO_2-eq in 2030, representing a reduction of around 0.31 Mt CO_2-eq. The reduction is associated with energy-efficiency improvements and changes in the industrial fuel mix. IPPU emissions are also projected to decline from approximately 1.35 Mt to 0.82 Mt CO_2-eq.

BTR1 reports 715.9 Gg CO_2-eq of IPPU emissions in 2022, representing a 22.6% reduction compared with 1990. The structure of emissions has changed considerably. The metal industry's contribution declined from approximately 64% in 1990 to 9% in 2022, while the mineral industry accounted for approximately 50% of IPPU emissions. Emissions from products used as substitutes for ozone-depleting substances represented approximately 40%.

The industrial mitigation pathway therefore combines improvements in energy efficiency and electrification with measures targeting process emissions. Particular mitigation potential exists in energy-intensive industrial processes, fuel switching, process optimisation and management of fluorinated gases.

4.3.5 Agriculture

Agriculture is a significant source of methane and nitrous oxide emissions, particularly from livestock, manure management and agricultural soils. NDC 2.0 established a target corresponding to approximately a 29% reduction in agricultural emissions by 2030 compared with 1990, more specifically from 1,490 Gg CO_2-eq in 1990 to 1,055 Gg CO_2-eq in 2030. The NDC 2.0 implementation roadmap quantified approximately 38.2 Gg CO_2-eq/year of reductions from livestock measures by 2030. The largest contribution, approximately 35 Gg CO_2-eq, was expected from reducing methane emissions from enteric fermentation in dairy cattle, while approximately 3.2 Gg CO_2-eq was associated with reductions in N_2O emissions.

The Updated NECP projects non-energy agricultural emissions of approximately 0.91 Mt CO_2-eq in 2030, compared with 1.06 Mt CO_2-eq under the initial pathway. Energy-related agricultural emissions are projected to decline from 0.10 Mt to 0.04 Mt CO_2-eq. The reduction in non-energy emissions is largely associated with lower projected livestock numbers. The Updated NECP introduces additional agricultural mitigation measures. One measure targets the use of manure for biogas production, with an objective that by 2030 approximately 10% of cattle manure and 25% of pig manure from the targeted large farms would be used for biogas production. The cost estimate for this measure remains to be determined, with financing expected from IPARD, national agricultural support programmes and private investment.

BTR1 reports agricultural emissions of approximately 1.20 Mt CO_2-eq in 2022, compared with approximately 1.56 Mt CO_2-eq in 1990, corresponding to a reduction of around 23%. Livestock accounted for approximately 67–71% of

agricultural emissions during 2017–2022, while agricultural soils represented approximately 30%. The historical decline is strongly influenced by the reduction in livestock numbers.

Further mitigation potential therefore depends increasingly on reducing emission intensity rather than on declining agricultural activity. The main constraints are the fragmented structure of the agricultural sector, limited access to finance and technology and the relatively small scale of many farms. Relevant measures include improved livestock and manure management and storage, methane reduction, improved fertiliser management, agricultural practices that increase resource efficiency and the utilisation of manure for biogas production.

4.3.6 LULUCF

LULUCF has a major influence on the Republic of North Macedonia's net emissions because of its role as a carbon sink. The magnitude and stability of removals are therefore particularly important for the difference between gross and net mitigation targets.

NDC 2.0 relied on a substantial LULUCF sink, with removals projected at approximately 3.86 Mt CO_2-eq in 2030. The increase in removals is the basis for the NDC 2.0 target of a 95% increase in LULUCF removals relative to 1990 and is a major reason why the NDC 2.0 target reaches 82% net emission reduction, compared with 51% for gross emissions. The projected sink should, however, be treated with particular caution. LULUCF removals are highly variable and affected by forest fires, drought, land-use change and forest degradation.

The final Updated NECP revises the 2030 Land + Other sink from approximately -3.86 Mt to -2.37 Mt CO2-eq. The weaker sink reflects lower afforestation trends and the inclusion of forest and land damage and disturbances, including the 2024 fire season. This revision is one of the principal reasons why the Updated NECP net-emissions pathway is higher than the original NDC 2.0 pathway.

The Updated NECP also flags a significant data uncertainty for the 2024 forest fires: the European Forest Fire Information System (EFFIS) reports 96,214 ha affected, while the State Statistical Office reports 7,434 ha. The NECP projections use the most recent SSO value but call for further technical assessment, including in connection with CORINE Land Cover 2024. NDC 3.0 should therefore treat the 2030 FOLU sink as a sensitivity range rather than as a risk-free fixed quantity, and should strengthen fire prevention, monitoring and post-fire restoration as both mitigation and adaptation measures.

BTR1 reports a net FOLU sink of approximately 3.09 Mt CO_2-eq in 2022, compared with approximately 1.81 Mt CO_2-eq in 1990. At the same time, the inventory demonstrates substantial year-to-year variability, particularly due to forest fires and other disturbances. The historical sink has generally ranged between approximately 1.5 and 3.0 Mt CO_2-eq, with significant deviations in years affected by fires.

The revised projections consequently place greater emphasis on the permanence and resilience of removals. Mitigation potential includes sustainable forest management, forest-fire prevention and integrated fire management, afforestation, restoration and improved land management. The -2.37 Mt CO2-eq Updated NECP 2030 land-sector sink provides an important planning reference, while the BTR1 WAM pathway indicates that larger removals are technically possible under stronger measures. Given the observed interannual variability and the 2024 data uncertainty, final NDC accounting should report the land-sector contribution transparently and avoid allowing uncertain removals to obscure progress in gross-emission reductions.

4.3.7 Waste

Waste is a smaller contributor to national emissions than energy but has experienced a significant increase in emissions since 1990. Waste emissions under the NDC 2.0 WAM pathway were projected to decline from 407 Gg CO_2-eq in 1990 to 323 Gg CO_2-eq in 2030, corresponding to a 21% reduction, primarily through improved waste treatment and landfill management, recycling and diversion of biodegradable waste. The principal mitigation opportunity is methane reduction from solid waste disposal, particularly through diversion of biodegradable waste from landfills, improved landfill management and landfill-gas capture. Wastewater treatment provides an additional mitigation opportunity. Implementation of the mitigation scenario in the waste sector is estimated to require investments of approximately EUR 58.6 million over the period 2020–2040, with an indicative emissions reduction of 663.5 Gg CO_2-eq.

The Updated NECP revises the 2030 waste projection from approximately 0.32 Mt to 0.66 Mt CO_2-eq, representing an increase of approximately 0.34 Mt CO_2-eq. The main factor is the slower development of waste-management infrastructure. The original pathway assumed the availability of sanitary landfill infrastructure with mechanical-biological treatment across planning regions by 2030, whereas the updated pathway incorporates more realistic implementation timelines.

BTR1 records waste emissions of approximately 831 Gg CO_2-eq in 2022, compared with 516.6 Gg CO_2-eq in 1990, corresponding to an increase of approximately 60.8%. The share of waste in total national emissions increased from 4.2% in 1990 to 7.6% in 2022. Solid waste disposal remains the dominant emission source.

The revised pathway therefore places substantial mitigation potential in the modernisation of waste management in order to overcome the long-standing barriers such as insufficient separate collection and treatment infrastructure, limited municipal financial capacity and low recycling and waste-diversion rates. Relevant measures include sanitary landfills, mechanical-biological treatment, separate collection, recycling and composting, diversion of biodegradable waste, landfill-gas capture and improved wastewater treatment. The difference between the BTR1 inventory level of 0.831 Mt CO_2-eq in 2022 and the Updated NECP projection of 0.66 Mt CO_2-eq in 2030 provides an important reference for assessing the scale and timing of the required reductions.

For each sector, the final NDC 3.0 mitigation package should report a common set of implementation fields: historical baseline and target-year emissions, quantified mitigation effect, policy or measure, implementation status, key barriers, investment requirement, responsible institution, monitoring indicator and financing status. Financing should distinguish measures that are domestically secured or already supported from measures whose implementation is conditional on additional international finance, technology transfer or capacity-building support. This structure allows the sectoral assessment in Chapter 4 to feed directly into the NDC target, conditionality, finance and MRV chapters.

Chapter 5. Adaptation Assessment

5.1 Climate Risks

The Republic of North Macedonia is highly exposed to a range of climate-related hazards, shaped by its geographical position, complex mountainous terrain, climate variability and diverse continental and Mediterranean climatic influences. The country is a so-called “hotspot for climate hazards” and is exposed to slow hazards (such as temperature increases and changes in precipitation) and sudden hazards (such as more extreme weather events) that reduce the productivity of capital (human, physical, natural and social) and affect fiscal revenues and public spending. Observed climate trends already indicate rising temperatures, changing precipitation patterns, and increasing frequency and severity of extreme events, including heatwaves, droughts, floods and flash floods, wildfires, and intense storms. The incidence of these risks and their associated impacts vary depending on the hazard, the geography, the level of exposure, the underlying vulnerabilities of the local communities, and their capacity to respond. Disasters and extreme climate events have caused estimated losses of US$ 667 million over the past 20 years, and their impacts can also compound and cascade, increasing overall risks for already vulnerable sectors, particularly agriculture.

Floods are the most frequent and damaging hazard, while wildfires are rapidly increasing in both frequency and severity, threatening livelihoods, ecosystems and biodiversity. Weather-related extremes, i.e. heatwaves, heavy rainfall, hailstorms, and droughts, are intensifying, with risks increasing due to climate change, urban expansion, and growing land consumption. By region, the Republic of North Macedonia is highly exposed to flooding, with the northern, southern, southeastern, and central areas particularly vulnerable, while during the summer months, all regions are exposed to wildfires and heatwaves.

Table 1 Main climate hazards in the Republic of North Macedonia and associated risk levels

HAZARD	RISK LEVEL
Flood	High
Wildfire	High
Water scarcity	Medium
Extreme heat	Medium

The frequency, intensity, and magnitude of climate risks are expected to increase, driven by rising average temperatures, the impacts of climate change and extreme events, environmental degradation, and intensive urbanization. Available evidence indicates that the Republic of North Macedonia is already experiencing a warmer climate, changing precipitation patterns and more frequent climate extremes. The Fourth National Communication identified increases in mean annual temperature relative to 1961–1990, a general decreasing precipitation trend and an increasing occurrence of heat waves. The exposure and potential losses and damages to these climate risks are presented in the table below:

Table 2 Exposure to climate hazards and potential L&D

#	HAZARD	MAIN EXPOSURE AND POTENTIAL L&D
1	Temperature	Population, biodiversity, ecosystems, agriculture, livestock and household welfare, infrastructure, i.e. power grid failures, telecommunication wires, structural infrastructure material degradation, transport, water supply, healthcare system, etc.
2	Drought	Population, biodiversity, ecosystems, agriculture, livestock and household welfare, water availability, food supply disruption, transport, power generation, etc.
3	Floods	Population, houses/buildings, livelihoods, businesses, CI assets and facilities, i.e. roads, bridges, transmission lines, energy and telecommunication facilities, health and education facilities, municipal infrastructure, cultural heritage, manufacturing facilities, industry, etc., irrigation and drainage systems, temporary disruption of services, agricultural land, livestock, ecosystems, etc.
4	Forest fires	Population, houses/buildings, transmission lines, energy and telecommunication facilities, health and education facilities, municipal infrastructure, cultural heritage, tourist infrastructure, manufacturing facilities, industry, etc., forests, agricultural land, pastures, livestock, ecosystems, temporary disruption of services.
5	Extreme weather events	Population, houses/buildings, transmission lines, telecommunication towers, road network, forest, agricultural land, livestock, temporary disruption of services.

Climate projections indicate further warming, longer dry periods, and increasing climate variability, with interacting risks expected to generate cascading impacts across agriculture, water resources, ecosystems, communities, critical infrastructure, and the wider economy. The country is expected to experience a warmer and drier climate, with more frequent extreme heat events and fewer cold extremes. The country will still be highly susceptible to floods, and its exposure to droughts and high temperatures during the summer months will increase. Reduced and prolonged summer

precipitation will increase drought risk, while more intense extreme rainfall may heighten the risk of flash floods. Longer dry periods, extended vegetation seasons, and more frequent forest fires, combined with extreme temperatures and heatwaves, are expected to exacerbate impacts on the population, agriculture, biodiversity, critical infrastructure, and other sectors.

Recent assessments reinforce the urgency of adaptation. The World Bank estimates that climate-related disasters and extreme events caused approximately US$ 667 million in losses over the previous two decades, while annual climate-related damages could reach around 4% of GDP by 2050 in the absence of adequate adaptation. The country is estimated to require approximately US$ 6.4 billion in adaptation-related investment over the next decade to protect people, infrastructure and economic activity.

For NDC 3.0, climate risk assessment should move beyond a hazard-only approach to consider the interaction of hazards, exposure, and vulnerability. Risks vary significantly across locations and population groups: rural and agricultural communities are particularly exposed to drought, heat, and hail, urban areas face increasing risks from prolonged heat waves resulting in urban heat islands and pluvial/flash/urban flooding, forest-dependent areas are highly exposed to forest fires, and critical infrastructure may be affected by multiple hazards simultaneously. Adaptation planning should therefore adopt a multi-hazard, systems-based approach that prioritizes vulnerable populations, local governments, ecosystems, and critical infrastructure. Consequently, the Republic of North Macedonia is strengthening the adaptation component of NDC 3.0, informed by the Fourth National Communication, BTR1, the National Development Strategy 2024 – 2044, the Long-term Climate Strategy with an Action Plan, risk and hazard assessments, the World Bank Country Climate and Development Report, and ongoing NAP climate and vulnerability assessments. At the same time, the country is developing its first National Adaptation Plan , with readiness support underway, while integrating adaptation measures into key sectoral strategies, including water, agriculture, forestry, biodiversity, health, infrastructure and human settlements.

5.1.1 Temperature

Temperature increase is one of the most robust and consequential climate risks facing the Republic of North Macedonia. Observational evidence already indicates a significant warming trend. Data for extreme temperature events as per the EM-DAT Database records more coldwaves, than heat waves. Former occurred in December 2001 (15 deaths), January 2005 (one death and three injured), January 2012 (5.100 affected), December 2014 (8.800 affected), January 2017 (three deaths and 2.220 affected). The latter occurred in July 2004 (15 deaths), July 2007 (202 affected), August 2021, July – August 2024 and July 2025.

National Hydrometeorological Service (UHMR) in its study analyze the palette of extreme climate events. Summer days, tropical nights, warm days and nights are increasing across the Republic of North Macedonia, with record values observed in recent years, indicating a clear intensification of heat extremes. For example, analysis for 1951–2024 shows a clear increase in the number of summer days, with the highest average recorded in Gevgelija (141 days) and the lowest in Lazaropole (27 days). Maximum values at almost all stations occurred during the second half of the study period, confirming a clear warming trend. In 2024, record values were reached, with 164 summer days in Strumica and 166 in Demir Kapija, highlighting the increasing persistence of warm conditions. A consistent upward trend has been observed, providing clear evidence of ongoing climate warming and increasing risks to the environment, agriculture, and public health. For the period 1951–2024 in the Republic of North Macedonia, the highest maximum air temperature was 45.7°C, measured on 24 July 2007 in Demir Kapija, and the lowest maximum air temperature was –16.7°C, measured on 9 January 1979 in Bitola. The absolute minimum air temperature of –31.5°C was measured on 27 January 1954 at the Berovo meteorological station, and the highest minimum air temperature of 26.8°C was measured on 13 August 1994 at the Gevgelija meteorological station. Calculations for 2024 show that the entire territory of the country experienced extremely warm conditions, with positive deviations from 1°C to 2.3°C above the reference period, i.e. 1981 – 2010.

Tropical nights are also increasing at most meteorological stations, although Demir Kapija and Kriva Palanka show a declining trend. In contrast, frost and ice days, as well as cold days, are decreasing across all stations, indicating milder winters and fewer cold extremes. Cold nights are also generally declining, except in Demir Kapija and Kriva Palanka. The growing season is significantly lengthening, potentially creating opportunities for additional agricultural production cycles. Compared with the 1951–2019 period, the 2020–2024 analysis highlights a particularly pronounced increase in maximum temperature extremes, confirming the strengthening trend toward more frequent and intense heat.

Heatwaves in the Republic of North Macedonia have become more frequent and longer in recent decades, with a marked increase after 2000 and a peak in 2024, when nearly all meteorological stations recorded more and longer heatwaves than in previous years, highlighting intensifying climate extremes and increasing risks to human health, agriculture, water resources, and energy systems. While shorter heatwaves remain the most common over 1951–2024, the overall trend indicates increasing heat extremes. The highest number of heatwaves was recorded in Demir Kapija and Gevgelija (191 each) and the lowest in Prilep (140). The longest heatwave lasted 23 days, recorded in Gevgelija from 2–24 October 2001 and again from 27 July–18 August 2021. The urban heat-island effect is particularly pronounced

in Skopje, where insufficient vegetation contributes to night-time temperatures up to 4.7°C higher in the city centre, disproportionately affecting poorer neighbourhoods. In Gevgelija, the duration of extreme heatwaves has increased sixfold over the past three decades, accompanied by a fivefold increase in tropical nights. In contrast, cold-wave duration has declined significantly, and no cold waves were recorded at the analyzed stations during 2020–2024, reflecting the broader rise in minimum temperatures. At the same time, the annual temperature range has increased across all stations, indicating greater daily temperature variability and an increasingly extreme climate. Analysis for 1951–2024 shows that shorter cold waves, typically lasting around six days, are the most common and occur less frequently than heatwaves. The highest number was recorded in Kriva Palanka (58), while the lowest was observed in Gevgelija (26). The longest cold wave lasted 22 days, occurring in Kriva Palanka from 30 March to 20 April 1997.

Climate projections as per the Fourth National Climate Change Communication consistently indicate continued warming throughout the century, with the magnitude increasing substantially across the RCP scenarios. Under RCP2.6, mean daily temperature is projected to rise from around 1°C in the near future to approximately 1.5°C by the end of the century, with broadly similar warming across seasons. Under RCP4.5, warming is projected to reach approximately 2.5°C by the end of the century, with the strongest increase in summer and increasingly pronounced winter warming. Under RCP8.5, mean daily temperature could increase from around 1°C in the near future to more than 5°C by the end of the century, with summer showing the strongest warming and winter warming becoming more pronounced than in spring and autumn toward the end of the century. As an example, compared to the baseline period (1986–2005), heat-related mortality in Skopje is projected to more than double in 2026–2045, and more than quadruple in 2081–2100.

The key adaptation concern is not only rising average temperatures but the intensification of temperature extremes, including more frequent and prolonged heatwaves, higher maximum temperatures, and more tropical nights. These trends will increase risks to human health, i.e. increased morbidity and mortality, as well as heat-related illnesses and vector-borne disease shifts, labour productivity, agriculture, livestock, forests, critical infrastructure, energy systems, and urban environments, with the urban heat-island effect further amplifying heat exposure in densely populated areas. Vulnerable groups, including older people, children (according to the latest UNICEF study, nearly nine in ten children are exposed to heatwaves), persons with disabilities, outdoor workers, and low-income households, may face disproportionate impacts, requiring measures such as heat-health early warning systems, heat action plans, resilient health services, urban greening and cooling, improved building performance, worker protection, and targeted social protection. Rising temperatures also act as a risk multiplier by increasing evapotranspiration and water demand, reducing soil moisture, and intensifying drought and vegetation dryness, thereby increasing forest fire risk, the interaction between heat, drought, and wildfires should therefore be explicitly addressed in adaptation planning. Monitoring, heat-health action plans, urban greening, and adjusted work practices form core response measures.

5.1.2 Drought

Drought is a major and increasingly systemic climate risk for the Republic of North Macedonia, affecting water availability, agriculture, food security, forests, ecosystems, energy production, and rural livelihoods. According to the assessment of the National Drought Plan, less than 1% of the country's territory is not vulnerable to drought, while 8% is slightly vulnerable, 51% moderately vulnerable, 39% vulnerable, and 1% strongly vulnerable. Regions such as Skopje, Pelagonija, and Southeastern areas show particular vulnerability. Frequent and severe droughts, particularly in the south and east parts of the Republic of North Macedonia, exacerbate socio-economic conditions. Already frequent in agricultural areas, droughts are expected to become more frequent, prolonged, and severe as rising temperatures, declining precipitation, and longer consecutive dry periods, particularly in summer, intensify under climate change. Drought risk is rising due to projected declines in annual precipitation (around 5% by 2050 on average, with summer declines of ~17% or more under mid-to-high scenarios) combined with higher temperatures, greater evaporative demand, and longer sequences of consecutive dry days. Temperature is expected to rise during the growing season and especially in summer months by 1.0°C in 2030 and by 1.6 °C in 2060, increasing the likelihood of drought conditions. Increasing length of consecutive dry days for the period 2046-2065 from between 10 to 30 days under RCP8.5 indicates a higher risk for drought onset. The probability of annual severe drought could be between 0.23 and 0.37 by 2060.

The Republic of North Macedonia has been exposed to prolonged droughts (ten successive dry years from 1985 to 1997). A severe drought in 1993 affected 10.000 population and caused substantial agricultural losses across the Republic of North Macedonia, with crop yields declining by up to 70% in the most affected municipalities and total losses estimated at MKD 2.67 billion (approximately EUR 80 million or US$ 93.3 million), equivalent to 7.6% of national agricultural production. Extreme droughts were recorded in March 2003 in the eastern parts of the country, April 2001 in the Ovche Pole region, and April 2004 in the southern parts of the country.

Drought impacts include reduced water availability for irrigation, domestic supply, and ecosystems, lower crop yields, particularly for maize and wheat, soil degradation, livestock stress, and increased wildfire risk. With limited irrigation coverage (less than 10% of agricultural land irrigated), agricultural losses can escalate rapidly, while drought can also worsen water-quality problems and constrain hydropower generation. Droughts lead to agricultural loss where the AAL to maize and wheat yield from droughts in the region are 4.2 per cent and 3.5 per cent, respectively. Without adaptation, droughts could reduce crop yields by around 10% by 2050, while adaptation could generate substantial benefits, with

estimated costs of US$1.3 billion and increased maize and wheat revenues of approximately US$30,000 per hectare. Drought triggers a cascading crisis across agriculture, hydrology, and public health. In the agricultural sector, it degrades cultivable land, disrupts growing seasons, and damages vital soil properties, including moisture, pH, and nutrient availability. Hydrologically, droughts deplete groundwater reserves and dry up lakes and water bodies. Ironically, these dry spells can be punctuated by extreme rainfall, i.e. when severe storms hit parched, impermeable urban surfaces, the risk of flash flooding spikes dramatically. Beyond environmental degradation, droughts pose severe threats to human well-being. They compromise drinking water quantity and quality, overwhelm sanitation infrastructure, and amplify health hazards. Vulnerable rural populations, particularly children, roughly three-quarters of whom face exposure to overlapping drought and heat hazards, bear the heaviest burden of these compounding crises.

Reduced river flows and groundwater recharge can affect municipal water supply, hydropower generation, industrial production and ecosystem functioning. Existing water stress and ageing water infrastructure increase the importance of demand management, leakage reduction, water storage, efficient irrigation and integrated river-basin management. Water availability is expected to become increasingly constrained. Earlier modelling estimated reductions in annual precipitation of around 5% by 2050 and 13% by 2100, with the largest reductions during summer. Increasing temperatures will further increase evapotranspiration and irrigation demand, compounding the effect of declining and increasingly variable rainfall.

For NDC 3.0, drought adaptation should be treated as a cross-sectoral resilience priority, combining climate-resilient water allocation and integrated water resources management with improved water-use efficiency, reduced non-revenue water, modernized and climate-smart irrigation, drought-resilient crops and practices, soil-moisture conservation, groundwater protection, ecosystem restoration, and strengthened monitoring and early warning systems. Drought-risk management should also be linked to wildfire preparedness and targeted social protection, as prolonged hot and dry conditions increase both livelihood vulnerability and fire danger. Key drought adaptation actions according to the National Drought Plan include improving irrigation and sustainable agricultural practices, strengthening the resilience of water-resource management and supply, safeguarding food security and health services, strengthening institutional and community preparedness and capacity, and establishing regular monitoring, evaluation, coordination, and updating of the national drought plan and related interventions.

5.1.3 Floods

Flooding is the most frequent and consequential natural hazard in the Republic of North Macedonia, occurring year-round across all river basins and often triggering cascading impacts such as landslides, erosion, rockfalls and landslides, soil degradation and reduced fertility, damage to geodiversity, geoheritage and biodiversity, and contamination of groundwater and drinking-water sources. The country is exposed to river floods, flash floods and urban/pluvial flooding, with risk influenced by intense precipitation, river-basin characteristics, topography, land use, settlement patterns and the condition of drainage and flood-protection infrastructure. River overflow in the Republic of North Macedonia causes both regional and localized flooding, with almost all rivers posing flood risks and more than 102,000 hectares potentially inundated during a one-year return period. The World Bank's 2024 Climate Public Finance Review reports a tenfold increase in flood frequency over the past 50 years, within a broader pattern of twelve climate-related national disasters over the past two decades that affected approximately 1.3 million people. National flash-flood modelling indicates that 63.6% of watersheds are prone to flash flooding, with 24.7% of subcatchments classified as very highly vulnerable and an average of 45.4% of the national territory falling within the high-to-very-high susceptibility classes. The Treska, Kriva Reka, and Pchinja catchments show the highest susceptibility, while the Vardar, Crna Reka, Strumica, Lepenec, and Bregalnica catchments have also experienced repeated major flood events. Accordingly, the most highly exposed municipalities ranked from highest to lowest exposure to floods are: Aerodrom, Petrovec, Centar, Demir Kapija, Krivogashtani, Negotino, Jegunovce, Ilinden, Bitola, Gazi Baba.

Historical evidence demonstrates the scale of potential impacts. Floods have been among the most frequent and damaging hazards in the country, i.e. major floods in 1962 and 1979 caused economic losses equivalent to around 7% of GDP, while the 1994 floods resulted in losses of 3.4% of GDP. Floods in the Strumica micro-region affected 100.000 population and caused damage of US$ 5.5 million. The December 2008 flood, caused by severe storms and torrential rainfall, affected much of the Republic of North Macedonia, with the most significant infrastructure damage recorded in Radovish and Konche, including two deaths, destroyed bridges, flooded industrial facilities, damaged roads, power outages, and disruptions to energy and communication networks. The 2015 floods in the Pelagonija and Tetovo regions (in the village of Shipkovica) caused 7 fatalities, affected more than 100.000 people, and caused damages that totalled US$107.42 million (across 43 municipalities, most damages and losses occurred in the agriculture and housing sectors, directly affecting 1.920 people and around 3.500 individual agricultural holdings, damaging or destroying 200 roads and 53 bridges, and affecting nine schools). The largest number of human casualties (22) resulted from the flash flood in the area of the City of Skopje in August 2016, the 1995 floods caused damage of US$ 245 million USD, and the floods during 2015 and 2016 caused damage of US$ 177 million. Furthermore, the 6 August 2016 flash flood affected around 5.000 households and greenhouses, partially or destroyed. Local road infrastructure was extensively damaged, along with the Skopje bypass, three substations, household electricity networks, water supply and wastewater systems, septic tanks, and telecommunications infrastructure. In 2020, more than 18 per cent of the total population was exposed to

floods. On average, every year, floods affect around 70.000 people and lead to annual losses exceeding US$500 million. Prolonged rainfall in February 2026 caused flooding of Kicevo and parts of Tetovo, Gostivar, Lipkovo, and Saraj, affecting an estimated 280 households, while a subsequent storm in July 2026 overwhelmed Skopje's urban drainage system and disrupted major urban transportation routes.

Flood intensity, frequency, and magnitude are expected to increase under climate change, with growing exposure to unpredictable hazards such as flash floods. Although average annual precipitation is projected to decline, short-duration extreme rainfall events may become more intense, increasing flash-flood risk, particularly in catchments and urban areas with limited drainage capacity. The Fourth National Climate Change Communication identifies intensifying extreme precipitation as a key driver of future flash-flood risk. The World Bank's CCDR (2024) identifies that flooding is projected to cause the largest output losses, reducing GDP by approximately 3.6% relative to the baseline under RCP2.6 by 2050.

Urbanization and land-use change can increase flood exposure by expanding impervious surfaces and accelerating runoff. Urban expansion over the past two decades has increasingly occurred in flood-prone areas, with newly developed parcels showing 120% higher flood exposure than pre-existing urban areas, resulting in an estimated 23% overall increase in urban flood exposure. On the other side, inadequate drainage and flood-protection infrastructure can amplify impacts across housing, transport, energy, water and wastewater systems, agriculture, businesses, public services, and ecosystems. In this regard, the World Bank's CCDR (2024) identifies that around 13 per cent of schools are highly exposed to floods.

For NDC 3.0, adaptation should prioritize integrated flood-risk management through structural, nature-based, and risk-informed measures, including impact-based early warning, river-basin planning, strengthening flood-risk assessment and management in line with the EU Floods Directive (2007/60/EC), including comprehensive flood hazard and risk mapping and implementation of integrated flood-risk management measures, resilient and upgraded flood-protection and urban drainage infrastructure, reforestation, wetland restoration and slope stabilization, protection of critical infrastructure, land-use controls in high-risk areas, and stronger local preparedness. Flood risk should be systematically integrated into spatial planning, infrastructure investment, and reconstruction, while multi-hazard approaches should address interactions between floods, droughts, and wildfires. The World Bank's CCDR (2024) calculates that for floods, the estimated cost of inaction is US$144.86 million in AAL, while adaptation action is estimated at US$267.19 million, generating US$46.56 million in reduced annual losses.

5.1.4 Forest fires

Forest and open-space fires are among the most destructive and rapidly escalating climate-related hazards, driven by rising temperatures, prolonged droughts that dry out vegetation, and stronger winds that accelerate fire spread and extend the fire season. These fires result from a combination of human activities and natural conditions. Key drivers include the interaction of high temperatures, prolonged drought, low humidity, combined with dry and highly flammable vegetation. Human-related causes include open burning, stubble burning, careless behaviour, inadequate management of logging residues, discarded cigarettes, and deliberate fires, while natural and technical causes include lightning and failures of power lines and transformers. Climate change is expected to increase the frequency and severity of conditions conducive to large and rapidly spreading fires.

Observed trends indicate a sharp increase in both fire incidence and burned area with significant impacts on livelihoods, nature and biodiversity. Over the past two decades, forest fires have increased in frequency and intensity, with an annual average of 215 fires affecting 12.716 ha, burning 121.149 m³ of timber, and causing EUR 13.6 million in damages between 2005 and September 2025. The 2007 wildfires affected nearly half of the country and caused over EUR 21 million (US$ 24.5 million) in damages, while the 2021 fires caused €37.3 million (US$43.5 million) in damages. In 2024, 250 fires affected 97.660 ha, or 3.80% of the country's total territory, representing the largest burned area in the past two decades. Since 2005, wildfires have affected 10.39% of the country's territory, with direct financial losses estimated at 1.82% of GDP. These trends have significant economic, social, and environmental consequences, highlighting the need for an integrated, long-term, and proactive approach that links prevention, response, and recovery to strengthen societal and community resilience. Furthermore, over the past 20 years, forest and open-space fires destroyed 18% of the total forest area and contributed to annual greenhouse gas emissions of 11.774 $GgCO_2$-eq, approximately equivalent to the Republic of North Macedonia's average annual GHG emissions.

Wildfires cause direct, indirect, and long-term damages, pressuring the resilience of forests, i.e. timber and economic losses, reduced forest growth and tree mortality, biodiversity loss, increased pest and disease occurrence, firefighting and restoration costs, increased GHG emissions and air pollution, soil and land degradation, erosion and sedimentation, water pollution, and long-term impacts on agricultural productivity and ecosystems. Severe fire years can also transform forests from carbon sinks into significant sources of greenhouse gas emissions, undermining both adaptation and mitigation objectives.

Adaptation should progressively shift from reactive firefighting toward integrated proactive wildfire risk management, including landscape fire management through strengthening the policy and regulatory frameworks (e.g. national DRR

strategy, an operational landscape fire-management strategy, harmonized legislation, etc.), institutional architecture and coordination (e.g. integrated incident command system, expanding ICT tools with AI-enabled solutions, active multi-stakeholder planning, and sustained partnerships with all key stakeholders), as well as prevention, response and recovery domains (e.g. risk assessment and mapping, early warning and detection, building response capacities and professional training, forest infrastructure, nature-based solutions, public awareness, and resilient post-fire recovery). Given the role of forests as carbon sinks, forest fire prevention and resilience should be addressed as both adaptation and mitigation priorities.

5.1.5 Extreme weather

Climate change increases the risks associated with a range of extreme weather events, including high and low temperatures, severe storms (strong winds, hail, heavy rainfall, thunderstorms, and lightning), heavy snowfall and snowdrifts, and frost. These hazards can occur independently but increasingly need to be considered as interconnected risks. Heatwaves represent a major and growing climate risk, with increasing heat extremes threatening human health, labour productivity, agriculture, energy demand, and urban systems. The Republic of North Macedonia has experienced a substantial increase in extreme climate events in recent decades, including more intense heatwaves and fires, as well as an increase in heavy rainfall events. Hail and severe storms pose particular risks to agriculture and rural livelihoods, where small family farms often have limited financial capacity to absorb repeated losses, compounded by inadequate insurance coverage and protective infrastructure. The World Bank's CCDR identifies drought, hail, limited irrigation, and insufficient insurance coverage as key sources of agricultural vulnerability. Small family farms are particularly vulnerable to storms and hail due to limited access to hail protection, climate-resilient technologies, and insurance, while climate shocks can reduce yields and incomes and exacerbate socioeconomic vulnerabilities in rural, declining, and rapidly expanding urban areas.

Climate projections indicate higher temperatures, reduced average precipitation, and potentially more intense extreme precipitation events, increasing the risk of flash floods, landslides, erosion, and infrastructure damage even when total seasonal rainfall is below average. Conversely, prolonged dry periods can be followed by intense rainfall, creating compound risks for degraded soils, burned landscapes, and exposed settlements. Consequently, compound risks, including heatwaves, severe hailstorms, unexpected summer freezes, and strong windstorms, are expected to intensify, increasing threats to crops, power infrastructure, and climate-vulnerable populations.

Weather-related events are increasing in frequency and magnitude. The EM-DAT database records numerous extreme weather events in the Republic of North Macedonia, including storms, hailstorms, strong winds, and heavy snowfall, which have caused fatalities, injuries, damage to agricultural land and households, and disruption to critical infrastructure. Notable events occurred in July 1995, June 2004, when a storm affected 287 ha of agricultural land in Strumica, January (winter storm left one death and three injured) and July 2005, June 2007, when hail affected 350 farmers in Novo Selo, June 2009, when hail affected 10 settlements, 1,095 farmers, and 634 ha of agricultural land in Strumica, November 2010, March 2011 and 2014, June 2015, when a storm in Veles caused MKD 58.3 million (EUR 0.95 million) in damages to agricultural land, orchards, vineyards, and households, August 2016, when storm damages were estimated at EUR 22 million, and July 2026, when a severe storm injured 10 people, affected critical infrastructure, and brought down 189 trees in Skopje alone. Heavy snowfall events were recorded in January 2005 (one death and three injuries), March 2009, February 2012, and January 2017 (three deaths and 2.220 people affected). Escalating heat waves, along with prolonged warm spells, have become an increasingly common occurrence in the Republic of North Macedonia. In the summer of 2024, the Republic of North Macedonia experienced one of its most severe wildfire seasons in history, driven by prolonged heatwaves and dry conditions.

Precipitation patterns are becoming increasingly variable, characterized by longer dry periods followed by shorter but more intense rainfall events. While total annual precipitation shows no clear trend, substantial year-to-year variability and generally increasing or stable rainfall intensity indicate changes in the distribution and intensity of precipitation. Extreme multi-day rainfall events vary considerably across regions, while a growing share of annual precipitation is concentrated in very wet days, increasing the risk of floods and erosion, particularly after prolonged dry periods. At the same time, drought periods are becoming longer, with 59 consecutive dry days recorded in Lazaropole in 2023 and several significant drought episodes during 2020–2024, confirming a trend toward more frequent and prolonged droughts. Precipitation distribution during 2020-2024 was irregular both temporally and spatially. The long-term trend of annual precipitation totals suggests a general decrease, but due to rapid year-to-year changes, this cannot be explicitly determined. Data show that natural variability dominates, with most variation arising from annual oscillations, although the long-term trend indicates a reduction in annual precipitation.

Extreme weather can generate cascading and compound risks: heatwaves followed by drought can increase wildfire risk; wildfires can accelerate erosion and flash-flood risk; and intense rainfall can damage already heat- or drought-stressed infrastructure. NDC 3.0 should therefore adopt a multi-hazard approach to risk assessment and preparedness, prioritizing integrated early warning systems, improved weather and climate monitoring, clear warning-to-action protocols, anticipatory action and emergency preparedness, climate-resilient critical infrastructure, resilient agriculture

and insurance mechanisms, protection of health systems and vulnerable populations, and integration of climate risk into spatial and investment planning.

5.2 Vulnerability Assessment

5.2.1 Background

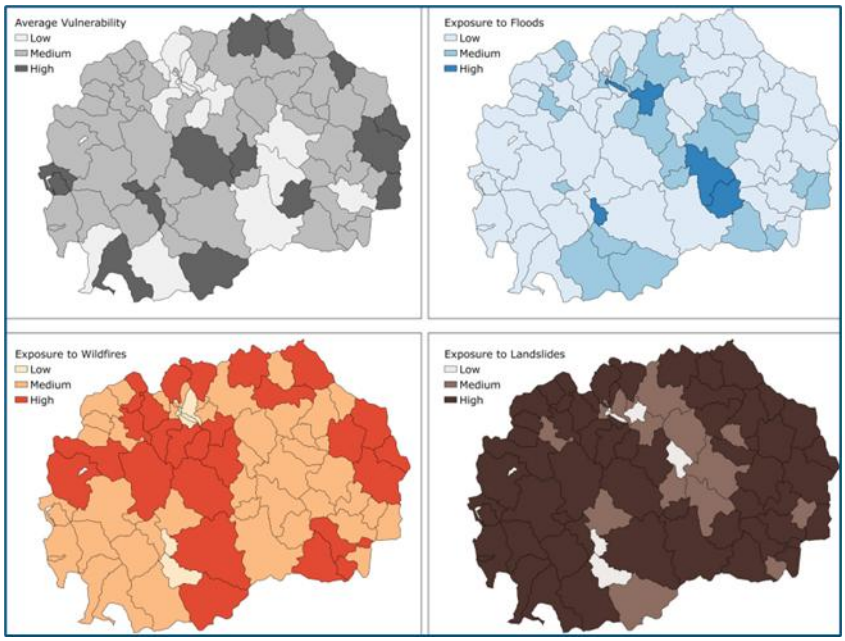
The Republic of North Macedonia is highly exposed to climate change due to its geographic, climatic, and socioeconomic characteristics, as well as the vulnerability of key sectors, ecosystems, infrastructure, and communities to climate variability and extremes. Climate impacts are already evident through rising temperatures, changing precipitation patterns, droughts, heatwaves, floods, wildfires, landslides, and other extreme events. Climate projections indicate that these pressures will intensify, with shifts in precipitation timing and distribution potentially increasing water stress and compound and cascading risks.

Vulnerability to climate change is not determined by climate hazards alone. It results from the interaction of hazard, exposure, sensitivity and adaptive capacity, and varies substantially across territories, population groups, economic sectors and ecosystems. The Republic of North Macedonia ranks as one of the most climate-vulnerable countries in Europe according to the ND GAIN Index for 2024. According to the INFORM Risk 2026, the baseline risk is low (2.7), ranking the country 135th out of 191 countries with lower overall risk, meaning the Republic of North Macedonia faces a relatively lower risk of humanitarian crises and disasters overwhelming national response capacities compared to higher-risk countries. The contributing dimensions, i.e. hazard exposure, vulnerability and lack of coping capacity, show that while the country has a relatively low vulnerability to humanitarian crises, its overall risk is driven primarily by natural hazards like floods and droughts, alongside localized gaps in infrastructure and institutional coping capacities. According to the INFORM Climate Change Tool, the country maintains a low overall risk profile, however, future climate projections indicate its relatively low societal vulnerability will be increasingly strained by a rising hazard and exposure score driven by climate-amplified threats like river floods, droughts, and extreme heatwaves, putting a heavier burden on the country's existing coping capacity.

In this regard, the Fourth National Climate Change Communication applied this approach through a Livelihood Vulnerability Index covering all eight planning regions and 71 municipalities, combining indicators of exposure, sensitivity and adaptive capacity. The findings reveal substantial regional and municipal disparities in adaptive capacity and climate vulnerability across the Republic of North Macedonia. Demographic, social, economic, infrastructure, and agricultural indicators vary considerably, affecting communities' ability to cope with climate impacts. The greatest differences are observed in population dynamics, education, road infrastructure, social capital, agricultural activity, and access to irrigation. Municipalities with the lowest adaptive capacity—particularly in the eastern and southeastern parts of the country—also overlap with areas of high sensitivity and exposure, resulting in greater overall vulnerability. In contrast, municipalities in the southwestern and Pelagonija regions generally show lower vulnerability, supported by more favourable adaptive capacity and exposure conditions.

Furthermore, considering the local-level vulnerabilities, the map below reveals significant spatial variation in climate vulnerability across the county's municipalities, reflecting differences in socio-economic resilience, adaptive capacity, and environmental sensitivity. While many central, western, and eastern municipalities show low to moderate vulnerability, distinct hotspots of high vulnerability are concentrated in parts of the eastern, central, and southwestern regions. These areas are less equipped to withstand and recover from extreme weather and climate-related shocks. Identifying such hotspots within the NDC framework can help policymakers prioritize adaptation measures, capacity building, and climate finance for the most vulnerable communities.

Table 3 Overlapping vulnerabilities in the municipalities in the Republic of North Macedonia (Source: WB CCDR, 2024)



In that sense, the ranking data from the World Bank's 2024 Country Climate and Development Report illustrates distinct geographical patterns across the Republic of North Macedonia, where different regions face highly specialized climate threats. High overall vulnerability is primarily concentrated in rural and economically peripheral municipalities such as Rankovce, Novaci, and Staro Nagorichane, reflecting lower socio-economic adaptive capacity and baseline resilience. In contrast, flood exposure heavily impacts densely populated urban centres and river basins, including Skopje municipalities like Aerodrom, Centar, and Gazi Baba, alongside key agricultural zones like Petrovec and Demir Kapija, where the concentration of infrastructure heightens potential damages. Wildfire exposure shifts the threat toward heavily forested and rural landscapes like Makedonski Brod, Chashka, and Zelenikovo, driven by rising temperatures and dense vegetation cover. Meanwhile, landslide risk is sharply defined by mountainous topography, concentrating extreme exposure in steep, terrain-sensitive western and northern municipalities like Centar Zhupa, Mavrovo i Rostushe, and Debar.

Table 4 The most highly exposed municipalities ranked from highest to lowest exposure, by hazard type (Source: WB CCDR, 2024)

Vulnerability	Rankovce, Novaci, Staro Nagorichane, Pehchevo, Novo Selo, Plasnica, Debar, Gradsko, Berovo, Resen
Floods	Aerodrom, Petrovec, Centar, Demir Kapija, Krivogashtani, Negotino, Jegunovce, Ilinden, Bitola, Gazi Baba
Wildfires	Makedonski Brod, Chashka, Zelenikovo, Zhelino, Prilep, Sopishte, Saraj, Berovo, Lipkovo, Valandovo
Landslides	Centar Zhupa, Mavrovo i Rostushe, Debar, Tetovo, Makedonski Brod, Zelenikovo, Chucher - Sandevo, Kavadarci, Saraj, Gostivar

For NDC 3.0, the vulnerability assessment adopts an integrated, risk-based approach that goes beyond describing climate hazards to identify who and what is vulnerable, where vulnerabilities are concentrated, their underlying causes, and which interventions can reduce them. This provides an evidence base for prioritizing adaptation investments, strengthening disaster risk reduction, addressing climate-related loss and damage, and enhancing the resilience of national and local development. The approach builds on the Republic of North Macedonia Enhanced NDC, which identified adaptation priorities (within the new National Adaptation Plan) across water, food, energy, health, biodiversity, tourism, forestry, disaster risk reduction, loss and damage, and infrastructure, while emphasizing stronger integration of adaptation into national planning.

Therefore, for NDC 3.0, climate vulnerability is understood as a function of four interrelated dimensions:

Climate hazard → Exposure → Sensitivity → Adaptive capacity → Climate risk

This approach recognizes that the same hazard can produce very different consequences depending on socioeconomic conditions, infrastructure quality, ecosystem condition, access to services, institutional capacity and availability of financial resources. Consequently, NDC 3.0 should prioritize risk reduction rather than hazard reduction alone, with particular attention to vulnerable populations, critical infrastructure, essential services, productive sectors and ecosystems.

5.2.2 Sectoral vulnerability assessment

Climate vulnerability is multidimensional and requires assessment across interconnected sectors. The Fourth National Climate Change Communication identified the prevailing impacts of the changing climate in the country, and with other researched impacts, they are presented in the table below.

Table 5 Prevailing climate change impacts in the Republic of North Macedonia

#	CLIMATE HAZARD	POTENTIAL IMPACT
1	Drought	Loss of cultivable lands and changes in cultivation periods/seasons; Changes in sub-surface water levels, especially the water table; Affect groundwater resources in both unconfined and confined aquifers; Changes in soil salinity, moisture and drainage capacity; Changes in shoreline of lakes and water bodies; Reduce crop yields, increase irrigation requirements and increase the probability of agricultural losses; Cascading impacts on food prices, rural incomes, employment and migration; Long-term land degradation; Reducing hydropower generation; Depleting freshwater reservoirs, groundwater levels, and drinking water supplies, etc.
2	Flood	River flooding and, over the longer term, changes in river morphology may occur in areas where rainfall is projected to increase; Changes in catchment capacity resulting from increased runoff may create additional storage requirements for dams and increase the risk of dam failure during extreme precipitation events; Erosion and landslide risks due to the occurrence of flash floods; Water resource variabilities (changes in incident rainfall, seasonal changes in rainfall, extreme rainfall events leading to flash floods); Damaging and/or destroying transportation corridors, residential housing, and commercial properties; Overwhelming urban drainage systems and causing severe localized flooding; Extensive topsoil erosion and inundation of fertile agricultural lands, etc.
3	Extreme weather events (extreme temperatures, heatwaves, storms)	Heatwaves can increase heat-related health risks, particularly in urban areas affected by heat-island effects, while also stressing vegetation, reducing plant health, and affecting agricultural production; Heatwaves pose direct risks to human health, increasing illness and mortality rates, particularly among vulnerable populations, e.g., the elderly and may also increase the emergence and spread of new diseases; Reduced frost days may lead to earlier spring onset, triggering shifts in plant flowering and other ecosystem life-cycle events; Drought, soil pH and nutrient changes, salinity, and shifts in annual precipitation patterns can alter cultivation periods and reduce agricultural productivity; Snow destabilisation that may increase risks of avalanches in new areas; Increase in cases of pests and diseases (risks to humans and for agriculture); Species migration changes in terms of both spatial and temporal shifts; Changing weather conditions can shift habitat ranges and the distribution of flora, making new areas suitable for some species while rendering existing habitats less suitable for others; Straining power grids through surging air conditioning and cooling demands; Triggering sudden urban flash floods and hail damage to standing crops, etc.
4	Wildfires	Triggering severe cascading risks starting from vegetation loss, which accelerates soil erosion, triggers flash floods and landslides, damages critical infrastructure, and ultimately leads to major livelihood losses; Extensive damage to biodiversity, critical ecosystem services, agricultural land, and carbon stocks; Degrading regional air quality, posing severe risks to human health, and severely impacting well-being, including some economic activities, e.g. tourism, etc.; Impacting forest and pasture management capacities, etc.

Consequently, the sectoral vulnerability assessment for NDC 3.0 priority sectors is presented below.

Table 6 Sectoral vulnerability assessment and priority action areas

#	SECTOR	PRINCIPAL CLIMATE HAZARDS	MAIN VULNERABILITIES	PRIORITY VULNERABILITY REDUCTION AREAS
1	Water	Drought Flood/flash-flood Heatwave Cold wave Storm	Reduced water availability and increased seasonal variability, compounded by competing demands; Declining reservoir storage and groundwater recharge levels; Ageing municipal water-supply systems with high distribution losses; Reduced summer river flows, affecting water-supply security;	Modernize water supply and distribution infrastructure to improve efficiency and reduce losses; Strengthen integrated river basin management (IRBM) and water resources planning; Protect and restore headwater catchments and natural groundwater recharge zones;

#	SECTOR	PRINCIPAL CLIMATE HAZARDS	MAIN VULNERABILITIES	PRIORITY VULNERABILITY REDUCTION AREAS
			Deteriorating raw water quality during droughts and flood events.	Strengthen drought preparedness and integrated water resources management; Upgrade wastewater treatment and promote industrial water reuse.
2	Agriculture	Drought Flood/flash-flood Heatwave Wildfire/open-space fire Cold wave Storm	High reliance on rain-fed agriculture, increasing exposure to climate variability and yield losses; Rising irrigation demand, compounded by inefficient infrastructure and water losses; Livestock heat and water stress, with associated impacts on farm incomes; Increased soil erosion during extreme weather events; Significant climate-induced crop yield losses in critical agricultural basins.	Expand modern, efficient, and precision irrigation systems; Promote drought- and climate-resilient crop varieties and climate-smart agricultural practices; Strengthen early warning systems for agricultural hazards; Expand agricultural climate micro-insurance mechanisms.
3	Forestry	Wildfire Drought Flood/flash-flood Heatwave Cold wave Storm	Extensive, highly flammable forest biomass, increasing wildfire risk and potential biomass and carbon losses; Forest degradation and declining native biodiversity; Severe post-fire soil erosion and increased landslide risk; Slow natural forest regeneration under warming conditions.	Enhance integrated forest fire management (IFFM), including automated fire detection, monitoring, and rapid response systems; Strengthen climate-informed forest management planning and monitoring, incorporating future climate scenarios into 10-year management plans; Promote climate-resilient silviculture, including native species selection and adaptive forest management practices; Strengthen forest protection and capacity to address increasing risks from fires, pests, diseases, and climate-related disturbances; Accelerate reforestation and restoration using climate-resilient native species; Implement bioengineering and erosion-control measures to reduce post-fire soil erosion and landslide risks.
4	Biodiversity	Wildfire/open-space fire Drought Flood/flash-flood Heatwave Cold wave Storm	Habitat degradation, species loss, and decline in ecosystem services; High risks to endemic and climate-sensitive alpine and aquatic species; Degradation and drying of critical wetland and peatland ecosystems; Climate-driven habitat shifts and redistribution of species ranges; Increased vulnerability to invasive alien species following climate-related disturbances.	Expand protected area networks and strengthen ecological corridors to improve connectivity; Implement Nature-based Solutions (NbS) for ecosystem restoration and climate resilience; Restore degraded wetlands, lakeshores, and riverine habitats; Establish long-term biodiversity monitoring systems to track climate impacts and ecosystem changes.
5	Health	Wildfire/open-space fire Drought Flood/flash-flood Heatwave Cold wave Storm	Intensifying urban heat-island effects in densely populated municipalities, increasing heat stress and heat-related mortality and morbidity; Greater health risks for vulnerable populations, including increased disease risks; Localized urban flash flooding, particularly in low-lying and highly built-up communities; Seasonal deterioration of air quality, potentially compounding respiratory illness.	Expand urban green-blue infrastructure to reduce heat-island effects and improve cooling; Expand implementation of the heat-health action plans, early warning systems, and health surveillance; Improve building thermal insulation and energy efficiency to reduce heat exposure; Strengthen and floodproof health facilities and critical municipal infrastructure to ensure service continuity during extreme events.
6	Infrastructure	Wildfire/Open-space fire Drought Flood/flash-flood Heatwave	Slope destabilization and landslides causing blockages and disruption along mountain road networks; Bridge scour and foundation damage during peak river discharge events;	Climate-proof mountain roads, transit corridors, and critical bridges through resilient design, maintenance, and risk screening;

#	SECTOR	PRINCIPAL CLIMATE HAZARDS	MAIN VULNERABILITIES	PRIORITY VULNERABILITY REDUCTION AREAS
		Cold wave Storm	Thermal stress causing road deformation, rail buckling, and power-line sagging; Overloaded urban drainage systems increasing localized flood risk; Physical damage to energy substations, water-supply facilities, and telecommunications infrastructure; Increased energy demand and reduced hydropower availability, creating service interruptions and potential cascading failures.	Upgrade urban drainage and stormwater retention systems to reduce flood risk; Strengthen energy grids, water pipelines, and telecommunications infrastructure against climate hazards; Diversify energy sources, strengthen grid resilience, and improve demand management to address supply risks; Conduct comprehensive climate-risk screening and structural audits for strategic infrastructure; Strengthen redundancy and continuity planning to minimize service interruptions and cascading failures.
7	Human settlements	Wildfire/open-space fire Drought Flood/flash-flood Heatwave Cold wave Storm	Intensifying urban heat-island effects and rising cooling energy demand; Increased heat-related morbidity and mortality, particularly among vulnerable groups; Structural flood damage to low-lying housing and public facilities; Climate-related housing damage and disruption of essential urban services.	Expand urban green-blue infrastructure and permeable surfaces to reduce heat and flood risks; Implement deep thermal retrofits and improve building energy efficiency; Strengthen heat-health warning systems and establish emergency cooling centres; Integrate climate risk into spatial planning, drainage, and urban development; Promote green infrastructure and nature-based measures to improve urban resilience.

NDC 3.0 shall promote people-centred, risk-informed, and system-wide climate resilience, ensuring that vulnerability assessments and adaptation investments reflect socioeconomic and demographic differences and prioritize the most vulnerable groups, communities, and ecosystems. Particular attention shall be given to low-income and energy-poor households, rural and remote communities, older persons and children, persons with disabilities, climate-sensitive livelihoods, informal and outdoor workers, people in high-risk settlements, and groups with limited access to essential services, information, finance, and decision-making. Major public infrastructure investments shall progressively incorporate climate-risk screening covering current and future hazards, exposure and vulnerability, criticality and service dependencies, resilient design and maintenance, residual risks, and potential financial impacts. Ecosystem resilience and nature-based solutions shall be integrated into adaptation planning alongside conventional infrastructure, while vulnerability assessments shall progressively incorporate multi-hazard and cascading-risk analysis, particularly for critical infrastructure, urban areas, agriculture, water resources, and emergency management. Strengthening adaptive capacity shall extend beyond physical infrastructure to institutions, governance, information, skills, finance, and social resilience, with particular emphasis on municipal and community-level capacity. Consequently, NDC 3.0 shall be guided by the following principles:

- Risk-informed development – Integrate current and projected climate risks into development and infrastructure decisions.
- Prevention and anticipatory action – Prioritize prevention, preparedness, early warning, and anticipatory action over post-disaster response.
- Territorial targeting – Direct investment toward areas with the highest vulnerability and risk.
- People-centred adaptation – Address differentiated risks related to socioeconomic and demographic conditions.
- Ecosystem-based resilience – Combine nature-based solutions and ecosystem restoration with grey infrastructure.
- Financial resilience – Integrate climate risks into public financial management, disaster-risk financing, insurance, and contingency mechanisms.
- No- and low-regret measures – Prioritize measures that remain beneficial under different future climate scenarios.
- Continuous learning and updating – Regularly update assessments using new climate, disaster, socioeconomic, and impact data.

5.3 Sectoral Adaptation Priorities

5.3.1 Water

Water security is an increasingly important climate adaptation priority for the Republic of North Macedonia, driven by rising temperatures, changing precipitation, droughts, floods and growing pressure on water infrastructure and ecosystems. Although the Republic of North Macedonia uses freshwater, which is three percentage points higher than the EU as a percentage of renewable freshwater resources (8.39%), the inefficiency of the water supply network exacerbates the problem, with a staggering loss of 62% in 2020. Besides this, non-compliance with legal obligations leads to a significant rate of water pollution of 75%, primarily in areas in close proximity to urban and industrial regions, as well as zones where agricultural activities are concentrated.

Recent policies and investments focus on improving water and wastewater services, strengthening water governance and aligning with EU water legislation. The National Adaptation Plan provides an opportunity to further integrate climate risks into water resource planning. Key challenges remain water losses, drought and flood risks, groundwater management, ageing infrastructure, water quality and institutional coordination. The NDS 2024 – 2044 places a strong focus on water conservation, with comprehensive strategies for efficient water resource management, having in mind that we are talking about the conservation of an invaluable natural resource, as well as a sustainable and rational approach to water use.

The water adaptation priorities are aligned with the EU Adaptation Strategy, particularly its objective to promote smarter and more systemic adaptation through improved climate risk knowledge and integration of climate change into water management. They also support progressive alignment with the EU Water Framework Directive, the EU Floods Directive and the wider EU environmental acquis by promoting integrated river basin management, sustainable water use, flood risk management and protection of aquatic ecosystems. At the global level, the priorities contribute to the Paris Agreement and the Global Goal on Adaptation, particularly the objective of enhancing resilience to climate-related impacts and reducing vulnerability. They also contribute to SDG 6 on Clean Water and Sanitation, SDG 13 on Climate Action and the Sendai Framework, particularly through improved risk assessment, flood and drought management, early warning and resilient infrastructure.

Adaptation objective - Strengthen the climate resilience, sustainability and equitable management of water resources and water services by improving water security, reducing vulnerability to droughts, floods and other climate hazards, rational use and conservation of water resources and protecting water-dependent ecosystems and communities.

- Strengthen climate-resilient water resources management – Integrate climate risks into water planning, allocation and river basin management.
- Increase resilience to drought and water scarcity – Improve water efficiency, reduce losses and strengthen drought preparedness and conservation.
- Reduce flood risks through integrated and nature-based approaches – Combine structural measures with ecosystem-based solutions to reduce flood impacts.
- Modernize water monitoring and early warning systems – Strengthen hydrological, groundwater and water-quality monitoring, forecasting and early warning and enhance regional and EU data sharing.
- Strengthen climate-resilient water infrastructure – Rehabilitate water supply, sanitation and irrigation systems, reduce water losses and improve resilience to climate risks.
- Strengthen institutional governance and financing – Improve coordination, align water planning with climate projections, strengthen regulatory frameworks and ensure sustainable financing, as well as improve cross-sector water management, including the regulation of agricultural groundwater.
- Reduce non-revenue water to boost the efficiency and resilience of supply systems
- Enhance digital and climate resilience of water systems – Expand automated monitoring, develop flood and drought models, and strengthen digital security of water infrastructure.
- Advance transboundary and ecosystem-based water management – Strengthen cooperation across shared river basins and expand nature-based solutions for watershed and erosion management.

5.3.2 Agriculture

Agriculture is one of the key economic sectors in the Republic of North Macedonia and plays a critical role in the social and economic stability of the Republic of North Macedonia. Changes in temperature and precipitation, as well as extreme events, are already influencing crop yields and livestock productivity in the Republic of North Macedonia. Climate change is projected to reduce crop and livestock productivity in the country, leading to significant socio-economic impacts for the country's economy and farmers in particular. Current conventional agricultural practices and food systems applied in the Republic of North Macedonia are inadequate to address the ever-growing climate impacts. Measures to improve resilience against climate impacts are therefore imperative to protect the agricultural sector in the country and ensure a climate-resilient and low-carbon economic development and accession to the European Union. Agriculture remains highly important for rural livelihoods, food security and economic development in the Republic of North Macedonia but is increasingly exposed to drought, heat, irregular precipitation, frost, floods, soil degradation and

other climate extremes. Recent developments include increased attention to climate-smart agriculture, irrigation modernization, sustainable land management and land consolidation. The NDS 2024 – 2044 stipulates that sustainable food production systems are key for the quality of life and resilience of the country. Also, it fosters a resilient and competitive agricultural sector by integrating cutting-edge eco-technologies, minimizing chemical inputs, and expanding organic production to protect biodiversity and mitigate soil degradation, while actively empowering women farmers as key agents in resource management to secure food safety, environmental protection, and sustainable economic growth in domestic and foreign markets. Furthermore, the National Land Consolidation Strategy 2025–2035 and ongoing support for agricultural modernization provide opportunities to improve farm productivity, reduce land fragmentation and strengthen climate resilience. However, farmers remain vulnerable to water scarcity, changing growing conditions, climate-related production losses and limited access to climate information and financial protection.

The agricultural priorities support the objectives of the EU Adaptation Strategy, the European Green Deal, the Green Agenda for the Western Balkans and relevant principles of the EU's Common Agricultural Policy and Farm to Fork Strategy. They promote sustainable and climate-resilient food production, soil and water conservation, biodiversity protection, resource efficiency and resilient rural livelihoods. Globally, the priorities contribute to the Paris Agreement and the Global Goal on Adaptation, particularly global adaptation outcomes related to food and agricultural production and resilient livelihoods. They also support SDG 2 on Zero Hunger, SDG 13 on Climate Action, SDG 15 on Life on Land and the Sendai Framework, particularly through agricultural risk assessment, early warning, anticipatory action and financial protection.

Adaptation objective - Build a productive, sustainable and climate-resilient agricultural and food system that protects food security, rural livelihoods, natural resources and farmers from increasing climate and disaster risks.

Potential agriculture priority adaptation actions can be defined as the following:

- Strengthen climate-resilient water management – Modernize irrigation, improve their maintenance, improve water-use efficiency, expand water storage and rainwater harvesting, and promote water reuse where appropriate.
- Promote climate-resilient crops and varieties – Introduce drought- and heat-tolerant varieties, diversify production, invest in climate-resilient agrifood value chains, organic farming, and processing innovations, and conserve locally adapted genetic resources.
- Strengthen sustainable soil management – Promote conservation agriculture, organic matter management, cover crops, mulching and erosion control and the sustainable management of natural resources to improve soil moisture retention and resilience, alongside supporting investments to mitigate farm-level greenhouse gas emissions.
- Adapt agricultural practices to changing climate conditions – Adjust planting dates, crop density, fertilization and crop rotation, supported by precision agriculture and digital technologies, production specialization, and land-use shifts toward high-value production based on competitive advantage.
- Strengthen integrated pest and disease management – Improve monitoring, early warning, biological control and preparedness for emerging and invasive pests and diseases.
- Expand agroforestry and protective measures – Establish windbreaks, agroforestry systems, protective vegetation and green infrastructure to reduce climate and erosion risks.
- Strengthen institutional and financial support for adaptation – Develop adaptation plans, expand agricultural insurance, support adaptive technologies and strengthen research, innovation and advisory services, promote climate-smart agriculture investments, and develop the Agriculture Knowledge and Information Innovation System (AKIS).
- Improve climate and agro-meteorological monitoring and early warning – Modernize monitoring networks and provide timely forecasts and digital climate-risk information to improve farmers' access to actionable agroclimatic insights. Increase the resilience and diversification of production systems – Reduce dependence on single crops, promote integrated and climate-smart farming, foster green and resilient agricultural diversification, and support efficient and circular use of agricultural resources.
- Strengthen climate-resilient livestock production – Promote heat-tolerant breeds, improved feeding practices, adequate water supply and better farm conditions, and investments to mitigate livestock greenhouse gas emissions to reduce climate-related stress.
- Improve pasture and natural resource management – Strengthen sustainable pasture management, shading and efficient use of land and water resources.
- Strengthen climate risk monitoring and farm preparedness – Improve early warning, disease monitoring and farm biosecurity to respond to climate-related risks.
- Support farmers’ capacity and innovation – Invest in knowledge, advisory services and modern technologies to strengthen adaptive capacity of livestock farms.

5.3.3 Forestry

Forests cover nearly 40% of the Republic of North Macedonia's territory, placing the country above the European average in forest cover. In 2024, total forest area was 1,027,065 ha, comprising mainly deciduous (607.843 ha) and mixed forests (315.426 ha). The largest forest areas are found in the Pelagonija and Southwest regions. State-owned forests account for around 90% of total forest area and 92% of growing stock. Private forests represent about 10% of the forest area but are highly fragmented across more than 200,000 parcels owned by approximately 65.000 households, with an average size of only 0.6 ha. This fragmentation is a major challenge for sustainable forest management and effective wildfire protection. Forests in the Republic of North Macedonia are increasingly vulnerable to droughts, extreme heat, wildfires, land degradation, pests and diseases. Another threat is the increasing rate of deforestation, which in 2023 totalled 17,999 ha and is mainly caused by land use change and forest fires, with burned areas averaging 7,000 ha/year and exceeding 15,000 ha in severe fire years[2].

Climate change is expected to affect the Republic of North Macedonia's forests through declining precipitation, rising temperatures, more frequent heatwaves and extreme rainfall. During 2016–2035, the growing season is projected to lengthen and average temperatures to increase, potentially raising forest productivity. However, more frequent heatwaves in the western and eastern regions may reduce productivity. By 2046–2065, forest productivity is expected to decline more significantly, further exacerbated by increasing pest and disease pressures. Recent wildfires highlight the need for an integrated approach combining sustainable forest management, wildfire prevention, climate monitoring, early warning, emergency preparedness and landscape restoration. Strengthening forest resilience is a national priority, including through afforestation, restoration of degraded land and climate adaptation, while protecting forests' vital roles in water regulation, soil conservation, biodiversity, carbon storage and disaster risk reduction.

In the NDS 2024 – 2044, wildfire prevention and response are not addressed as a standalone priority but are integrated into broader strategic disaster-risk management priorities of the Strategic Area 5 on safe, secure and resilient society. The planned transformation of the disaster risk management system also focuses on prevention, multi-hazard early warning, risk-informed planning, improved risk assessment and mapping, climate adaptation, and stronger preparedness and response to climate-related hazards. In the Strategic Area on green transformation, priorities for conserved biodiversity and sustainably managed habitats include implementing solutions such as expanding protected areas, afforestation, and adopting sustainable land management practices. The Sustainable Forestry Development Strategy identifies wildfires as a major threat to forest management, causing significant economic and environmental losses. It aims to strengthen the forestry sector through sustainable forest management while protecting environmental resources. The Strategy also calls for maintaining and improving the forest wildfire early warning, alert and suppression system. Under the 2024–2026 Action Plan, two practical measures are planned: artificial regeneration of state and private forests damaged by wildfires (Measure 5.1.3) and the establishment and maintenance of firebreaks in high-risk forest areas (Measure 5.4.5a). In the Long-term Climate Action Strategy, emission reduction measures include the establishment of integrated forest fire management and afforestation. The National Strategy for Nature Protection 2017–2027 outlines the need for establishing and maintaining a Single Information System and Registry for Forest Fires managed by MAFWE.

The forestry priorities are aligned with the EU Adaptation Strategy, the EU's policy direction on sustainable forest management, the EU Forest Strategy for 2030, the EU Biodiversity Strategy and the Green Agenda for the Western Balkans. They support climate-resilient forest management, restoration, biodiversity conservation and integrated wildfire risk management. At the global level, the priorities support the Paris Agreement, the Global Goal on Adaptation, the Kunming-Montreal Global Biodiversity Framework, SDG 13 and SDG 15. They also support the Sendai Framework by strengthening wildfire prevention, risk assessment, preparedness, early warning and resilient recovery.

Adaptation objective - Strengthen the resilience, health and sustainable management of forests and forest landscapes to climate change, drought, wildfire, pests and other climate-related disturbances while enhancing ecosystem services and supporting biodiversity and climate resilience.

Potential forestry priority adaptation actions can be defined as the following:

- Promote climate-resilient and sustainable forest management – Integrate climate risks into forest planning and management to improve ecosystem health, productivity and long-term resilience, i.e. development of a programme for climate change adaptation of the forestry sector, development of forest management plans including adaptation sections, landscape fire management strategy, etc.
- Establishing integrated management of forest fires[3]– Enhance wildfire prevention, i.e. policy and regulatory enhancement incl. Law on Forests, a special rule book for forest fire protection, a development strategy

[2] PLANT Assessment for North Macedonia. UNDP. 2026. p.3-4.

[3] Ministry of Environment and Physical Planning. Long-term Strategy on Climate Action and Action Plan. 2021. P.147. Online. Available at: https://unfccc.int/sites/default/files/resource/MKD_LTS_Nov2021.pdf

addressing fires, diseases, and insects, and an action plan for project realization and procurements for PE "Makedonski sumi.", preparedness, early warning and response to reduce climate-related fire risks and impacts.
- Increase forest resilience to drought, pests and diseases – Apply adaptive management and preventive measures to reduce vulnerability to climate-related stresses and disturbances.
- Restore degraded and fire-affected forests and landscapes – Support forest regeneration and ecosystem restoration to recover ecological functions and strengthen resilience to future climate impacts, as well as afforestation with native and climate-resilient species.
- Strengthen forest landscape and watershed management – Promote integrated landscape approaches to improve water regulation, soil conservation and ecosystem resilience.
- Enhance forest, climate and wildfire monitoring through digital technologies – Improve data collection, risk assessment, mapping, early warning and decision-making through modern monitoring and digital tools.
- Strengthen local and community capacities for forest resilience – Build local capacity for sustainable forest management, wildfire prevention, preparedness and effective response to climate-related risks.
- Promote mixed-species forests – Reduce reliance on vulnerable monocultures by introducing locally adapted tree species to increase ecosystem resilience to pests and extreme weather events.
- Actively manage disturbance risks – Apply fuel management to reduce severe wildfire risk and strengthen rapid pest and disease monitoring to prevent outbreaks.
- Increase structural diversity – Develop forests with varied age classes and canopy layers to improve resilience to strong winds and heavy snowfall.
- Apply assisted migration where appropriate – Strategically relocate suitable tree species or genetic populations to areas expected to provide more favourable future climate conditions.

5.3.4 Biodiversity

The country is characterized by high species richness and significant levels of endemism, particularly in its mountain and freshwater ecosystems. However, important conservation gaps remain, with protected areas currently covering only around 23% of nationally important mountain biodiversity sites. Biodiversity and ecosystems are increasingly affected by climate change, alongside existing pressures from habitat degradation, land-use change, agricultural runoff, water stress, pollution, tourism development and wildfires. Forests, wetlands, rivers, mountains and agricultural landscapes are particularly important for maintaining ecosystem services and reducing climate-related risks. Recent policy developments have strengthened attention to protected areas, habitat management, ecosystem restoration and nature-based solutions. Nevertheless, climate change is expected to further increase pressure on vulnerable species and ecosystems, highlighting the need to better integrate climate risks into biodiversity conservation, protected area management, land-use planning and sectoral development.

The NDS 2024 – 2044 within the Strategic Area on green transformation and the goal on clean and healthy environment stipulates that a clean environment also ensures environmental balance by preserving biodiversity and complex ecosystem relations. Consequently, one of the priorities is to conserve biodiversity and sustainably manage habitats. Key priorities include expanding protected areas, afforestation and sustainable land management, alongside measures to protect and restore aquatic ecosystems and reduce human pressures on natural habitats. These actions will help conserve biodiversity, maintain ecosystem services, improve air and water quality, and protect the region’s natural heritage. In parallel, tailored medium-term measures are needed to remediate environmental hotspots, such as lindane-contaminated sites, and reduce their risks to ecosystems and human health. The National Strategy for Nature Protection 2017– 2027 outlines a comprehensive decade-long roadmap to manage biological diversity, modernise legislative structures, and ensure sustainable ecosystem services by implementing measures to protect and sustainably use biodiversity in all relevant sectors in the country, together with economic and social development of the country.

These biodiversity adaptation priorities are aligned with the EU Biodiversity Strategy for 2030, the EU policy direction on Nature Restoration, the EU Adaptation Strategy and the Green Agenda for the Western Balkans, as well as directives on habitats and birds, etc. They support ecosystem restoration, ecological connectivity, biodiversity mainstreaming and nature-based solutions. Globally, the priorities directly support the Kunming-Montreal Global Biodiversity Framework, the Paris Agreement and Global Goal on Adaptation, SDG 14 and SDG 15, and the Sendai Framework. Healthy ecosystems are recognized as essential components of resilience because they reduce flood, drought, erosion and heat risks.

Adaptation objective - Conserve, restore and enhance the resilience of biodiversity and ecosystems to climate change while strengthening ecosystem services that support water security, livelihoods, disaster risk reduction and human well-being.

Potential biodiversity priority adaptation actions can be defined as the following:

- Integrate climate change into biodiversity conservation and protected area management – Strengthen conservation measures and protected areas to address climate-related pressures on species and ecosystems.
- Restore degraded and climate-vulnerable ecosystems – Scale up afforestation, ecosystem restoration and sustainable land management, including in forests, wetlands, rivers and other vulnerable habitats.

- Scale up ecosystem-based adaptation and nature-based solutions – Use healthy and restored ecosystems to reduce climate risks and maintain essential ecosystem services.
- Strengthen ecological connectivity and climate-resilient landscapes – Improve ecological corridors and landscape management to support species and ecosystem adaptation, as well as green (biodiversity) corridors to allow the free movement of animals, facilitate seed dispersal, and expand vegetation cover.
- Strengthen aquatic ecosystem resilience – Protect and restore rivers, wetlands and other aquatic ecosystems while reducing pressures from pollution, water stress and climate change.
- Integrate biodiversity and climate risks into spatial and development planning – Mainstream biodiversity and climate considerations into land-use planning and sectoral development.
- Strengthen biodiversity and ecosystem monitoring – Improve monitoring, data and assessment to inform climate adaptation and conservation action, and establish a surveillance system for forest and biodiversity monitoring purpose.
- Strengthen ecosystem finance and local stewardship – Mobilize financing for ecosystem-based adaptation and strengthen local participation in sustainable ecosystem management.
- Remediate environmental hotspots – Implement targeted measures to remediate contaminated sites, including lindane-contaminated areas, and reduce associated risks to ecosystems and human health

5.3.5 Health

Climate change is becoming an increasingly important public health concern in the Republic of North Macedonia, particularly due to rising temperatures and more frequent and intense heatwaves. Climate risks can also affect public health through floods, water scarcity, deteriorating air and water quality and changing patterns of vector-, water- and food-borne diseases. Previous climate assessments have identified health as a priority adaptation sector, while recent policy processes increasingly recognize the need for stronger integration of climate risks into public health planning.

The National Sustainable Development Strategy 2024 – 2044 recognizes that climate change is a multidimensional challenge that significantly affects human health, productivity, ecosystems, and macroeconomic stability. Disasters, including floods, particularly flash floods, prolonged droughts, heatwaves, and forest and open-space fires, are among the impacts that require effective mitigation and adaptation policies. A comprehensive societal response also requires resilient and sustainable infrastructure, transformed business models, sustainable agriculture, green transformation, and responsible resource management. In that regard, the NDS 2024 – 2044 in the Strategic area: Demographic revitalization and social and cultural development.

Accordingly, the health system in the Republic of North Macedonia is equally important for both mitigation and adaptation, and NDC 3.0 underscores the importance of a low-carbon transition to safeguard public health and services and further strengthening of climate resilience-building of the health sector through adaptation to the existing and emerging climate risks. According to the Action Plan for Preventing the Effects of Heatwaves on the Health of the Population in the Republic of North Macedonia 2025–2030 building resilience of the health system to climate change is a continuous, cumulative process informed by previous experience and lessons learned. It aims to strengthen the health system while improving population health and ensuring sufficient, qualified, and accessible health personnel through an effective and accountable approach. This process involves reducing climate-related health risks, including hazards, exposure and vulnerability, while strengthening the capacities of the health system by integrating climate considerations into health policies and activities. Therefore, the NDC 3.0 provides an opportunity to move towards a more systematic climate-resilient health system based on prevention, surveillance, early warning, preparedness and protection of vulnerable groups.

The health priorities are aligned with the EU Adaptation Strategy and the EU climate and health policy framework, including the increasing focus on protecting populations from heat, climate-sensitive diseases and environmental risks. They also support the approach of the European Climate and Health Observatory to strengthening the evidence base, preparedness and climate-resilient health systems. At the global level, these priorities contribute to the objectives of the Paris Agreement and the Global Goal on Adaptation, particularly the global adaptation outcome on health. They also support SDG 3 (Good Health and Well-being), SDG 13 (Climate Action) and the Sendai Framework for Disaster Risk Reduction 2015 – 2030 across the four priorities.

Adaptation Objective - Protect human health and well-being from climate-related risks by strengthening the preparedness and resilience of health systems, while enhancing prevention, surveillance, early warning, and equitable access to health protection.

Potential health priority adaptation actions can be defined as the following:

- Build a resilient public healthcare system – Strengthen the capacity of the public healthcare system to anticipate, prepare for and address current and future health and financial challenges, including those arising from climate change and other emerging risks, supported by strategic investments to equip and train primary healthcare providers for an extended scope of care.

- Strengthen heatwave early warning systems - Improve existing early warning systems to enable timely alerts to the population about impending heatwave-related risks and challenges.
- Strengthen climate-sensitive disease surveillance and prevention – Enhance monitoring, early detection and prevention of diseases whose occurrence or transmission may be affected by climate change, e.g. for vector-borne and water-borne disease risk linked to flooding and warming trends, backed by legislative and technical prerogatives for robust cross-sectoral connections.
- Strengthen climate-sensitive disease surveillance and prevention – Enhance climate-informed surveillance, early detection, prevention and response to vector-borne and water-borne diseases, including through vector and environmental monitoring, climate-health early warning, targeted control measures, strengthened health-system capacities and public risk communication.
- Climate-proof health facilities and essential health services – Improve the resilience of health infrastructure, equipment and essential services to floods, storms and other climate-related hazards, making strategic investments to strengthen responses to climate-related hazards and other health emergencies.
- Climate-proof health infrastructure and equipment – Integrate heat-resilient design and upgrades into new and existing health facilities, including insulation, green roofs and facades, shaded green spaces, external shading and cooling measures, and appropriate facilities for reducing heat exposure.
- Strengthen climate-health early warning and emergency preparedness – Improve early warning systems, emergency planning and response capacities to enable timely action during climate-related health emergencies.
- Improve climate and environmental health risk communication – Strengthen timely, accessible and targeted communication on climate-related health risks and appropriate protective measures, alongside raising population awareness of climate-resilient practices.
- Protect vulnerable populations and climate-exposed workers – Strengthen targeted measures for older people, children, people with chronic conditions and other vulnerable groups, as well as workers exposed to heat and other climate-related hazards.
- Strengthen climate-health data, research and institutional coordination – Improve the collection and use of climate-health data, research, and evidence while strengthening institutional coordination, including the development of climate-hazard-related functionalities for both patients and healthcare providers in the Republic of North Macedonia's eHealth system (MojTermin), to support informed adaptation planning and action. Explicitly capture air-quality and climate co-benefits – Integrate measures that reduce air pollution, particularly PM10, as they can simultaneously improve air quality, reduce climate-related respiratory health risks and strengthen overall population health resilience, while raising the capacities of health sector administrative and clinical professionals on the health effects of climate change.

5.3.6 Infrastructure

Infrastructure is increasingly exposed to floods, landslides, extreme heat, wildfires, storms and other climate-related hazards, which can disrupt transport, water, energy, communications and other essential services, with cascading economic and social impacts. Recent policy processes have increased attention to resilient public infrastructure, municipal investment, transport connectivity and climate risk assessment, while transport is also among the sectors covered by the ongoing National Adaptation Plan process. Nevertheless, there is a need for more systematic climate and multi-hazard risk screening, climate-resilient design standards, improved asset management and greater consideration of infrastructure interdependencies.

The NDS 2024 – 2044 refers to building the resilience of the infrastructure, including adoption of policies, measures and tools to strengthen the resilience of critical infrastructure and essential systems. Within the scope of the Strategic Area on safe, secure and resilient society, one of the priorities is to strengthen resilience of critical infrastructure and services by mainstreaming resilience across the design, construction, reconstruction and operation of infrastructure and essential services, including the immediate reassessment of planned infrastructure against resilience and accessibility standards. Among other objectives, the Long-term Strategy on Climate Action aims to mainstream climate resilience across the relevant sectors covered by this study. It highlights the role of green infrastructure and the need to integrate climate risks into Environmental Impact Assessments (EIA), Strategic Environmental Assessments (SEA), and other planning and design processes. In the Republic of North Macedonia's NDC 3.0 framework, infrastructure adaptation shifts from purely green-energy goals to multi-sectoral physical, natural, and digital resilience.

The infrastructure priorities align with the EU Adaptation Strategy, the European Green Deal, the Green Agenda for the Western Balkans and EU objectives on sustainable and climate-resilient connectivity. They support the progressive integration of climate resilience into public investment, transport, environmental and critical infrastructure planning and management. At the global level, the priorities contribute to the Paris Agreement and the Global Goal on Adaptation, particularly the objective of strengthening the resilience of infrastructure and human settlements. They also support SDG 9 (Industry, Innovation and Infrastructure), SDG 11 (Sustainable Cities and Communities), SDG 13 (Climate Action) and the Sendai Framework for Disaster Risk Reduction, particularly through resilient infrastructure investment, risk-informed planning and the continuity of essential services.

Adaptation objective - Ensure that critical infrastructure systems are climate- and disaster-resilient, capable of maintaining essential services and supporting sustainable economic development under changing climate conditions.

Potential infrastructure priority adaptation actions can be defined as the following:

- Strengthen the policy and institutional framework for resilient infrastructure – Integrate climate and multi-hazard resilience into infrastructure policies, standards, planning, investment and asset management, supported by clear institutional responsibilities and coordination mechanisms.
- Integrate climate resilience into infrastructure standards, planning and financing – Embed climate resilience requirements into technical standards, spatial and infrastructure planning, public investment and financing decisions, including prioritizing climate resilience across design, construction, and public procurement processes.
- Strengthen climate risk reporting for critical infrastructure – Require public and private entities involved in critical infrastructure management, including local authorities and major asset owners, to assess and report material climate risks and resilience measures.
- Strengthen climate-resilient local and regional infrastructure and services – Establish gender-responsive financing and investment frameworks for the development, reconstruction, and operation of climate-resilient infrastructure and services, specifically improving the resilience of key transportation corridors and networks like roads and railways through robust technical documentation, including the review of planned and existing assets against resilience standards. Climate-proof critical infrastructure and public investments – Integrate climate and multi-hazard risks into infrastructure planning, design, investment and asset management, such as investing in the resilient design and construction of integrated freight corridors.
- Strengthen climate- and disaster-risk-informed asset management – Improve risk screening, monitoring, maintenance and prioritization of infrastructure assets based on climate and disaster risks.
- Promote resilient, green and nature-based infrastructure – Expand green and nature-based solutions that reduce climate risks while delivering environmental and social benefits, alongside investing in charging infrastructure and non-motorized transport to support a lower-carbon transition.
- Strengthen the business continuity and resilience of essential infrastructure services – Ensure that water, energy, communications and other critical services can withstand and recover from climate-related disruptions.

5.3.7 Human Settlements

Municipalities, urban and rural, face increasing climate risks from heatwaves, floods, water scarcity, wildfires and extreme weather, combined with pressures from urbanization, demographic change and ageing infrastructure. Human settlements in the Republic of North Macedonia are increasingly vulnerable to climate-induced hazards, notably severe urban heat islands (UHI), prolonged droughts, and flash flooding caused by high-intensity torrential rainfall. Over 80% of national greenhouse gas emissions stem from energy, transport, and buildings, making the spatial restructuring of human settlements central to both mitigation and adaptation.

The National Development Strategy 2024–2044 emphasizes sustainable and resilient settlements, improved environmental quality and more efficient resource management. Recent investments in municipal infrastructure, water and sanitation provide opportunities to improve resilience at the local level. However, climate and disaster risks are not yet systematically integrated into all spatial, urban and local development planning processes, while municipalities require additional technical, institutional and financial capacity to plan and implement adaptation. The Integrated National Energy and Climate Plan (NECP) 2025–2030 deploys 61 core measures spanning decarbonization and energy efficiency across municipal infrastructure and residential building envelopes. Under the NDC 3.0 framework, the Republic of North Macedonia commits to transitioning from reactive crisis responses to a proactive, climate-resilient spatial and municipal planning paradigm by integrating local governance with national adaptation targets.

The priorities are aligned with the EU Adaptation Strategy, the European Green Deal, the Green Agenda for the Western Balkans, and EU policy directions on sustainable and climate-resilient cities, green infrastructure and climate-responsive buildings. They also reflect the principles of the New European Bauhaus, particularly sustainability, inclusion and the quality and resilience of the built environment. At the global level, the priorities contribute to the objectives of the Paris Agreement and the Global Goal on Adaptation, particularly by strengthening the resilience of human settlements and infrastructure. They also support SDG 11 (Sustainable Cities and Communities), SDG 13 (Climate Action), the New Urban Agenda and the Sendai Framework for Disaster Risk Reduction 2015 - 2030, including through risk-informed land-use planning, resilient infrastructure, early warning systems and preparedness, as well as resilient recovery.

Adaptation objective - Develop safe, inclusive, climate-resilient and sustainable urban and rural municipalities that reduce exposure and vulnerability to climate hazards and ensure the continuity of essential services and quality of life.

Potential human settlement priority adaptation actions can be defined as the following:

- Integrate climate and multi-hazard risks into spatial and urban planning – Ensure that climate, seismic and other relevant hazards are systematically considered in land-use planning, infrastructure development and permitting,

building on the Methodology for Mainstreaming Climate Change Considerations into Spatial Planning in the Republic of North Macedonia.

- Climate-proof housing, buildings and public facilities – Support retrofits and resilience upgrades, particularly in informal and ageing settlements, to address heat, flooding and other climate-related risks while improving energy and resource efficiency, including the retrofitting of buildings and public infrastructures for climate-resilient cities.
- Urban planning climate mitigation and thermal comfort – Eliminate or mitigate local urban heat islands around healthcare facilities by expanding green coverage, applying high-albedo (heat-reflective) coatings, constructing publicly accessible drinking fountains, and establishing dedicated cooling spaces to protect vulnerable populations.
- Strengthen urban and settlement flood resilience – Prioritise flood risk reduction and drainage upgrades in the most exposed municipalities, including through improved drainage, flood protection and risk-informed development.
- Expand green, blue and nature-based infrastructure – Increase the use of green and blue infrastructure and invest in nature-based solutions to adapt urban areas to climate change, manage stormwater, and enhance urban resilience through green and cool roofs and the creation of urban parks, forests, and gardens to reduce urban heat island (UHI) effects. Strengthen climate resilience and preparedness of rural settlements – Support rural communities in reducing vulnerability to climate-related hazards and maintaining essential services and infrastructure, including through local risk assessments, contingency and evacuation plans, early warning and communication systems, preparedness measures, and community-based emergency response for hazards such as floods, severe storms, wildfires and heatwaves.
- Strengthen municipal adaptation planning, capacities and finance – Enhance local institutional capacity, planning tools and access to finance to support effective adaptation planning and implementation.
- Promote inclusive and community-centred adaptation – Ensure that adaptation planning and implementation address the needs of vulnerable groups and actively engage local communities and stakeholders.

5.4 Loss and Damage

5.4.1 Loss and Damage in the context of the Republic of North Macedonia

As a landlocked country in Southeastern Europe, the Republic of North Macedonia is already experiencing the accelerating impacts of climate change, reflected in the increasing frequency, intensity, and magnitude of extreme weather events, including devastating flash floods, severe wildfires, prolonged heatwaves and droughts, and powerful storms, with cascading impacts on livelihoods, communities, critical infrastructure, and the economy. Disasters and extreme climate events have caused estimated losses of US$ 667 million over the past 20 years, and their impacts can also compound and cascade, increasing overall risks for already vulnerable sectors, particularly agriculture. Such events also cause economic, consumption, and well-being losses and introduce contingent liabilities that place pressure on public finances. The country faces severe and escalating river, flash, and urban flood risks driven by climate and infrastructure factors, with flood frequency increasing tenfold over the past 50 years and historical events causing hundreds of millions of dollars in damages (e.g., the last three major floods in 1995, 2015 and 2016 caused damages of USD$ 422 million or EUR 362.4 million), significant GDP losses (e.g. the major floods of 1962 and 1979 caused economic losses equivalent to approximately 7% of GDP, while the 1994 floods resulted in losses of 3.4% of GDP), and casualties (the 2016 Skopje flash flood resulted in 22 human fatalities). Wildfires are among the most destructive and rapidly escalating climate-related hazards, and since 2005, wildfires have affected 10.39% of the country's territory, with direct financial losses estimated at 1.82% of GDP. Drought is a major and increasingly systemic climate risk for the Republic of North Macedonia, affecting water availability, agriculture, food security, forests, ecosystems, energy production, and rural livelihoods. Recurring extreme droughts, notably in 1993, 2001, 2003, and 2004, have severely impacted food security, with the 1993 drought alone affecting 10,000 people, cutting localized crop yields by 70%, and causing $93.3 million in losses (7.6% of national agricultural production). The rising frequency and magnitude of extreme weather events, specifically storms, hail, erratic snowfalls, and intense precipitation, increasingly trigger devastating flash events, structural destruction, and extensive agricultural losses.

Climate change poses serious threats to vulnerable societies and communities, causing both economic and non-economic losses. Climate change is also expected to increase the frequency, intensity and/or duration of several hazards, while compounding risks may arise from the interaction of heat, drought, wildfire, water scarcity, land degradation and ecosystem degradation. The IPCC emphasises that even if warming is limited to 1.5°C, unavoidable losses will disproportionately impact the most vulnerable populations, particularly in developing countries. Addressing these challenges requires comprehensive, multi-risk approaches including strengthened risk governance, anticipatory actions, sustainable financing, disaster prevention, preparedness, response, and resilient recovery. The concept of Loss and Damage (L&D) has emerged in international climate debates to highlight impacts that cannot be avoided through mitigation or adaptation. Some adverse effects are already "locked in" due to past, present, and projected emissions, making L&D a critical element of climate resilience strategies and policy planning.

Climate change poses an existential threat to the Republic of North Macedonia, driving unavoidable economic (i.e. damage to housing, infrastructure, agriculture, business operations, tourism, etc.) and non-economic losses (i.e. loss of life, health impacts, displacement, cultural heritage loss and ecosystem degradation) that disproportionately impact vulnerable communities even under a 1.5°C warming scenario. Rising emissions have locked in cascading hazards, including compounding heatwaves, droughts, wildfires, and intense storms, that cause severe structural destruction, crop failure, and ecosystem degradation. Aligned with Article 8 of the Paris Agreement, L&D in this NDC encompasses the adverse impacts of both sudden-onset events (floods, flash floods, wildfires, hail, storms, heatwaves) and slow-onset processes (increasing temperatures, changing precipitation patterns, drought, land and forest degradation) that cannot be fully resolved through mitigation, adaptation, or disaster risk reduction alone. Effectively addressing these risks requires a comprehensive, multi-hazard framework centred on strengthened risk governance, anticipatory action, sustainable financing, early warning systems, and resilient recovery pathways. Despite proactive investments in adaptation, climate-driven impacts are increasingly exceeding the limits of adaptation capacity, therefore, the country recognises L&D as an additional pillar of climate action alongside mitigation and adaptation.

This integrated approach is consistent with the National Development Strategy 2024–2044, which identifies a secure, safe and resilient society and green transformation among the country's six strategic priorities. The NDS also identifies the need to strengthen resilience and move from predominantly reactive approaches towards more proactive prevention, preparedness and risk reduction.

Establishing a comprehensive loss and damage system in the Republic of North Macedonia faces several institutional, legal, methodological, data, and financing barriers. Addressing these challenges is essential to strengthen disaster risk management, support climate adaptation, improve risk financing, and meet national and international reporting requirements.

- Fragmented legal and institutional framework – Overlapping mandates result in fragmented responsibilities for disaster and L&D data management across the climate and disaster risk reduction domains.
- Unclear institutional responsibility for recovery – No institution has a clear mandate to coordinate comprehensive post-disaster recovery at the national level.
- Existing methodological gaps in L&D assessment – Current methodologies focus mainly on physical damage and insufficiently capture wider economic, social, environmental, and livelihood losses.
- Fragmented L&D data systems – Dispersed, largely paper- and PDF-based data systems and limited interoperability lead to delays, errors, and weak long-term analysis.
- Limited access to private-sector risk data – Proprietary private-sector risk and insurance data are not systematically integrated into national systems, limiting risk-informed planning and financing.
- Reactive DRR and L&D financing – Predominantly ex-post financing and limited loss and actuarial data constrain the development of pre-arranged risk-financing mechanisms.
- National and local capacity constraints – Limited human, digital, and technical capacities and insufficient training hinder modernised L&D assessment and data management.

Overcoming these institutional and technical barriers is critical to unlocking evidence-based L&D and DRR financing and building local resilience in the Republic of North Macedonia. A systematic L&D tracking system would transform fragmented disaster records into consistent, quantifiable evidence to support climate reporting, municipal planning, and risk-informed investment. A standardised and auditable L&D database would also strengthen access to international climate and disaster finance by providing robust evidence aligned with global requirements. More comprehensive L&D assessments would further improve post-disaster recovery by capturing economic, ecosystem, livelihood, and non-economic losses and informing Build Back Better approaches.

5.4.2 Approach to operationalise Loss and Damage in the Republic of North Macedonia

The Republic of North Macedonia will apply a risk-informed, people-centred and whole-of-society approach to L&D. The approach will recognise that losses and damages result from the interaction between climate hazards, exposure, vulnerability and adaptive and coping capacity. Establishing a functional L&D system in the Republic of North Macedonia, particularly at the local level, requires coordinated action across legal, institutional, methodological, technical, financial, and capacity dimensions. The Republic of North Macedonia shall utilise both objective and subjective, quantitative and qualitative, information and data to inform efforts to address L&D.

The adaptation goal for Loss and Damage of the NDC 3.0 is the following: To strengthen the capacity of the Republic of North Macedonia to anticipate, avert and minimise climate-related Loss and Damage and to effectively address residual economic and non-economic losses and damages that cannot be avoided through mitigation, adaptation and disaster risk reduction, through systematic L&D assessment and monitoring, risk-informed recovery, financial protection, institutional capacity and strengthened resilience of people, communities and ecosystems.

Accordingly, the objectives until 2030 and 2035 are the following:

- 2030 – By 2030, the Republic of North Macedonia will establish the institutional, methodological, data and financial foundations required to systematically assess, anticipate, avert and minimise climate-related Loss and Damage and address residual impacts through integrated adaptation, disaster risk reduction, recovery and risk-financing systems.
- 2035 – By 2035, the Republic of North Macedonia will have an operational, integrated and risk-informed system for systematically assessing, monitoring and addressing climate-related Loss and Damage, including economic and non-economic losses, supported by resilient recovery, proactive financial protection and strengthened capacities of national and local institutions and communities.

The following measures address the main identified barriers and would strengthen evidence-based disaster risk management, climate adaptation, disaster risk financing, and national and international reporting:

Table 7 L&D operationalisation in the Republic of North Macedonia

#	Reference	Target	Commitment type	Timeframe
1	Harmonise legal and institutional frameworks	Align relevant legislation and clarify institutional mandates to establish a coherent national L&D governance and reporting system.	Unconditional/conditional	Short-term/mid-term
2	Strengthen recovery governance	Assign clear recovery responsibilities across national and local institutions and provide municipalities with the mandates, procedures, and resources required to manage recovery effectively.	Unconditional/conditional	Short-term/mid-term
3	Modernise L&D assessment methodologies	Expand existing damage and loss assessments to capture economic, livelihood, ecosystem, and non-economic losses, drawing on PDNA principles and adapting them to national and local capacities.	Unconditional/conditional	Mid-term
4	Build interoperable digital infrastructure	Replace fragmented reporting arrangements with standardised digital systems that enable consistent data collection, integration, and aggregation from the municipal to national level.	Conditional	Mid-term/long-term
5	Improve access to complementary data	Establish mechanisms for incorporating relevant private-sector, insurance, and other data into national L&D assessments, while addressing data-sharing and confidentiality constraints.	Unconditional/conditional	Mid-term
6	Strengthen proactive financial protection and risk financing	Use reliable L&D data to support risk-informed budgeting, contingency financing, insurance, risk-transfer, anticipatory actions, and access to international climate and disaster finance.	Unconditional/conditional	Short-term to long-term
7	Build institutional capacity	Strengthen national and municipal capacities through standardised training, technical assistance, clear guidance, and accessible digital tools.	Unconditional/conditional	Mid-term/long-term

The Republic of North Macedonia will strengthen cooperation with international, regional and bilateral partners on Loss and Damage, including through relevant mechanisms and bodies under the UNFCCC and Paris Agreement, regional cooperation, the EU Civil Protection Mechanism and international climate and disaster risk financing initiatives. The country will seek to strengthen access to technical assistance, knowledge, technology, capacity development and financial resources for addressing climate-related L&D, particularly for strengthening data systems, early warning, risk assessment, financial protection, recovery and resilience.

5.5 Disaster Risk Reduction

The Republic of North Macedonia is highly exposed to multiple natural and climate-related hazards, including floods (riverine flooding and flash floods), wildfires, landslides, erosion, droughts and extreme weather events. These hazards interact with existing social, economic, environmental and infrastructure vulnerabilities, increasing risks to people, livelihoods, critical infrastructure, ecosystems and local economies. Climate change is further exacerbating these risks through rising temperatures, more frequent and severe heatwaves and droughts, prolonged dry periods, increased wildfire risk, and more intense precipitation and flash flooding, placing growing pressure on water resources, agriculture, local economies, forests, biodiversity, ecosystems and human health. These trends are expected to accelerate, compounded by environmental degradation and rapid and often unplanned urbanisation. Key sectors at risk include agriculture, water resources, energy, transport, water supply, forestry, human health and urban systems, while rural communities, urban-poor and low-income households, women, children and youth, persons with disabilities, older persons and outdoor workers are particularly vulnerable to climate impacts.

Anchored by global sustainable and resilient development frameworks and regional mechanisms, i.e. the EU, since the Fourth National Climate Change Communication the Republic of North Macedonia has progressively engaged in the transition to a proactive, prevention- and risk-reduction-oriented approach. DRR is now embedded in the national development framework and processes, predominantly through the National Development Strategy 2024–2044, which

within the Strategic Area: Secure, Safe and Resilient Society sets the mission to build a safe, secure and resilient society through integrated, coordinated and risk-informed governance, effective information-sharing and whole-of-government and whole-of-society action that strengthens human security, social development and local resilience while addressing the differentiated vulnerabilities and needs of women and men. This strategic approach prioritises, over the next four decades, a prevention-focused disaster risk management system, a functional multi-hazard early warning system, risk-informed prevention and reduction planning, adequate resilience financing, resilient critical infrastructure services and building climate-resilient communities. The country has also advanced climate and disaster risk information, expanding existing ICT frameworks and digital tools, local strategic planning and climate-smart investments, embarking on loss and damage data integration, while strengthening river-basin flood-risk management, flood resilience-building, multi-hazard early warning and disaster resilience, making cities resilient, resilient infrastructure investment and recovery, enhancing transboundary and cross-border cooperation, and embedding DRR into national adaptation planning and community-level preparedness. Furthermore, the country has engaged in reforming its national crisis management framework to improve the overarching disaster risk management system. This is being achieved by creating strategic solutions to integrate the two primary institutional pillars, the Crisis Management Centre (CMC) and the Protection and Rescue Directorate (PRD),thereby streamlining operational coordination and eliminating institutional redundancies.

Nevertheless, important gaps remain in systematic risk-informed investment, national and local capacities, anticipatory action, inter-institutional coordination, multi-hazard early warning systems covering the whole territory and reaching everyone in the communities, financial protection, interoperable disaster-loss data and full integration of DRR and climate adaptation across sectors. NDC 3.0 therefore provides an opportunity to consolidate these developments and establish DRR as a core pillar of climate adaptation, with measurable actions towards 2030 and 2035.

DRR is a critical component of climate adaptation and resilience-building. The Republic of North Macedonia's NDC 3.0 will strengthen the integration of climate risks into disaster risk management, risk- and adaptation-informed development planning, resilient public investment and local governance, shifting from reactive response towards proactive, risk-informed prevention and resilience-building. It will strengthen synergies between DRR, adaptation, loss and damage and climate finance, with particular attention to vulnerable people, communities and climate-sensitive livelihoods.

The adaptation goal for DRR of the NDC 3.0 is the following: To protect lives, livelihoods, critical infrastructure and businesses by 2035 through an integrated, proactive and climate-resilient society where climate and disaster risks are systematically embedded in governance, planning, investment and development, supported by coordinated and people-centred risk management, actionable early warning for all, anticipatory action, resilient infrastructure and financial protection.

Accordingly, the proposed NDC 3.0 DRR objectives for 2030 and 2035 are the following:

- 2030 – Strengthen a coordinated, people-centred and risk-informed system for anticipating, preparing for and reducing climate-related disaster risks, protecting people, livelihoods, critical infrastructure and businesses.
- 2035 – Achieve an integrated and proactive climate-resilient society where climate and disaster risks are systematically embedded in governance, planning, investment and development, supported by effective and actionable early warning for all, anticipatory action, resilient infrastructure and financial protection.

Given the comprehensive approach to DRR priorities established under the National Development Strategy 2024–2044 and in the absence of a dedicated National DRR Strategy, NDC 3.0 will focus on integrating climate-related disaster risk priorities into its adaptation framework, ensuring coherence and complementarity with the country's long-term development vision. In NDC 3.0, the DRR sector will pursue the following priorities:

- Comprehensive risk assessment and planning;
- Functional multi-hazard early warning system leveraging artificial intelligence;
- Climate adaptation-informed planning;
- Preparedness and response to climate risks;
- Predictable, adequate and integrated financing for adaptation;
- Climate-resilient infrastructure and services.

Table 8 Priority areas – Disaster risk reduction

NDS-aligned priority	Brief description	Lead institution(s)	Key actions by 2030	2030 indicators	Key actions by 2035	2035 indicators	Global framework alignment
1. Comprehensive risk assessment and planning	Establish an integrated evidence base on hazards, exposure, and socioeconomic/gender/disability vulnerabilities across sectors.	CMC, PRD, MoEPP, National Hydrometeorological Service, key ministries, technical agencies,	Regular update of national, municipal and pilot-sector risk and hazard assessmen	Updated national, municipal and pilot-sector risk and hazard assessme	Update national, municipal and sectoral risk and hazard assessme	The country, all municipalities and all sectors covered by dynamically updated	UAE Framework for Global Climate Resilience; Paris Agreement

NDS-aligned priority	Brief description	Lead institution(s)	Key actions by 2030	2030 indicators	Key actions by 2035	2035 indicators	Global framework alignment
		municipalities, academia, R&D	ts; develop multi-hazard and risk maps; integrate climate risks into local DRR plans; prepare local adaptation strategies with stakeholder engagement.	nts; 50% of municipalities possess climate-risk-informed planning instruments; multi-hazard and risk maps published; climate risks integrated into 50% of local DRR plans; local adaptation strategies prepared for 50% of municipalities.	nts using next-generation climate projections; expand high-resolution local risk and residual-risk mapping; finalise integration of climate risks into local DRR plans; finalise local adaptation strategies with stakeholder engagement.	assessments; multi-hazard and risk maps widely used; 100% of local DRR plans; 100% of local climate adaptation strategies.	Arts. 7 and 8; Sendai Framework Priorities 1–2; SDGs 11, 13.
2. Functional multi-hazard early warning system leveraging artificial intelligence	Deploy people-centred, impact-based early warning systems using AI, machine learning, and automated predictive modelling.	CMC, National Hydrometeorological Service, PRD, MoEPP, key ministries, technical agencies, municipalities, academia, R&D, private sector incl. tech providers	Integrate AI models for impact-based forecasting; automate multi-channel last-mile alerts; establish protocol testing for priority hazards.	AI-driven multi-hazard EWS operational for priority hazards; automated warning protocols established in high-risk zones.	Scale up generative AI/predictive analytics for decadal forecasting; institutionalise automated community-level alert loops.	Nationwide AI-enhanced EWS coverage with documented improvements in warning lead times and population reach.	EW4All Initiative; Paris Agreement Art. 8; Sendai Framework Target G and Priority 4; GGA – risk assessment and preparedness; SDG 13.
3. Climate adaptation-informed planning	Mainstream climate resilience into spatial development, public investment screening, and sectoral planning frameworks.	MoEPP, MoF, MoTC, MAFWE, MoLSG, sectoral ministries; CMC, PRD, municipalities, private sector, academia, R&D	Introduce mandatory climate-risk screening and proofing for major public investments; integrate climate projections into spatial/urban planning.	100% of new major public investment projects screened systematically for climate and disaster risks.	Institutionalise climate-risk screening and proofing across public-private partnerships (PPPs) and strategic national infrastructure projects.	Climate adaptation screening and proofing fully institutionalised for all scales of public and public-private investments.	Paris Agreement Arts. 7 and 8; GGA; Sendai Framework Priorities 1, 2 and 4; New Urban Agenda; SDGs 9, 11, 13.
4. Preparedness and response to climate risks	Strengthen institutional and civil capacity to anticipate, absorb, and effectively respond to extreme climate emergencies.	CMC, PRD, MoEPP, MoH, key ministries, technical agencies, municipalities,	Update climate risk response plans; design and/or	All high-risk municipalities have operational climate	Institutionalise recurrent multi-agency emergenc	A nationwide climate preparedness programme	GGA – health, settlements and livelihoods; Sendai

NDS-aligned priority	Brief description	Lead institution(s)	Key actions by 2030	2030 indicators	Key actions by 2035	2035 indicators	Global framework alignment
		Red Cross, NGOs, communities	update climate-hazard protocols; provide education and training; execute regular simulations and training.	preparedness procedures and verified simulation tracking.	y simulations and drills; refine local response plans using automated feedback loops.	is fully operational with demonstrated yearly response improvements.	Framework Priority 4; SDGs 3, 11, 13.
5. Predictable, adequate and integrated financing for adaptation	Secure sustainable domestic and international funding pathways for adaptation through integrated budget frameworks and investments from public and private domains.	CMC, PRD, MoF, MoEPP, MoLSG, MAFWE, key ministries, municipalities, private sector	Establish a national climate-resilience financing framework; apply climate budget tagging and tracking; build a bankable project pipeline.	DRR Financing Landscape and Scoping Study prepared; climate-resilience framework fully operational; climate budget tagging and tracking applied; national pipeline of investment-ready projects established.	Integrate adaptation funding into medium-term expenditure frameworks; deploy risk-transfer and innovative private instruments.	Adaptation financing systematically mainstreamed into public budgeting with verified increases in mobilised finance; risk transfer operational in key sectors and for the population; innovative private investment mechanisms established.	Paris Agreement Arts. 7 and 9; Addis Ababa Action Agenda; Sendai Framework Priority 2; SDGs 13.a and 17.3.
6. Climate-resilient infrastructure and services	Upgrade critical physical infrastructure and essential services to withstand current and projected climate disruptions.	CMC, PRD, MoF, MoTC, MoH, MoEPP, MAFWE, key ministries, technical agencies, municipalities, CI operators, private sector	Complete comprehensive climate-risk audits for critical assets; update technical design and construction standards.	Climate-risk assessments completed for critical infrastructure assets; resilience criteria woven into building codes.	Execute priority structural resilience retrofits; mandate climate-resilient engineering standards for service providers.	High-risk critical infrastructure and essential public services retrofitted or fully covered by funded resilience plans.	GGA – infrastructure and human settlements; Sendai Framework Priorities 2, 3 and 4; Paris Agreement; SDGs 6, 9, 11, 13.

5.6 Nature-Based Solutions

As mentioned above, the Republic of North Macedonia is increasingly exposed to climate-related hazards, including drought, floods, flash floods, wildfires, heatwaves, soil erosion and landslides, with growing economic and human costs. These risks are interconnected with pressures on water resources, agricultural productivity, forests, biodiversity, infrastructure and settlements. Climate change is amplifying the frequency and intensity of these events, undermining development gains and threatening vulnerable populations, critical infrastructure, and ecosystems.

NbS provide a cost-effective opportunity to reduce these risks while avoiding maladaptation and strengthening the ecological systems on which communities and economic sectors depend. NbS address societal challenges through actions to protect, sustainably manage, and restore natural and modified ecosystems, benefiting people and nature at the same time. They are a relatively recent approach promoted by the international community to address climate

change, disasters, and other societal challenges. A key strength of NbS is their ability to foster the integrated involvement of stakeholders, local communities, and vulnerable groups in nature protection through awareness-raising, participation, and direct or indirect engagement in implementation on the ground. NbS approaches address seven societal challenges (climate change adaptation and mitigation, disaster risk reduction, economic and social development, human health, food security, water security, and ecosystem degradation and biodiversity loss).

The Republic of North Macedonia faces several challenges in mainstreaming and implementing NbS, including limited knowledge and data, particularly on stakeholder engagement, gender, inequality, and traditional knowledge; institutional silos and limited cross-sectoral capacity on climate change; and insufficient understanding and application of ecosystem services in decision-making. These challenges are compounded by the need to protect and restore biodiversity and natural capital, address increasing climate-related risks, and overcome insufficient financial and administrative capacity. Finally, stronger links are needed between policy commitments and practical implementation, including better alignment with the EU climate acquis, stronger institutional capacities, and improved monitoring and reporting.

Consequently, NbS are a key component of the country's climate adaptation and resilience-building approach under the NDC 3.0 for protection, sustainable management and restoration of natural and modified ecosystems in ways that address societal challenges while simultaneously providing benefits for climate resilience, biodiversity, water security, livelihoods and human well-being. Accordingly, NbS priorities are aligned with the NDS 2024–2044, the National Strategy for Nature Protection with Action Plan (2017–2027), the National Biodiversity Strategy and Action Plan, the forthcoming NAP, the Just Energy Transition Investment Platform, and other relevant sectoral policies. The overarching aim is to mainstream NbS into sectoral development and investment planning, rather than treating them as stand-alone interventions within a siloed approach.

The adaptation goal for NbS of the NDC 3.0 is the following: By 2035, the Republic of North Macedonia will scale up the planning, financing, implementation, and monitoring of Nature-based Solutions as an integral component of climate adaptation, DRR, and sustainable development, prioritising the restoration and protection of ecosystems that mitigate exposure and vulnerability to drought, floods, wildfires, heat, landslides, soil erosion and other climate-related hazards.

Accordingly, the proposed NDC 3.0 NbS objectives for 2030 and 2035 are the following:

- 2030 – Establish the necessary regulatory, institutional, financial, and monitoring conditions to systematically integrate Nature-based Solutions into national and local climate resilience-building and across key priority sectors, i.e. agriculture, water, forestry, biodiversity, health, infrastructure, and human settlements.
- 2035 – Achieve large-scale implementation of Nature-based Solutions across priority landscapes, river basins, agricultural areas, forests, and settlements to measurably reduce vulnerability to climate hazards, enhance ecological health, and build long-term climate resilience.

NbS will be integrated into the country's broader climate resilience and DRR systems. Climate and disaster risk assessments will identify areas where ecosystem degradation increases exposure and vulnerability, and where ecosystem restoration can reduce risk. Particular attention will be given to wildfires, droughts, floods and flash floods, heatwaves, soil erosion and landslides, linking NbS with prevention, early warning and anticipatory action, risk-informed land-use planning, watershed management, wildfire prevention, and post-disaster recovery. Following disasters, ecosystem restoration will be incorporated into risk-informed recovery and Build Back Better, ensuring that natural buffers and ecosystem functions are restored alongside, or where appropriate before, grey infrastructure to reduce future risks. Accordingly, NbS will be mainstreamed through the following sectoral measures.

Table 9 Priority NbS sectoral measures

#	Priority sector	Proposed NbS measures	Climate/DRR benefits
1	Agriculture	Climate-resilient farming with agroforestry, hedgerows, windbreaks, cover crops, conservation agriculture, soil restoration and sustainable pasture management.	Reduces drought, heat and soil-erosion risks; improves soil moisture, water retention, crop resilience and livelihood security.
2	Water	Integrated water management with wetland, floodplain and riparian restoration, river restoration, natural water-retention areas and degraded catchment restoration.	Reduces flood, flash-flood, drought, erosion and sedimentation risks; increases water retention, groundwater recharge and water availability.
3	Forestry	Sustainable forest management with restoration of degraded and fire-damaged forests, climate-resilient species, landscape mosaics and ecological fuel management.	Reduces wildfire, drought, erosion and post-fire flood risks; improves forest resilience, watershed protection and carbon sequestration.
4	Biodiversity	Ecosystem conservation and restoration with ecological corridors, protected-area management, wetland and forest restoration and improved ecosystem connectivity.	Increases ecosystem resilience to climate change, reduces habitat degradation and biodiversity loss, and maintains ecosystem services that buffer climate hazards.
5	Infrastructure	Climate-resilient infrastructure with NbS integrated with grey infrastructure, natural	Reduces flood, erosion, landslide and heat risks; protects critical infrastructure, reduces damage and

#	Priority sector	Proposed NbS measures	Climate/DRR benefits
		buffers, restored floodplains, vegetated slopes and permeable surfaces.	supports resilient and cost-effective infrastructure investment.
6	Human settlements	Climate-sensitive urban planning with urban forests, green corridors, parks, green roofs and walls, rain gardens and permeable surfaces.	Reduces urban heat, pluvial flooding and runoff; improves thermal comfort, air quality, water management and community resilience.
7	Health	Climate-resilient health environments with urban forests, green spaces, cooling corridors, riparian buffers and natural water-quality measures.	Reduces heat-related health risks and exposure to air pollution; supports water quality, thermal comfort, mental well-being and resilience to climate-related health risks.
8	DRR and L&D	NbS integrated with prevention, preparedness and resilient recovery measures.	Reduces exposure and vulnerability to floods, droughts, wildfires, erosion and heat; prevents avoidable losses, strengthens preparedness and supports resilient recovery.

NDC 3.0 will establish a coordinated institutional approach for NbS involving the Ministry of Environment and Physical Planning, Ministry of Agriculture, Forestry and Water Economy, Ministry of Transport, Ministry of Finance, Crisis Management Centre, local self-government units, public enterprises, protected-area managers, research institutions, private sector, civil society and local communities.

Table 10 NbS NDC 3.0 implementation table

#	NbS priority action	By 2030	By 2035
1	NbS policy mainstreaming	Develop NbS guidance and integrate NbS into key sectoral and spatial plans.	NbS mainstreamed across national, sectoral and local planning.
2	Institutional coordination	Establish inter-sectoral NbS coordination mechanism and clarify responsibilities.	Fully operational institutional coordination and implementation framework.
3	NbS project pipeline	Identify priority areas and develop a national NbS investment pipeline.	Scale up priority projects to landscape and river-basin level.
4	Capacity and knowledge	Develop standards, guidelines and technical capacity.	Establish sustained technical capacity and knowledge systems.
5	Resilient investments	Introduce NbS screening into relevant infrastructure investments.	Systematically integrate NbS with or as alternatives to grey infrastructure.
6	Finance	Develop NbS financing pipeline and mobilise climate and development finance.	Establish sustained public and blended financing for NbS.
7	MRV and L&D	Establish NbS monitoring and integrate NbS into adaptation, DRR and L&D reporting.	Quantify climate-resilience, avoided-loss, ecosystem and socioeconomic benefits.

5.7 Global Goal on Adaptation Alignment

The Republic of North Macedonia NDC 3.0 aligns its adaptation ambition with the Global Goal on Adaptation (GGA) under Article 7 of the Paris Agreement and the UAE Framework for Global Climate Resilience adopted at COP28. The UAE Framework provides a common structure for advancing adaptation through seven thematic and three process-related targets. Building on previous NDC priorities and the ongoing National Adaptation Plan process, NDC 3.0 covers key sectors including water, food, forestry, health, biodiversity, infrastructure, disaster risk reduction and human settlements. It strengthens the adaptation approach by linking sectoral priorities with measurable resilience outcomes and integrating climate information, early warning, disaster risk reduction, loss and damage, social inclusion and sustainable development. The NDC 3.0 adaptation framework is structured around the seven thematic targets of the UAE Framework, adapted to the Republic of North Macedonia's national circumstances.

The NDC 3.0 adaptation framework is structured around the following thematic targets of the UAE Framework, adapted to the Republic of North Macedonia's national circumstances:

Table 11 Alignment of NDC 3.0 adaptation priorities with the GGA/UAE Framework thematic targets

#	GGA/UAE Framework target	Alignment of the Republic of North Macedonia NDC 3.0
1	Water	Strengthen water security and climate-resilient water resources management, reduce vulnerability to droughts, floods and water scarcity, improve water-use efficiency, monitoring and early warning, and strengthen resilient water and sanitation services and ecosystem protection.
2	Food and agriculture	Build a productive, sustainable and climate-resilient agricultural and food system, reduce vulnerability to droughts, heat, floods, pests and diseases, improve water and soil management, strengthen climate-resilient crops, livestock and production systems, and enhance farmers' access to climate information, innovation, finance and advisory services. Strengthen the resilience and sustainable management of forests and forest landscapes, reduce vulnerability to drought, wildfires, pests and extreme weather, restore degraded and fire-affected

#	GGA/UAE Framework target	Alignment of the Republic of North Macedonia NDC 3.0
		areas, promote climate-adapted and diverse forests, and enhance monitoring, early warning, watershed management and local capacity.
3	Health	Strengthen climate-resilient health systems, reduce health risks from heatwaves, climate-sensitive diseases and extreme events, improve health surveillance, early warning and emergency preparedness, climate-proof health infrastructure and services, and strengthen risk communication, protection of vulnerable groups, air quality, data and institutional coordination.
4	Ecosystems and biodiversity	Conserve, restore and strengthen the climate resilience of biodiversity and ecosystems, reduce vulnerability of terrestrial and aquatic ecosystems to climate change, expand ecosystem-based adaptation and nature-based solutions, strengthen ecological connectivity and monitoring, and integrate biodiversity into spatial planning, financing and local stewardship.
5	Infrastructure and settlements	Strengthen climate- and disaster-resilient infrastructure systems, integrate climate and multi-hazard risks into infrastructure standards, planning, financing and asset management, improve risk assessment and reporting, promote green and nature-based solutions, and ensure continuity and rapid recovery of essential services. Develop safe, inclusive and climate-resilient urban and rural settlements, integrate climate and multi-hazard risks into spatial and urban planning, climate-proof buildings and essential services, reduce heat and flood risks, expand green and blue infrastructure, and strengthen municipal capacity, financing and community participation.

The Republic of North Macedonia NDC 3.0 translates the Global Goal on Adaptation (GGA) and the UAE Framework into a continuous national adaptation pathway. It focuses on three core process dimensions: strengthening climate hazard and risk assessments by 2030 to inform policy, integrating country-driven, inclusive adaptation planning into national, sectoral, and spatial frameworks, and driving implementation through climate-resilient investment, nature-based solutions, and an adaptive Monitoring, Evaluation, and Learning (MEL) system. Operating as an iterative cycle, the approach links adaptation with disaster risk reduction and loss and damage, shifting measurement from activity tracking to impact-driven indicators that demonstrate reduced vulnerability and enhanced societal resilience through 2030 and beyond.

Chapter 6. Just Transition and Social Inclusion

6.1 Vulnerable Groups

Persons with disabilities. People with some form of disability constitute at least 15% of the global population, with 2–4% experiencing significant difficulties in functioning. In the Republic of North Macedonia, the 2021 Census reported 94,412 persons with disabilities, or nearly 5% of the total population, although the census did not provide a comprehensive picture of disability prevalence. Of these, 42,209 were men and 52,203 women, indicating a higher prevalence among women. More than half of persons with disabilities (54.8%) were aged 65 and above, while 43.5% were aged 15–64 and 1.8% were children aged 0–14. Mobility difficulties were the most frequently reported type of disability, affecting 38,499 people (40.8%). Applying the global estimate of 15% to the Republic of North Macedonia's population suggests that approximately 276,000 people may experience some form of disability.

In the Republic of North Macedonia, persons with disabilities are bearing the heaviest burden from climate and disaster risks, commonly due to their prevailing exclusion from climate and disaster risk reduction policies and insufficient inclusive risk reduction practices, stigmatization and unequal economic opportunities.

Disability inclusion in disaster risk management is insufficiently integrated into existing systems. Persons with disabilities are often overlooked and treated as part of a broader vulnerable population. Consequently, they aren't considered in climate and disaster risk reduction efforts and lack fair access to policy-making, decision-making, and resilience-building activities. The current disaster risk reduction approach remains primarily reactive rather than proactive, focusing more on response than prevention and mitigation. The 2023–2030 Convention on the Rights of Persons with Disabilities and related policies aren't adequately recognized as a foundation for developing inclusive policies, regulations, practices, and actions to enhance the resilience of persons with disabilities. Work is underway on the National Adaptation Plan (NAP) that uses nexus approaches in various sectors, including water, food, energy, health, biodiversity, tourism, forestry, disaster risk reduction, loss and damage, and infrastructure.

A recent UNDP study on disability-inclusive DRR finds that disability mainstreaming in DRR and climate change adaptation, and conversely their integration into disability policies and practices, remain at a rudimentary stage and are not yet adequately recognised as essential to protecting the lives, well-being and resilience of persons with disabilities. Identified gaps indicate that disability inclusion remains insufficiently mainstreamed across adaptation policies, legislation, institutional arrangements, climate risk assessments, planning and financing. Persons with disabilities and their representative organisations are not systematically involved in adaptation decision-making, while climate risk information, early warning systems and adaptation measures are often not accessible or tailored to different disability-related needs. The lack of disaggregated data, disability-responsive budgeting, institutional capacity and sustained financing further limits the development and implementation of inclusive, locally appropriate adaptation measures.

Considering that many persons with disabilities in the Republic of North Macedonia depend on their families, local communities and disabled persons' organisations, specially tailored adaptation activities are necessary to ensure inclusive responses to the changing climate. Nonetheless, experience in the Republic of North Macedonia demonstrates that persons with disabilities and their representative organisations can be active and effective contributors to climate action and resilience-building. Through civil society initiatives, community engagement and advocacy, they contribute valuable knowledge of accessibility barriers, local vulnerabilities and practical solutions for inclusive adaptation and risk reduction. Recognising persons with disabilities as partners rather than solely as a vulnerable group can strengthen the design, implementation and monitoring of climate policies and help ensure that adaptation measures are inclusive and leave no one behind. Consequently, for the NDC, the recommendations could be translated into the following disability-inclusive climate change adaptation actions:

- Mainstream disability inclusion across national and local adaptation policies, plans and risk assessments, ensuring alignment with the Convention on the Rights of Persons with Disabilities and meaningful participation of persons with disabilities and their representative organisations.e
- Establish disability-inclusive multi-hazard early warning and climate risk communication systems, ensuring that warnings, forecasts and adaptation information are available in accessible formats, including sign language, Braille, easy-to-read and audio-visual formats.
- Strengthen disability-disaggregated climate risk and vulnerability data, including by sex and age, and integrate these data into climate risk assessments, adaptation planning, loss and damage assessments and NDC monitoring.
- Invest in accessible and climate-resilient infrastructure, including public buildings, schools, health facilities, shelters and critical infrastructure, applying universal design and accessibility standards and upgrading existing infrastructure where necessary.

- Strengthen institutional capacity and coordination for disability-inclusive adaptation, including by appointing disability focal points, building the capacity of national and local authorities, and ensuring representation of persons with disabilities in relevant climate and disaster risk governance mechanisms.
- Introduce disability-responsive climate adaptation financing and budgeting, including dedicated resources for prevention, preparedness, resilient infrastructure, social protection and recovery measures that address the specific needs of persons with disabilities.
- Build the resilience of persons with disabilities and their support networks through accessible preparedness training, community-based adaptation, emergency planning, and strengthened capacities of caregivers, service providers and local organisations.
- Ensure that persons with disabilities are active partners in adaptation, rather than being treated only as a vulnerable group, by establishing formal mechanisms for their participation in the design, implementation and monitoring of NDC adaptation measures.

The vulnerability lens used for NDC 3.0 is deliberately broader than disability alone. UNDP's Country Programme Document for the Republic of North Macedonia 2026–2030 notes that disasters have disproportionate effects on persons with disabilities, older persons, women and children and calls for their needs to be mainstreamed into local and sector-specific rescue and protection plans. This is consistent with the disability-inclusive disaster-risk-reduction work undertaken in the Republic of North Macedonia, which emphasises accessible risk information, evacuation, emergency preparedness and continuity of essential services. Particular attention is required for older persons, especially those living alone or with limited family or community support, as extreme heat, cold spells, floods, power outages and disruptions to health and social services may have particularly severe consequences for them.

Climate vulnerability is also shaped by income, housing conditions, energy poverty, location and access to services. Particular attention is therefore required for low-income and energy-poor households; older persons living alone; children; female-headed and single-parent households; persons with disabilities; rural and remote communities; informal and outdoor workers; climate-sensitive livelihoods; residents of high-risk settlements; and socially excluded groups where poverty, inadequate housing or weak access to health, social protection, transport, information or finance compounds exposure. UNDP's work in the Republic of North Macedonia also identifies underserved households, including female-headed households, single parents and households with a person with a disability, as priority beneficiaries for affordable energy-efficiency and renewable-energy finance.

For implementation, vulnerability should be operationalised through disaggregated indicators rather than treated only as a narrative principle. Priority indicators include: the share of early-warning and emergency-information products available in accessible formats; the number and share of municipalities with inclusive evacuation/rescue plans; beneficiaries of energy-efficiency, heating-replacement and cooling support disaggregated by sex, age, disability, income and location; access of vulnerable households to heat-health protection and emergency cooling; and the proportion of major resilience investments subject to both climate-risk and accessibility screening. These indicators should be linked to municipal, social-protection, health and disaster-risk-management data systems.

6.2 Gender Analysis

The Republic of North Macedonia has a relatively solid legal and strategic basis for gender equality, and the intersection between gender and climate change has increasingly entered national policy frameworks. Gender and climate considerations are reflected to varying degrees in documents such as the Gender Equality Strategy, the Long-term Strategy on Climate Action and the Draft Climate Action Law. The proposed Climate Action Law conceptually recognizes the need to include gender aspects and the needs of vulnerable groups, including young people, in the promotion of climate policy and participation. Nevertheless, these provisions remain insufficient for the full mainstreaming of gender equality into climate governance, while climate change itself is not yet adequately embedded within the gender-equality legal framework. This points to a two-way integration challenge. Namely, gender needs to be more systematically incorporated into climate policy, while climate change needs to be more explicitly addressed as a gender-equality issue.

The gap between formal commitments and implementation is particularly visible at the institutional level. Coordination between gender mechanisms and climate institutions remains weak, with a central-level institutional gap and disconnected policy processes also evident at the local level. Gender mainstreaming in climate and environmental action remains overly dependent on the gender machinery, while climate institutions themselves often lack the knowledge, tools and established routines needed to integrate gender considerations into their work. Weak visibility and functioning of coordination mechanisms, insufficient involvement of relevant actors and limited capacities within both climate institutions and the gender machinery further constrain implementation. Stronger inter-institutional cooperation, practical guidance and training are therefore needed to translate policy commitments into routine administrative practice.

Table 12. Gender equality in the Republic of North Macedonia by numbers

TABLE 2: Gender Equality in North Macedonia by Numbers

Human Development Index (HDI) 2021	78th position	High Human Development countries, still behind all ex-Yugoslavian countries, including Albania and Bulgaria.
Gender Development Index (GDI) 2021	0.945	Group 3
Gender Equality Index (GEI) 2019 and 2022	62 points in 2019 64.5 points in 2022	67.4 EU average in 2019 68.6 EU average in 2022
Socioeconomic status of women and men in North Macedonia	**Men**	**Women**
Poverty rate (2020)	21.7%	21.9%
Activity rate (2021)	67.2%	44.9%
Employment rate (2021)	56.2%	38.3%
At-risk of poverty (2018)	women-headed households are more likely to be at risk of poverty or social exclusion by 7.3%	
Annual gross earnings (2018)	480,377 among men	399,966 among women

Source: Gender Gap Analysis on Climate Change and Environment in the Republic of North Macedonia, UN Women, 2025

An implementation gap is reflected in the availability and governance of gender-responsive climate data. Limited gender- and sex-disaggregated data in the fields of climate change and environment continue to constrain both analysis and policy design, while the absence of a unified system for gender and climate indicators makes it difficult to monitor outcomes consistently. Gender-gap analysis can identify disparities, but deeper gender analysis is also required to understand the social norms, institutional structures and cultural factors through which inequalities are produced and reproduced in climate and environmental contexts.

Consultation with institutions confirms that the problem is not a lack of recognition of the relevance of gender-responsive reporting, but rather the practical foundations required to implement it. The May 2026 Set of Gender Indicators for NDC 3.0 operationalises this approach through nine proposed indicators grouped across six thematic areas: decision-making; mitigation ambition; climate education and awareness; green skills and employment in the context of just transition; gender in adaptation; and gender-responsive implementation and reporting. A consultation covering 28 completed questionnaires from 25 institutions, representing more than half of the 44 institutions involved in the relevant working group All nine proposed indicators were generally regarded as relevant for NDC 3.0 reporting, but the consultation also revealed substantial gaps in sex-disaggregated data, data availability and institutional ownership. For several indicators, institutions reported that the required data were not collected, were not available in sex-disaggregated form, or were not clearly understood as falling within their institutional mandate..

These findings make data governance an institutional issue as much as a technical one. Limited clarity remains regarding which institutions are responsible for collecting particular data, according to which methodologies and for which reporting purposes. Establishing a functioning gender-responsive monitoring framework therefore requires more than selecting indicators. Namely, it requires clearer institutional responsibilities, coordination between data producers and policy institutions, harmonized approaches to data collection and stronger reporting arrangements. The Republic of North Macedonia has reached a point where the relevance of gender-responsive climate indicators is broadly acknowledged, while the measurement, reporting and verification basis needed to operationalize them remains underdeveloped.

A structured set of gender indicators provides a pathway for addressing this gap and moving from general equality commitments toward measurable climate-governance outcomes. The proposed framework covers decision-making, mitigation ambition, climate education and awareness, green skills and employment in the context of just transition, gender in adaptation, and gender-responsive implementation and reporting. This breadth reflects the relevance of gender across the climate-policy cycle rather than limiting it to social policy or stakeholder participation. The indicators can also be aligned with national frameworks and the wider climate-policy architecture, including the Integrated National Energy and Climate Plan and BTR1/NDC-related reporting requirements.

The evidence base also highlights structural gender inequalities that are directly relevant to the distribution of transition benefits. The 2026 Gender and Just Transition policy brief reports a female activity rate of 43.8% compared with 62.1% for men, a female employment rate of 38.8% compared with 55.0% for men, and an average gender pay gap of 12% in 2024. These gaps strengthen the case for tracking women's participation and outcomes in green employment, reskilling, entrepreneurship, energy-efficiency support, sustainable transport and rural-development measures, and for linking NDC implementation to gender-responsive budgeting and sex-disaggregated MRV.

Selected gender-responsive indicators proposed for NDC 3.0 include: at least 50% women in inter-ministerial bodies responsible for NDC drafting, implementation and monitoring; annual sex-disaggregated reporting on beneficiaries of energy-efficiency and vulnerable-consumer support; sex-disaggregated monitoring of sustainable-transport incentives; tracking of women and men participating in green employment, reskilling and entrepreneurship; sex-disaggregated rural-development and climate-transition support; and gender-responsive budgeting and reporting of climate/just-transition allocations. The Annual Just Transition Implementation Plan 2026 already provides an operational entry point through its 20% female-participation target in ESM reskilling programmes.

The monitoring architecture should therefore connect gender indicators to the national MRV/MRVA system and to gender-responsive budgeting. Baselines, responsible institutions and reporting cycles should be defined at adoption and data should be disaggregated by sex and, where relevant, intersecting factors such as age, disability, income and location. This would allow NDC 3.0 to move from general gender sensitivity to measurable gender-responsive implementation and would make it possible to assess who benefits from subsidies, skills programmes, climate finance and adaptation investment.

6.2.1 Gender dimensions of the green and just transition

Sex-disaggregated labor-market and socio-economic data show that women remain concentrated in relatively low-emission service sectors, while men dominate climate-critical and higher-innovation sectors such as energy, transport, mining and construction. Many of the sectors expected to expand through green investment are therefore sectors in which women are already underrepresented. Without corrective measures, green-transition investments and rapidly growing green employment could reproduce existing occupational segregation and inequalities, creating the risk of a gender-blind mitigation transition.

At the same time, the Republic of North Macedonia has a strong female talent base that could support greater participation in innovation-intensive and climate-relevant sectors. Women constitute a majority of the research and development workforce and are well represented among doctoral-level researchers. This educational and research attainment, however, is not adequately translated into leadership positions or wider professional opportunities in green, climate-related and innovation-intensive sectors. A disconnect therefore persists between women's knowledge and qualifications and their access to the economic and leadership opportunities likely to emerge through the transition.

These labor-market inequalities form part of a wider set of structural constraints. Persistent gaps in women's employment, higher unpaid household and care burdens, limited ownership of land and property, and barriers to entrepreneurship and access to finance affect women's ability to participate fully in adaptation, mitigation and transition processes. Unpaid care responsibilities are particularly relevant to just-transition measures because they can restrict women's ability to participate in retraining, formal employment, entrepreneurship and public decision-making.

The gender implications of the just transition also extend beyond the composition of the existing workforce. Although coal and energy employment is predominantly male, this should not be interpreted as meaning that women are less affected by transition processes. Women can experience indirect effects through reductions in household income, increased care burdens, declining community resilience and exclusion from newly created employment opportunities in the green economy. A gender-responsive understanding of just transition therefore needs to capture impacts at household and community level as well as direct employment effects, broadening the definition of who constitutes a transition-affected population.

Energy poverty further connects climate transition with existing gender and socio-economic inequalities. Women are disproportionately exposed to energy-related vulnerability while not always being adequately reached by support schemes or represented in the design of those measures. Energy poverty and the feminization of poverty are also identified as major concerns within the broader gender and climate analysis. These vulnerabilities connect gender-responsive climate policy directly with social protection, energy affordability and the targeting of climate-support measures.

Gender-based vulnerabilities are also present across a wider range of climate-relevant sectors, including energy, tourism, health, transport, agriculture, education, environment and water. Existing strategies do not yet fully reflect these vulnerabilities, while women's roles as agents of change and their contributions to the green economy and green employment also remain insufficiently recognized in some policy frameworks. Addressing vulnerability therefore needs to be accompanied by greater recognition of women's potential contributions to mitigation, adaptation, innovation and economic transformation.

These patterns sit within a broader context of inequality and marginalization shaped by socio-economic and educational disparities and by intersecting and structural forms of discrimination. Although improvements in gender-equality indicators have been recorded, significant inequalities persist, particularly among groups experiencing multiple forms of vulnerability. Climate impacts and transition measures interact with these pre-existing conditions, including poverty, labor-market segmentation, social exclusion and unequal access to services. Gender-responsive climate action therefore needs to be linked with wider development challenges such as social inclusion, energy security, public-service capacity and resilience to multidimensional shocks.

6.2.2 Implications for NDC 3.0

The evidence points to a gender agenda for NDC 3.0 that extends considerably beyond the inclusion of gender-related language or representation targets. The Republic of North Macedonia already has an important legal and strategic foundation, and institutions broadly recognize the relevance of gender-responsive climate indicators. The remaining challenge is to translate this recognition into functioning governance arrangements, institutional responsibilities, sex-disaggregated data systems and measurable implementation.

At the same time, the substantive scope of gender-responsive climate action needs to reflect the inequalities through which climate impacts and transition measures are experienced. Labor-market segregation, unpaid care responsibilities, access to finance and entrepreneurship, energy poverty, political representation, access to services and intersecting forms of vulnerability all influence who can participate in and benefit from climate action. A gender-responsive just transition must therefore address both direct and indirect effects, including those experienced by women in households and communities even where they are not directly employed in carbon-intensive sectors.

To summarize, NDC 3.0 provides an opportunity to move from the recognition of gender inequalities toward a more operational and accountable model of gender-responsive climate action. This would combine stronger institutional coordination and capacity with improved sex-disaggregated data, measurable indicators and clearly assigned responsibilities, while integrating gender considerations into mitigation, adaptation, education, green skills and employment, just transition and implementation. Such an approach would allow climate outcomes to be assessed both in environmental terms and through their distributional effects, identifying who participates in climate decision-making, who gains access to emerging opportunities, who receives support, and which groups remain exposed to disproportionate risks. In this way, gender equality becomes a component of effective climate governance and a condition for a socially inclusive and just transition.

6.3 Youth Considerations

Youth integration in the Republic of North Macedonia's climate-policy framework remains limited and uneven, with young people insufficiently embedded in the governance, implementation and monitoring architecture of climate action. Across key national climate and related policy documents, youth considerations are only weakly operationalized. Institutionalized mechanisms for participation remain limited, youth-disaggregated climate data are largely absent, and monitoring frameworks rarely allow the impacts of climate policies on younger generations to be assessed separately. Climate action is also not consistently connected with youth employment, skills development or opportunities to participate directly in implementation. The limited treatment of intergenerational equity further reinforces a broader gap between recognizing young people as stakeholders and integrating them as a cross-cutting dimension of climate policy.

These institutional weaknesses have direct socio-economic implications. Evidence collected from young people, particularly in regions affected by the energy transition, connects climate policy with immediate concerns about employment, local economic opportunities, access to information and prospects for remaining in their communities. Young people are therefore assessing the transition not only in environmental terms, but also according to whether it can provide credible education, employment and livelihood pathways. Insufficient information continues to constrain meaningful participation, while limited access to green-skills opportunities reduces the ability of younger generations to benefit from emerging sectors of the low-carbon economy.

The weakness lies less in the absence of a legal basis for youth participation than in the lack of mechanisms that translate existing commitments into practice. An assessment of eleven national climate documents produced an average youth-mainstreaming score of only 5.7 out of 20. Particularly notable is the low performance of the National Energy and Climate Plan, despite its direct relevance to changes in employment, skills and the transition workforce. This points to an implementation gap spanning governance arrangements, data systems, education and training pathways, labor-market measures and monitoring frameworks.

At the same time, young people have already contributed substantive priorities to the preparation of NDC 3.0. Consultations conducted in four cities addressed energy, transport, agriculture and land use, waste management, and education and youth participation. The resulting input demonstrates that youth engagement can extend beyond general consultation to concrete sectoral questions at the core of NDC implementation. Young people also bring knowledge of climate impacts experienced within their own communities and can contribute locally grounded solutions adapted to changing environmental and socio-economic conditions. Their role can therefore extend from being beneficiaries of future climate outcomes to participating in the design and implementation of present-day climate action.

Organized youth engagement reinforces these priorities. The first Local Conference of Youth on Climate in the Republic of North Macedonia, involving around 50 participants, brought together students, activists, youth representatives, youth workers, civil society organizations, experts and public officials. Participants called for more accessible, youth-friendly versions of key climate documents, stronger representation in decision-making, institutionalized youth advisory councils and greater accountability. Education emerged as a particularly prominent area, including the integration of climate and justice considerations into curricula, institutional support for climate education and activism in schools, training for educators and programs that reflect current climate realities. Youth priorities also extend to resilience and well-being, including attention to eco-anxiety and mental health, indicating that the implications of climate change for younger generations extend beyond employment and formal participation. The first LCOY in the Republic of North Macedonia

was held on 12–14 June 2025. Youth from the Republic of North Macedonia also participated in UNFCCC COP29 and COP30, reported from negotiations and side events, and contributed Youth Climate Declarations submitted to the Government, with support from international organisations including UNDP.

Accordingly, these priorities suggest that meaningful youth mainstreaming in NDC 3.0 requires action across several interconnected areas. Climate education and literacy need to be accompanied by access to green-skills development and viable employment pathways. Youth participation needs to move from ad hoc consultation toward institutionalized involvement in climate governance at national and municipal levels. Opportunities for young people can also be strengthened through green entrepreneurship, clean-energy activities, climate-resilient agriculture and youth-led circular-economy initiatives. These measures are particularly relevant in transition-affected regions, where the credibility of climate action will partly depend on whether economic restructuring generates tangible prospects for younger generations.

A corresponding monitoring framework can turn these commitments into measurable elements of NDC implementation. Youth-responsive indicators can track representation in climate-governance structures, municipal engagement mechanisms, youth employment in environmental and energy sectors, participation of young farmers in climate-resilient agriculture, participation in green reskilling programs and access to green-skills training. They can also capture the integration of climate change into national education concepts, youth climate literacy and engagement, and the incorporation of youth-disaggregated monitoring into climate documents. Such a framework would make it possible to move beyond recording whether young people were consulted and assess whether they participate in, benefit from and contribute to climate action over time.

Table 13. Youth-responsive indicators

#	Indicator (Abbreviated)	Cluster	Baseline	Target	Frequency
1	Youth representation on the National Council on Climate Change (NCCC) and sub-committees	Governance (National)	0 (2025)	≥2 by 2027; ≥3 by 2030, with gender parity	Annual
2	Municipalities with active youth-climate engagement mechanisms	Governance (Local)	3 of 14 surveyed (Deliverable 1, 2026)	≥15 by 2030; ≥40 by 2035	Annual
3	Youth share of employment in NACE 35–39 (environmental and energy sectors)	Mitigation	≈10–13% (derived from SSO LFS Q2 2024)	≥18% by 2030; ≥22% by 2035, with ≥40% women	Annual
4	Young farmers (under 40) in climate-resilient agriculture support measures	Adaptation	838 young farmers cumulative (March 2024, Merka 112)	≥1,500 by 2030; ≥3,000 by 2035	Annual
5	Youth (18–29) completing green reskilling programmes in Just Transition regions	JT (Supply Side)	0 (programme launch, 2025)	≥300 by 2028; ≥800 by 2030, with ≥50% women	Annual
6	Youth migration intention rate (15–29) in Just Transition regions	JT (Outcome)	59.3% (Deliverable 1 survey, N=118; 2026)	≤40% by 2030; ≤30% by 2035	Biennial
7	Youth (15–29) access to green skills training in the past two years	JT (Demand Side)	35.6% (Deliverable 1 survey, N=118; 2026)	≥65% by 2030	Biennial
8	Climate change recognised as a cross-curricular learning area in National Education Concepts	Education (Structural)	0 of 2 Concepts (Primary 2021, Gymnasium 2025)	Recognised in both Concepts by 2028; ≥3 subjects per level by 2030	Triennial
9	Youth Climate Literacy and Engagement Index (composite of four sub-components)	Education (Composite Index)	23.3% (composite, Deliverable 1 survey; 2026)	≥60% by 2030; ≥75% by 2035	Biennial
10	National climate documents with youth-disaggregated data; continuous biennial youth-climate survey	Data Infrastructure	0 of 11 documents; 1 survey wave completed (Deliverable 1; 2026)	≥6 of 11 documents by 2030; survey 2028, 2030, 2032	Doc: Annual; Survey: Biennial

Source: UNDP CLIMATE PROMISE: FROM PLEDGE TO IMPACT

The 2026 youth evidence base substantially strengthens the diagnosis of the participation and implementation gap. Field research combined 118 valid youth-survey responses with 22 semi-structured stakeholder interviews across Pelagonija, Southwest and Vardar. It found that 83.9% of surveyed young people were unaware of the NDC, 79.7% were unaware of the concept of Just Transition, and 87.3% rated their opportunities to participate in climate decision-

making at 3 or below on a five-point scale. The composite Youth Climate Literacy and Engagement Index was only 23.3%, while 56.8% identified insufficient information as the principal barrier to engagement.

The just-transition findings are equally important for implementation. Although 71.2% of respondents expressed interest in green-skills training, only 35.6% had accessed such training during the preceding two years, a gap of about 36 percentage points. At the same time, 59.3% of surveyed youth in the just-transition regions were considering or actively planning out-migration within three years. These findings link youth policy directly to the credibility of the transition: without accessible skills pathways, quality employment and meaningful participation, the regions most affected by coal phase-out risk losing the very workforce expected to deliver the post-coal economy.

In conclusion, youth mainstreaming in NDC 3.0 should extend beyond participation and awareness. It should link intergenerational equity with the practical conditions for implementation, by access to emerging skills and jobs, participation in decision-making, opportunities for young people in transition-affected regions, and improved institutional capacity to monitor outcomes for younger generations. Embedding these considerations across governance, education, employment, sectoral measures and monitoring would position youth not as a separate stakeholder category, but as a cross-cutting dimension of the Republic of North Macedonia's climate transition.

6.3.1 Climate education

Climate education remains insufficiently embedded in the Republic of North Macedonia's formal education framework, particularly as an explicit cross-curricular area. This limits the extent to which climate knowledge, skills and engagement are systematically developed through the education system and points to a need for stronger institutional integration of climate-related learning.

The relevance of education to NDC 3.0 is also reflected directly in youth participation in its preparation. Education with youth participation was one of the five thematic areas addressed during youth consultations, alongside energy, transport, agriculture and land use, and waste management. Climate education therefore emerges from the consultation process itself as an area in which young people expect climate action to be reflected, rather than solely as a policy priority identified through technical analysis.

Youth priorities point toward a concept of climate education that extends well beyond general environmental awareness. Organized youth participating in the first Local Conference of Youth on Climate called for the integration of justice into curricula, the institutionalization of climate education and activism in schools, training for local educators and the updating of educational programs to reflect current climate realities. Their recommendations also draw attention to eco-anxiety and mental health, adding a wellbeing dimension to the educational response to climate change. Consequently, these priorities frame climate education as a combination of curriculum development, educator capacity, opportunities for school-based civic engagement and support for young people's ability to understand and respond to the social and psychological dimensions of climate change.

Embedding climate education more systematically would also create a basis for monitoring whether these commitments translate into practice. The proposed youth-responsive indicator framework includes both Climate Change in National Education Concepts and a Youth Climate Literacy and Engagement Index. These indicators address two complementary dimensions, i.e. the extent to which climate change is institutionally incorporated into national education concepts, and the extent to which young people's climate knowledge and engagement develop over time. Climate education can therefore be approached not only as a policy commitment but as a measurable component of NDC implementation.

This approach also connects education with the longer-term requirements of the green transition. Across the Western Balkans, greater integration of environmental knowledge and green skills into education systems is linked to the role that today's children and young people will assume as future workers, decision-makers and innovators. In the context of NDC 3.0, strengthening climate education can consequently support both informed participation in climate action and preparation for the skills, employment and citizenship demands associated with a low-carbon and climate-resilient economy.

Therefore, the evidence supports an approach to climate education in NDC 3.0 that combines stronger institutional integration with meaningful youth participation and measurable outcomes. This would involve moving beyond awareness-raising toward the incorporation of climate change and climate justice into educational content, strengthening educator capacity, supporting youth engagement within schools, addressing relevant wellbeing dimensions, and monitoring climate literacy and participation over time.

6.3.2 Green jobs

The transition towards a low-carbon economy creates new employment opportunities for young people, but access to the skills required to benefit from these opportunities remains a significant constraint. For young people, particularly those living in regions affected by the just transition, employment prospects, access to green training and the socio-economic consequences of the energy transition are closely connected. The availability of credible pathways into emerging sectors therefore influences not only participation in the green economy, but also young people's perceptions of their future within transition-affected communities.

The gap between demand for green skills and access to training illustrates the scale of this challenge. Among surveyed youth in just transition regions, 71.2% expressed demand for green-skills training, while only 35.6% reported having access, representing a gap of approximately 36 percentage points. At the same time, 59.3% of surveyed youth were considering or actively planning out-migration within the following three years. The combination of strong demand for skills, limited access to training and high migration intentions connects the green-jobs agenda directly with the capacity of transition regions to create attractive economic prospects for younger generations. Expanding access to relevant skills and employment pathways can therefore form an important part of efforts to translate the just transition into tangible local opportunities.

These opportunities extend across several sectors affected by climate mitigation and economic transformation. Renewable energy, building renovation, transport, waste management, agriculture and circular-economy activities provide potential entry points for integrating youth employment into climate-policy implementation. Linking youth employment measures to these sectors would position green jobs within specific areas of NDC implementation rather than treating them as a separate or general employment objective. Youth-disaggregated reporting on employment outcomes would further make it possible to determine whether younger workers are actually benefiting from the economic opportunities associated with climate action.

A youth-responsive monitoring framework can provide the basis for tracking this relationship between skills development and employment outcomes. Proposed indicators covering Youth Employment in Environmental and Energy Sectors, Youth in Green Reskilling Programs (Just Transition Regions) and Youth Access to Green Skills Training would capture complementary stages of the employment pathway, from access to skills development and reskilling to participation in relevant sectors of the labor market. Incorporating these indicators into NDC implementation would allow progress on green jobs to be assessed in terms of actual opportunities available to and taken up by young people.

A stronger youth green-jobs agenda can also build on the country's broader employment-policy framework. The Decent Work Country Programme for the Republic of North Macedonia 2023-2025 identifies more and better jobs for inclusive growth and improved employment prospects for young women and men as a national priority. Green employment measures under NDC 3.0 can therefore be linked with wider labor-market objectives rather than developed as a parallel climate-specific employment agenda.

Existing initiatives also indicate that mechanisms supporting employment, skills development and green investment are already being implemented. UNDP reporting identifies 915 new jobs created with benefits for youth, Roma and persons with disabilities, 200 green jobs supported through green investments, 265 SMEs supported in strengthening productivity and the green transition, and 83 individuals improving their skills through VET and lifelong-learning programs. While these results are not exclusively youth-specific and should therefore not be interpreted as direct evidence of youth green-employment outcomes, they demonstrate an existing implementation base involving job creation, enterprise support, green investment and skills development on which more explicitly youth-responsive measures could build.

Subsequently, the reporting places skills development, labor-market access and local economic opportunity at the center of the youth dimension of the just transition. For NDC 3.0, this creates a pathway from identifying sector-specific employment opportunities, through accessible green-skills and reskilling programs, to monitoring whether young people ultimately enter and benefit from emerging green sectors. In transition-affected regions in particular, connecting these elements is relevant not only to employment outcomes but also to the broader challenge of creating viable local prospects for a generation among whom migration intentions are high.

6.3.3 Climate entrepreneurship

Youth entrepreneurship can provide an additional pathway for translating the green transition into economic opportunities for younger generations, particularly where conventional employment opportunities remain limited. Within the just-transition context, this requires moving beyond general support for youth participation and skills development toward operational mechanisms that enable young people to create and develop economic activities linked to climate action. A proposed youth-led green entrepreneurship facility offers one such mechanism, positioning entrepreneurship as part of the practical implementation of the just transition rather than as a stand-alone youth initiative.

The viability of such entrepreneurship depends, however, on the support structures available to young people. Youth perspectives indicate a need for training, financial support and grants, as well as practical and accessible entry points into sectors associated with the transition. Entrepreneurship opportunities therefore depend not only on young people's willingness to engage, but also on their ability to access the skills, finance and institutional support needed to turn ideas into viable activities.

Several areas of climate action provide potential entry points for this approach. Youth entrepreneurship in clean energy and youth-led circular-economy initiatives have been identified as opportunities for stronger youth mainstreaming in climate policy. These areas connect entrepreneurship directly with mitigation, resource efficiency and local innovation, allowing young people to participate economically in the implementation of climate objectives while developing new activities and services associated with the transition.

Existing enterprise-support mechanisms provide a potential institutional foundation on which more targeted measures could build. Support has already been provided to 265 SMEs to strengthen productivity, competitiveness and the green transition. Although these interventions are not identified as youth-specific and should not be interpreted as evidence of

youth entrepreneurship outcomes, they indicate that mechanisms for supporting enterprise development within the green transition are already in place. Connecting such mechanisms more deliberately with youth-focused finance, training and entrepreneurship support could help create practical pathways for young people to participate in green economic activity.

Within NDC 3.0, youth climate entrepreneurship can therefore complement green-skills and employment measures by creating pathways for young people not only to enter emerging green labor markets, but also to generate economic opportunities themselves. A more operational approach would combine targeted entrepreneurship mechanisms with access to training, finance and practical sectoral opportunities, particularly in clean energy and the circular economy.

6.3.4 Youth participation in decision-making

Youth participation is already present in the preparation of NDC 3.0, providing a foundation for a more systematic role for young people in climate decision-making. Consultations conducted in four cities gathered youth perspectives across energy, transport, agriculture and land use, waste management and education with youth participation. By organizing engagement around sectors directly relevant to NDC implementation, the consultation process enabled young people to contribute to concrete climate-policy questions rather than participate only in a general dialogue on climate change. Young people's experience of climate impacts within their communities also provides a basis for locally grounded and contemporary solutions, strengthening their potential contribution to policy design.

The challenge is to build on this consultative experience by creating more continuous and institutionalized forms of participation. Across the national climate-policy framework, formal mechanisms through which young people can influence climate governance remain weak or absent, creating a gap between periodic engagement and sustained participation in decision-making. Stronger youth representation and dedicated advisory mechanisms could help move participation beyond individual consultation exercises and embed it more consistently within climate-governance structures.

Young people's own priorities point in the same direction. Organized youth have called for stronger representation and institutionalized youth advisory councils, alongside youth-friendly versions of key climate documents. These priorities highlight the conditions for meaningful participation, stressing that young people need continuing channels through which they can contribute to decisions, but they also need climate-policy information to be accessible and understandable in order to use those channels effectively. Therefore, participation encompasses both representation within governance structures and access to the information required for informed engagement. In this sense, practical barriers reinforce the need to address both dimensions. Insufficient information and weak engagement channels can restrict young people's ability to participate meaningfully even where opportunities for consultation exist. Strengthening participation consequently requires not only the creation of formal mechanisms, but also communication and engagement arrangements that allow young people to understand climate-policy processes, identify opportunities to contribute and engage with them in practice.

International climate processes have also provided an additional channel for youth participation. Young people from the Republic of North Macedonia have been supported to engage with UNFCCC COP processes (COP29 and COP30) and related preparatory activities, while national youth-led climate advocacy has produced formal declarations and recommendations submitted to decision-makers. This international engagement complements the domestic NDC 3.0 consultations: it should be used as a pathway for bringing negotiation experience, intergenerational-equity concerns and youth proposals back into national climate governance, rather than remaining a stand-alone event-based activity. The NDC 3.0 process should therefore institutionalise feedback from youth delegates and youth climate networks into the national consultation and monitoring cycle.

Moreover, institutionalizing participation would also make it possible to monitor whether youth engagement becomes a sustained feature of climate governance. The proposed indicators provide a basis for tracking participation at both national and local levels. Their inclusion would shift monitoring away from simply recording whether consultations have occurred toward assessing whether young people have representation and functioning engagement mechanisms through which they can participate over time.

Hence, for NDC 3.0, the existing consultation process can serve as a starting point rather than the endpoint of youth participation. Building on sector-specific consultations with more permanent representation, advisory mechanisms, accessible climate information and functioning local engagement channels would create a clearer pathway from consultation to institutionalized participation. Monitoring representation and engagement mechanisms would, in turn, provide a means of assessing whether that transition is taking place in practice.

6.3.5 Youth-specific NDC targets

A central challenge for integrating youth into NDC 3.0 is the limited capacity of the existing climate-policy framework to measure whether climate action is reaching, involving and benefiting younger generations. The near-complete absence of youth-disaggregated data, dedicated monitoring mechanisms and accountability tools makes it difficult to move from general commitments to demonstrable results. Addressing this gap requires youth-responsive targets and indicators that can be tracked over time and linked to specific areas of NDC implementation.

A proposed framework of youth-responsive indicators provides a basis for doing so across several dimensions of climate action. The indicators cover youth representation in climate governance and municipal engagement mechanisms, youth

employment in environmental and energy sectors, young farmers in climate-resilient agriculture, participation in green reskilling programs and access to green-skills training, migration intentions in just-transition regions, integration of climate change into national education concepts, youth climate literacy and engagement, and youth-disaggregated monitoring within climate documents. These areas connect participation, education, skills, employment, agriculture and just-transition outcomes within a common monitoring framework.

This responds to a broader weakness in the existing policy architecture. Youth considerations are not adequately integrated across climate-policy documents, while youth-disaggregated monitoring and accountability arrangements remain limited. As a result, references to youth do not necessarily translate into mechanisms through which implementation or outcomes can be assessed. Introducing structured youth-responsive commitments in NDC 3.0 would help bridge this gap by linking policy recognition with measurable implementation.

Target-setting can also build directly on the participatory process undertaken during the preparation of the NDC. Youth consultations addressed the principal climate-policy sectors and explicitly included education with youth participation, providing a basis for connecting measurable commitments with issues already raised through youth engagement. Youth-responsive targets can therefore serve as a bridge between consultation and implementation, allowing priorities articulated during the NDC process to be reflected in subsequent monitoring and follow-up.

Additionally, the need for measurable targets is particularly relevant to the just transition, where the central challenge is the operationalization of existing commitments rather than simply the creation of additional legal provisions. Gaps in access to green skills, migration risks and limited institutionalization of youth participation point to areas where implementation instruments and systematic follow-up are needed. In this way, youth-specific targets would provide an implementation link between the different components of the youth agenda in NDC 3.0. Governance indicators can track whether participation becomes institutionalized. Education indicators can assess the integration of climate learning and changes in climate literacy. And, skills and employment indicators can monitor access to opportunities created by the transition, while just-transition indicators can capture developments affecting young people in transition regions. This approach would allow youth mainstreaming to be assessed through observable outcomes rather than primarily through the presence of youth-related language in policy documents.

Chapter 7. Climate Finance Assessment

The Republic of North Macedonia's climate-finance challenge is defined by a large investment requirement, a fragmented system for tracking financial flows, and a financing structure that necessarily combines domestic public resources, private capital and international support. Available national evidence does not support treating any one of these sources as sufficient on its own. Public budgets face fiscal constraints; private climate finance is not yet systematically tracked and remains limited in several high-upfront-cost sectors; and international support, while significant, is reported mainly as project commitments rather than as a comprehensive measure of actual climate expenditure.

Three findings frame this chapter. First, climate-finance tracking remains incomplete: public climate expenditure is dispersed across institutions and budget programmes, private investment is not comprehensively reported, and international finance is distributed across multiple donors, instruments and implementing entities. Second, the scale of the investment requirement exceeds the capacity of domestic public finance and requires substantial mobilisation of private and international capital, including blended instruments. Third, mobilisation is constrained not only by the availability of finance but also by project maturity, regulatory and institutional capacity, financing costs and the limited use of risk-sharing and other green-finance instruments.

The quantitative evidence must be interpreted with care because the principal sources use different time horizons, scenarios, price bases and cost concepts. Estimates presented in this chapter therefore are not combined mechanically. In particular, modelled investment requirements, international commitments, budget expenditure and prospective financing envelopes are treated as distinct concepts. The assessment build on BTR1, the updated NECP, eNDC and other relevant national assessments to provide the technical and financial evidence base for assessing climate investment needs, available financing and financing gaps.

Table 14Key Climate Finance Consideration for NDC 3.0 Development

Key issue	Current evidence	Relevance for NDC 3.0 development
Investment needs	Available assessments indicate substantial investment requirements but use different scopes and time horizons. The eNDC estimate is approximately EUR 29.88 billion by 2030 (2025 prices); the Updated NECP estimates approximately EUR 39.39 billion for 2025–2050, comprising EUR 10.14 billion for 2025–2030, EUR 16.03 billion for 2031–2040 and EUR 13.22 billion for 2041–2050; and the Long-Term Climate Action Strategy estimates approximately EUR 41.54 billion to 2050 (2025 prices). In parallel, the World Bank CCDR estimates approximately USD 6.4 billion in comprehensive adaptation investment needs through 2050 (2020 USD).	These estimates provide complementary benchmarks rather than directly comparable estimates of NDC 3.0 financing requirements. Mitigation and adaptation needs should be assessed separately, with consistent treatment of scope, time horizon, price basis and costing methodology.
Financing structure and international support needs	Existing assessments indicate that implementation will require a combination of domestic public resources, private and other non-government financing, and international and blended finance. For the eNDC, the Financing Strategy envisages approximately 4% of the investment requirement being financed from domestic public sources, around 43% from non-government sources, and approximately 54% through mixed or blended financing. The subsequent assessment of financial support needs estimates that approximately USD 20–22 billion in international financial support would be required during 2024–2030.	The NDC 3.0 financing framework should distinguish between total investment needs and the portions expected to be mobilised from domestic public, private/non-government and international sources, while clearly differentiating estimated financing needs from finance already secured or committed and avoiding double counting across financing categories.
International climate finance committed	According to BTR1, international support committed to climate-related projects during 2020–2022 amounted to approximately USD 198.2 million, of which USD 96.4 million (48.6%) was identified as committed international climate finance.	Commitments represent identified financial support rather than actual disbursements and should not be directly compared with, or subtracted from, multi-year investment requirements.
Climate finance tracking and financing gap	Available evidence indicates that public, private and international climate-finance flows are not captured within a single, fully integrated national tracking framework. This limits the ability to establish a comprehensive and directly comparable estimate of	Assessment of the NDC 3.0 financing gap should distinguish between total investment needs, finance already secured or committed, disbursements and actual expenditure, and financing not yet secured. Strengthened measure- and project-level tracking will be required to

	available climate finance against identified investment needs.	establish a more robust financing baseline and avoid double counting.

Source: Long-Term Action Strategy and Action Plan (2020 – 2050); First Biennial Transparency Report (BTR1); Updated National Energy and Climate Plan (NECP); Climate Public Finance Review; Strategy for Financing the Enhanced Nationally Determined Contribution (eNDC); Information on Financial, Technology Development and Transfer and Capacity-Building Support Needed and Received under Articles 9–11 of the Paris Agreement.

7.1 Current Climate Finance Landscape

The Republic of North Macedonia's current climate-finance landscape builds on the financing and implementation framework established for the 2021 Enhanced Nationally Determined Contribution (eNDC). The eNDC was complemented by a dedicated Financing Strategy and an Implementation Roadmap, which together were intended to translate the mitigation commitments into an implementable and financeable set of measures. The Financing Strategy estimated that financing requirements for implementation of the eNDC would exceed EUR 20 billion through 2030 and envisaged a multi-source financing approach combining domestic public resources, private investment, international climate and development finance, and other sources. The Implementation Roadmap complemented this framework by linking individual mitigation measures with responsible institutions, indicative implementation periods, investment requirements and potential financing sources.

The Financing Strategy also identified several elements required to operationalise this approach, including stronger coordination of climate-finance activities, integration of climate priorities into national budgeting and infrastructure planning, assessment of public and private financing options, improved access to international climate finance, development of a project pipeline and establishment of a climate-finance monitoring, reporting and verification system. In this respect, the eNDC Financing Strategy and Implementation Roadmap established an important foundation for linking climate ambition with financing and implementation planning.

The subsequent assessment of eNDC implementation provides evidence on how this framework has functioned in practice. The 2025 Rapid Assessment finds that the Implementation Roadmap successfully identified the 63 mitigation measures, together with responsible institutions, indicative budgets, implementation periods and financing sources, but that its operational use has been more limited. Implementation progress has also varied across sectors, with stronger progress for several renewable-energy and energy-efficiency measures and more limited progress in areas such as transport and agriculture. The assessment further identifies the absence of a formal monitoring framework linked to the Implementation Roadmap and insufficient integration of the Implementation Roadmap into the operational frameworks and budgets of relevant institutions.

Similar limitations are identified in relation to the eNDC Financing Strategy. While the Strategy established a broad multi-source financing framework, the Rapid Assessment finds that its operationalisation has remained limited, particularly due to the absence of a detailed financing pipeline linking specific projects and measures with financing sources and implementation timelines. Limitations are also identified in financial tracking, disbursement scheduling and coordination across funding sources, as well as in access to finance at the municipal level and the mobilisation of private investment.

BTR1 adds an important transparency and reporting dimension to this implementation framework by providing updated information on progress towards the eNDC and on financial support needed and received. It therefore complements the eNDC Financing Strategy, Implementation Roadmap and subsequent implementation assessment by strengthening the evidence base for tracking climate action and associated financing. At the same time, the available information does not yet provide a fully integrated climate-finance tracking system linking individual measures and investment needs with financing sources, commitments, disbursements, actual expenditure and implementation results.

The Updated NECP (2025) provides an additional implementation framework relevant to the transition towards NDC 3.0, strengthening the links between climate-related policies and measures, financial planning, implementation and monitoring. This provides an important basis for aligning the future NDC 3.0 implementation framework with existing national planning and governance arrangements.

The broader strategic context is provided by the Long-Term Climate Action Strategy (2020–2050), which extends the mitigation and investment perspective to 2050 and provides a longer-term reference for aligning successive NDC cycles with the country's decarbonisation pathway.

Taken together, the eNDC, its Financing Strategy and Implementation Roadmap, the subsequent assessment of their implementation, BTR1, the Updated NECP and the Long-Term Climate Action Strategy (2020–2050) provide the principal evidence base for the development of the NDC 3.0 financing and implementation framework. The experience with NDC 2.0 highlights the importance of establishing clearer links between measures, responsible institutions, investment requirements, financing sources, implementation schedules and monitoring indicators. BTR1 strengthens the transparency and reporting dimension by providing updated information on implementation progress and financial support needed and received, while the Updated NECP strengthens the link with national planning, budgeting, implementation and monitoring arrangements. Whether NDC 3.0 will require a separate Implementation Plan or whether

these functions will be operationalised through an integrated framework aligned with existing national planning, financing, implementation and reporting arrangements remains to be determined as part of the NDC 3.0 development process.

7.2 Public Finance

Domestic public finance has a dual role in supporting climate action: it directly finances public goods and enabling infrastructure, while also helping to reduce investment risks and mobilise additional private and international capital. Available assessments provide information on selected public and municipal climate-related expenditures, but do not provide a comprehensive and systematically tracked estimate of climate-related public expenditure across the public financial management system.

An additional coverage limitation arises because public-sector climate finance is not necessarily fully captured by the central government budget and its reporting systems. Climate-related investments may also be undertaken through public enterprises and utilities and therefore fall outside standard budget reporting. As a result, budget expenditure represents only part of the broader domestic public-finance contribution to climate action.

At the local level, one of the available quantified examples relates to the City of Skopje. In 2018–2019, approximately USD 5.61 million of own-source budget funds were allocated to 37 climate-related projects, of which approximately USD 3.55 million (63.3%) supported mitigation and USD 2.06 million (36.7%) adaptation. While this provides evidence of locally financed climate action, the data are historical and relate to a single local government unit; they therefore cannot be used to estimate current municipal climate finance at the national level.

The updated NECP strengthens the link between public finance and implementation. Measure PM_D1: Strengthening institutional and governance framework for effective NECP implementation, envisages detailed assessment and planning of the financial requirements of NECP measures, including multiannual, annual and medium-term budgeting, identification of funding gaps and financing strategies drawing on the national budget, EU and other donor resources, and green finance. The measure also provides for a monitoring and reporting mechanism for NECP implementation. These arrangements provide a relevant basis for strengthening the integration of climate-related financial requirements into national planning and budgeting and for improving the tracking of financing and implementation of measures covered by the NECP. They can also inform the design of the NDC 3.0 financing, implementation and monitoring framework.

The medium-term fiscal framework also provides an important context for climate-related public investment. The Fiscal Strategy 2027–2031 identifies capital expenditure as a key instrument of fiscal policy, including investment in transport, energy, water and other infrastructure. However, these capital expenditures cannot be treated as climate finance without project- or programme-level assessment of their climate relevance.

Green financing instruments have also begun to be incorporated into the domestic public-finance framework. In 2023, the Republic of North Macedonia issued its first sovereign green bond in the amount of EUR 10 million, with the proceeds directed to the Energy Efficiency Fund within the Development Bank. Together with EUR 5 million provided through the World Bank-supported Public Sector Energy Efficiency Project, these resources provided the initial capital base for the Fund, which is intended to support energy-efficiency investments through loans, guarantees and grants.

The integration of climate considerations into public investment management was assessed through the IMF Climate-Public Investment Management Assessment (C-PIMA) conducted in 2023. The assessment identified scope for strengthening the integration of climate considerations across public investment planning, coordination, project appraisal and selection, budgeting and portfolio management, and fiscal risk management. In particular, it highlighted the need to incorporate mitigation and climate-resilience considerations into project appraisal and prioritisation, improve reporting on climate-related public investments, and progressively strengthen green budgeting practices. These findings provide an important reference for assessing the extent to which the evolving public investment management framework can support the financing and implementation of NDC 3.0 measures.

A significant recent development is the strengthening of the national Public Investment Management (PIM) framework. Following the establishment of a dedicated Public Investment Management Department within the Ministry of Finance, the new framework introduced a Public Investment Committee and a unified process for the appraisal, prioritisation and monitoring of major public infrastructure projects. Under the PIM framework, public infrastructure project proposals above EUR 5 million submitted by budget users, public enterprises, state-owned companies and municipalities are subject to a more structured assessment and prioritisation process. In 2026, this process resulted in the preparation of the first Final Priority List of Public Investment Project Proposals. Some of these projects may contribute to measures and investment priorities under the eNDC, the Updated NECP and, potentially, NDC 3.0. However, determining their climate relevance would require project-level screening and classification against the corresponding climate objectives and measures.

Climate budget tagging represents an important mechanism for improving the identification and tracking of climate-related public expenditure. The country-specific approach described in the Climate Public Finance Review classifies programmes according to mitigation, adaptation or combined relevance and applies weights reflecting the strength of the climate link. Once integrated into the public financial management system, such tagging could provide a more systematic basis for identifying climate-related budget allocations and comparing planned allocations with actual expenditure and NDC financing requirements.

Taken together, these developments point to the need to strengthen the link between NDC implementation, public budgeting and public investment management. For NDC 3.0, a more systematic public-finance baseline would require identification of climate-relevant budget allocations and expenditure, screening of relevant public investment projects, and clearer links between individual NDC measures, responsible public institutions, financing sources and implementation status. This would also improve the basis for distinguishing domestic public finance from private and international financing contributions and for assessing remaining financing needs.

7.3 Private Finance

Private capital is an important component of the climate-finance architecture, particularly because a significant share of investments in renewable energy, buildings, transport, industrial modernisation and household energy efficiency can generate commercial or quasi-commercial returns. Nevertheless, national evidence on private climate finance remains incomplete. There is no comprehensive reporting framework that systematically captures climate-related investment by companies, households and financial institutions. Available information should therefore be interpreted as providing partial evidence of private climate-finance flows rather than a comprehensive estimate of their overall contribution.

The domestic banking sector has expanded green lending in recent years, with green-loan products increasingly supported by credit lines and financing arrangements involving international financial institutions. The stock of green loans increased from approximately EUR 117 million (MKD 7.18 billion) in 2019 to EUR 475 million (MKD 29.18 billion) in 2024, while their share in total bank lending increased from 2.15% to 5.96% over the same period. Green lending is predominantly directed towards non-financial corporations, which accounted for approximately EUR 456 million (MKD 28.03 billion) of the total green-loan portfolio in 2024 (NBRNS 2025). Despite this expansion, green lending still represents a relatively limited share of overall credit activity. The available banking data provide an important indicator of financial-sector involvement in green investment, but do not capture private climate investment financed through companies' and households' own resources, equity, leasing or other financing instruments.

A relevant example is the Green Finance Facility (GFF) to Improve Air Quality and Combat Climate Change in the Republic of North Macedonia, a UN Joint Programme implemented by UNDP, IOM and UNECE in partnership with the Government of the Republic of North Macedonia, the European Bank for Reconstruction and Development (EBRD) and local financial institutions. The Facility is designed to improve access to affordable finance for small and medium-sized enterprises (SMEs) and underserved households for investments in renewable energy and energy efficiency. Its estimated financing amounts to USD 46.7 million, comprising a USD 8.0 million grant from the Joint SDG Fund, a USD 0.8 million grant from the Government of the Republic of North Macedonia, USD 31.4 million in EBRD credit and USD 6.5 million in credit from participating financial institutions. The GFF illustrates the role of blended-finance mechanisms in mobilising private climate investment through the domestic financial sector. By combining financing through local financial institutions with technical assistance and performance-based incentives, the Facility supports renewable-energy and energy-efficiency investments by SMEs and households. The Facility has subsequently been expanded in response to market demand, with additional EBRD credit lines channelled through participating in domestic financial institutions.

More recent developments indicate further diversification of green-finance mechanisms. In March 2026, EBRD provided NLB Bank Skopje with a financing facility of up to EUR 30 million under the Western Balkans Green Outcomes-Linked Debt Financing Framework (WB GOLD), the first such facility in the Republic of North Macedonia. The financing is intended to support green lending to SMEs investing in sustainable technologies and introduces outcome-based incentives linked to the achievement of green-finance targets. This provides a further example of international finance being intermediated through the domestic banking sector to support private green investment.

The main barriers identified across the reviewed national assessments include high upfront investment requirements, financing costs, insufficient project preparation, limited availability of risk-sharing instruments, regulatory uncertainty and institutional capacity constraints. These barriers are particularly relevant for deep building renovation, industrial decarbonisation, municipal infrastructure and other investments characterised by long payback periods or limited direct revenue streams. Strengthening the availability of appropriate financial instruments and mechanisms that combine public, international and private resources is therefore relevant for expanding the pool of finance available for climate-related investment.

7.4 International Climate Finance

International climate finance is a major component of the Republic of North Macedonia's climate-finance architecture. For 2020–2022, BTR1 and the Supporting assessment on financial, technology-development, technology-transfer and capacity-building support report the same underlying project portfolio. To avoid duplication, the figures are presented once below. The dataset therefore provides a historical baseline for international climate-finance support rather than a measure of the financing currently available for NDC 3.0 implementation.

The portfolio amounted to USD 198.205 million in total international commitments for climate-related projects; after application of the Rio Marker attribution methodology, USD 96.414 million was identified as climate-attributable finance, equivalent to 48.6% of total commitments. These are commitments rather than actual disbursements and should be interpreted accordingly.

Table 15Commited International Support

Indicator	2020–2022 amount (USD)	Interpretation
Total international commitments for climate-related projects	198,205,109	Approved/committed project portfolio
Total climate finance commitment	96,414,444	Rio Marker-attributed climate share
Climate finance share	48.6%	Share of total climate-related commitments

Source: BTR1, pp. 97; Information on Financial, Technology Development and Transfer and Capacity-Building Support Needed and Received under Articles 9–11 of the Paris Agreement. The two sources report the same underlying 2020–2022 dataset.

Under the Rio Marker methodology, USD 65.29 million (32.9%) of total commitments were classified as climate-specific (CS) and USD 132.91 million (67.1%) as climate-relevant (CR). Following application of the corresponding attribution coefficients, these amounts resulted in USD 43.25 million and USD 53.16 million of climate-attributable finance, respectively. This distinction is important because the headline value of climate-related projects should not be interpreted as equivalent to the amount attributable to climate objectives.

International climate support during 2020–2022 was concentrated among a relatively small number of development partners. The European Union, the World Bank and Switzerland together accounted for approximately USD 162.94 million, or 82.2% of total international commitments, and USD 70.67 million, or 73.3% of climate-attributable finance. The World Bank represented the largest source of committed support, with approximately USD 77.9 million in total commitments and USD 31.16 million in climate-attributable finance, followed by Switzerland (USD 50.96 million and USD 20.39 million, respectively) and the European Union (USD 34.08 million and USD 19.12 million, respectively). Multilateral climate funds, including the Global Environment Facility (GEF) and the Green Climate Fund (GCF), provided smaller volumes of finance but with a comparatively high share attributed to climate objectives.

Table 16Distribution of Climate finance by Providers

Funding Provider	Total international commitement for the climate related project in USA$	Total climate finance commitement in USA$
EU	34.076.183	19.118.703
FAO TCP	381.000	381.000
GCF	3.687.651	2.390.406
GEF	12.056.698	9.828.645
Germany	3.445.099	3.442.260
GIZ	209.725	209.725
International Visegrad Fund	23.160	23.160
SDG Fund (+ EBRD credit)	9.340.000	3.736.000
Multilateral Fund (Montreal Protocol)	751.904	357.762
Sweden	5.027.583	5.027.583
Switzerland	50.959.037	20.392.132
USAID	347.069	347.069
World Bank	77.900.000	31.160.000
Total	**198.205.109**	**96.414.444**

Source: BTR1, pp. 100; Information on Financial, Technology Development and Transfer and Capacity-Building Support Needed and Received under Articles 9–11 of the Paris Agreement. The two sources report the same underlying 2020–2022 dataset.

Adaptation accounted for the largest share of total commitments in the 2020–2022 portfolio, at approximately USD 100.91 million, while mitigation recorded the highest climate-attribution rate, at approximately 54.8%. Climate-attributable finance was distributed across adaptation (USD 46.90 million), mitigation (USD 28.59 million) and cross-cutting activities (USD 20.93 million).

Table 17Purpose of funding: Mitigation, Adaptation, or Cross-cutting

Climate objective	Total commitments (USD)	Climate-attributable finance (USD)
Adaptation	100,907,310	46,895,986
Mitigation	52,164,651	28,592,484
Cross-cutting	45,133,149	20,925,974
Total	**198,205,109**	**96,414,444**

Source: Information on Financial, Technology Development and Transfer and Capacity-Building Support Needed and Received under Articles 9–11 of the Paris Agreement.

The sectoral distribution of international support provides further insight into the allocation of climate-related finance during 2020–2022. Water and sanitation received the largest volume of international commitments (USD 52.83 million), followed by agriculture (USD 50.88 million), general environmental protection (USD 37.65 million), energy generation, distribution and efficiency (USD 28.41 million), and disaster prevention and preparedness (USD 22.02 million). In terms of climate-attributable finance, these sectors accounted for approximately USD 25.42 million, USD 20.58 million, USD 23.14 million, USD 11.97 million and USD 10.87 million, respectively. The distribution indicates that international climate-related support was concentrated primarily in water, agriculture and environmental protection, alongside energy-related investments.

By financing instrument, grants accounted for approximately USD 110.97 million of total commitments and USD 61.52 million of climate-attributable finance; loans accounted for approximately USD 87.24 million and USD 34.90 million respectively. These categories should not be confused with the separate classification of support as financial, technical, capacity-building or technology support, because those forms of support may overlap within individual projects.

Table 18Type of Funding of international climate commitement

Instrument	Total internaional commitement for the climate related project (in USA$)	Total climate finance commitement (in USA$)
Grants	110,965,109	61,518,444
Loans	87,240,000	34,896,000
Total	198,205,109	96,414,444

Source: Information on Financial, Technology Development and Transfer and Capacity-Building Support Needed and Received under Articles 9–11 of the Paris Agreement.

Earlier TBUR reporting provides a historical reference but should not be merged with the 2020–2022 BTR1 dataset without methodological reconciliation. For 2018–2019, approximately USD 25.15 million of international financial support for climate-related activities was reported, of which 62% was classified as climate-specific and 38% as climate-relevant. Differences in reporting periods and methodology limit direct comparison with the BTR1 figures.

A significant development in the Republic of North Macedonia's international climate-finance architecture is the Just Energy Transition Investment Platform (JETIP), launched in 2023 to bring together the Government and international financial and development partners in support of the country's energy transition. The Platform provides a framework for coordinating and mobilising public, international and private finance for investments related to renewable energy, grid infrastructure, coal phase-out and the just transition. The associated investment requirements are discussed separately in Section 7.6 in the context of investment needs.

The Fund for responding to Loss and Damage (FRLD) may represent an additional potential source of international support for the Republic of North Macedonia, subject to applicable eligibility and access requirements.

Taken together, the available evidence confirms the important role of international climate finance in supporting climate action in the Republic of North Macedonia. The 2020–2022 data provide a quantified baseline of international commitments and show that support was concentrated among a relatively small number of development partners, while covering both mitigation and adaptation priorities through a combination of grants and loans. At the same time, mechanisms such as JETIP illustrate an evolving approach towards greater coordination of international financial support and mobilisation of public and private capital. For NDC 3.0, maintaining a clear distinction between commitments, disbursements and actual expenditure, as well as between international climate finance and private finance mobilised through international support, will be important for consistent climate-finance tracking and for avoiding double counting across financing sources and instruments.

7.5 Financing Gap

The financing gap for climate action in the Republic of North Macedonia cannot currently be expressed as a single robust numerical estimate. Available sources provide different but complementary information on investment needs, expected financing sources and international support received. These estimates differ in their time horizons, price bases, sectoral coverage and underlying cost concepts. In addition, available information on international climate finance primarily refers to commitments rather than actual disbursements. Consequently, a simple subtraction of recorded

international commitments from estimated investment requirements would not provide a methodologically consistent measure of the financing gap.

The original investment requirement for implementation of all identified eNDC mitigation measures by 2030 was estimated at EUR 25.03 billion in 2021 prices. Re-estimated to 2025 prices, this corresponds to approximately EUR 29.88 billion (USD 34.89 billion), of which EUR 29.68 billion relates to the energy sector, EUR 131 million to AFOLU and EUR 69.9 million to waste.

The eNDC Financing Strategy provides an indicative ex ante structure of the financing needs associated with the implementation of the eNDC mitigation measures. Approximately 4% of the total financing requirement is identified as needing to be covered entirely from domestic public sources, around 43% from non-government sources, including private investment, donor programmes and consumer-financed schemes, while approximately 54% would require mixed or blended financing combining international public finance, private co-investment and concessional instruments. Within this financing structure, the estimated need for international financial support during 2024–2030 amounts to approximately USD 20–22 billion. These estimates represent indicative financing needs rather than finance already secured, committed or disbursed and should therefore not be interpreted as a directly measured financing gap.

A complementary perspective is provided by the mitigation analysis prepared for BTR1. Under the WAM scenario, the estimated investment requirement to 2040 amounts to approximately EUR 22.1 billion. This estimate should be distinguished from the eNDC investment requirement of EUR 29.88 billion by 2030, as the two estimates differ in scope, time horizon and methodological approach and should therefore not be directly combined when assessing the financing gap.

Available information on international climate finance provides evidence of resources mobilised but does not allow the remaining financing gap to be derived directly. For the 2020–2022 reporting period, total international commitments for climate-related projects amounted to USD 198.2 million. After application of the Rio Marker methodology, approximately USD 96.4 million was identified as climate-attributable finance. These amounts represent commitments rather than disbursements or actual expenditure and relate to a different reporting period from the investment needs estimates. They should therefore not be directly deducted from the estimated investment requirements for eNDC implementation.

Accordingly, the available evidence points to a substantial financing requirement, particularly for measures that depend on international, blended or private financing, but does not yet permit a precise estimate of the outstanding financing gap. A comprehensive assessment would require a measure- or project-level comparison between investment requirements and financing already secured, distinguishing domestic public finance, private investment and international finance, as well as commitments, disbursements and actual expenditure. This would also require consistent treatment of the implementation period and price basis and mechanisms to prevent double counting where international public finance is used to mobilise domestic or international private capital. The current absence of a single national mechanism for systematically collecting and consolidating information on international support further limits such an assessment.

Table 19Key Investment and Financing Estimates Relevant to the Climate Financing Gap

Financial reference	Quantitative estimate	Relevance for financing-gap assessment
eNDC investment needs	EUR 29.88 billion (2025 prices) USD 34.89 billion (2025 prices)	Reference investment requirement for eNDC mitigation measures
Estimated international support needed for eNDC	USD 20–22 billion	Indicative international financing requirement for 2024–2030; not secured finance
International climate finance committed, 2020–2022	USD 96.4 million climate-attributable finance	Historical commitments; not directly deductible from investment needs

Source: Information on Financial, Technology Development and Transfer and Capacity-Building Support Needed and Received under Articles 9–11 of the Paris Agreement; BTR1.

Beyond the quantitative funding requirement, the effective financing gap is also influenced by the capacity to translate identified investment needs into mature, financeable and implementable projects. Relevant constraints include project preparation and investment-pipeline development, access to concessional and risk-sharing instruments, institutional and municipal capacity, and systems for monitoring and tracking climate finance. These constraints affect the extent to which available domestic, private and international financial resources can be mobilised and effectively deployed for NDC implementation.

7.6 Investment Needs to 2035

Investment estimates in the reviewed national and international assessments vary considerably because they address different policy frameworks, scenarios, time horizons and cost concepts. Some estimates represent cumulative investment requirements, while others refer to scenario-based or incremental investment needs. Differences in price bases and sectoral coverage further limit direct comparability. The estimates should therefore be interpreted as complementary indications of the scale of climate-related investment rather than as competing estimates of the same financing requirement. None of the reviewed assessments provides a comprehensive aggregate estimate of climate

investment needs specifically to 2035; the available estimates therefore serve as reference points for assessing the scale and composition of investment relevant to the NDC 3.0 horizon.

Table 20Summary of Climate Investment Needs Relevant to NDC 3.0 Development

Source / framework	Horizon	Scenario / concept	Indicative amount	Key interpretation
2021 NDC Financing Strategy, updated in BTR1 to 2025 prices	to 2030	Investment requirements for implementation of eNDC mitigation measures	≈ EUR 29.9 billion (≈ USD 34.9 billion)	Broad mitigation investment requirement; strongly concentrated in energy
BTR mitigation assessment	to 2040	WAM mitigation scenario; investment requirement	≈ EUR 22.1 billion	Scenario-based investment reference; more than 92% concentrated in energy-related measures
Updated NECP 2025	to 2050	NECP implementation; total investment requirement	≈ EUR 39.39 billion	Total estimated investment needs: EUR 10.14 bn (2025–2030), EUR 16.03 bn (2031–2040), and EUR 13.22 bn (2041–2050).
Long-term Strategy on Climate Action and Action Plan, updated to 2025 prices	To 2050	WAM scenario; cumulative capital investment requirement	≈ €41.54 billion (US$ 48.51 billion)	Long-term mitigation investment benchmark.
World Bank CCDR – adaptation	2025 - 2050	Comprehensive adaptation investment needs	≈ USD 6.4 billion; ≈ USD 260 m/year	Adaptation investment benchmark covering multiple climate-vulnerable sectors
Just Energy Transition Investment Platform (JETIP)	to 2030	Just energy transition investment platform	≈ EUR 3.0 billion	Sector-specific energy-transition investment benchmark; potentially overlapping with eNDC, BTR1 and NECP investment requirements

Source: BTR1; Information on Financial, Technology Development and Transfer and Capacity-Building Support Needed and Received under Articles 9–11 of the Paris Agreement; Updated NECP; World Bank CCDR; EBRD Financing Just Transition: Investment Plan for the Republic of North Macedonia.

The investment requirements are highly concentrated in a limited number of sectors. Mitigation investment is strongly concentrated in the energy system and energy-related infrastructure, including renewable-energy deployment, electricity networks, buildings and transport. Under the BTR1 WAM assessment, more than 92% of the estimated investment is associated with energy-related measures. The Updated NECP similarly identifies substantial requirements for new and renovated buildings, transport, new power-generation capacity, electricity networks and other energy infrastructure.

The Just Energy Transition Investment Platform (JETIP) provides an additional sector-specific investment benchmark for the energy transition. The Platform aims to mobilise around EUR 3 billion of public and private finance by 2030 to support the phase-out of coal-fired power generation, deployment of renewable-energy capacity, grid and storage infrastructure, and just-transition measures. This estimate should be interpreted as a sector-specific investment benchmark rather than added to the broader eNDC, BTR1 or NECP investment estimates, as substantial overlap may exist between their respective investment scopes. As implementation progresses, the Platform provides an emerging framework for linking the aggregate JETIP investment envelope with specific financing commitments and project-level investments.

The CCDR estimates total adaptation investment needs of approximately USD 6.4 billion over 2025–2050, equivalent to approximately USD 260 million annually, with the largest requirements identified for disaster risk management (USD 2.04 billion), transport (USD 1.74 billion), water (USD 1.40 billion) and urban resilience (USD 851.5 million). These estimates represent a separate adaptation investment benchmark and should not be added mechanically to the predominantly mitigation-focused estimates presented above, given differences in scope, time horizon and methodology.

For the proposed NDC 3.0 target architecture, the Technical Background distinguishes between unconditional and conditional components. However, the available technical and financial assessments do not provide a separate aggregate investment-cost estimate for each component. The BTR1 WAM investment estimate provides a technical

reference for the currently modelled mitigation portfolio, but it cannot be directly allocated between the unconditional and conditional components without additional measure- and project-level costing.

Table 21Financing Requirements and Costing Status of the Proposed Unconditional and Conditional Components

2035 component	Financing interpretation	Cost status
Unconditional component	Financing requirements to be determined on the basis of the measures included in the final unconditional package	No separate aggregate cost currently quantified
Conditional component	Additional financing requirements to be determined on the basis of the measures included in the final conditional package	No separate aggregate cost currently quantified

Source: Authors' assessment based on the reviewed technical and financial evidence.

Accordingly, assigning separate monetary totals to the unconditional and conditional components at this stage would overstate the precision of the available evidence. Their respective investment requirements will need to be refined once the final NDC 3.0 target architecture and corresponding packages of mitigation and adaptation measures are established and costed. Refining these estimates will require measure- and project-level information linking investment requirements, implementation periods and expected financing sources, while distinguishing domestic public resources, private finance, international support already secured or committed, and additional international support required.

Overall, the reviewed assessments demonstrate the substantial scale of climate-related investment relevant to the NDC 3.0 horizon, but they do not provide a single consolidated estimate specifically for 2035. The available mitigation, energy-transition and adaptation estimates differ in scope, methodology and time horizon and, in several cases, are likely to overlap. They should therefore be used as complementary investment benchmarks rather than aggregated into a single estimate of NDC 3.0 investment needs. A more precise estimate for the 2035 horizon will depend on the final NDC 3.0 target architecture and the costing of the corresponding mitigation and adaptation measures.

Chapter 8. Technology and Capacity Needs

Technology is one of the core means of implementation of the Republic of North Macedonia's NDC 3.0. Achieving the mitigation and adaptation objectives identified elsewhere in this technical background document will depend not only on the availability of mature low-carbon technologies, but also on the country's ability to select, finance, transfer, adapt, operate and continuously improve those technologies. The 2026 Technology Needs Assessment (TNA), together with the assessment of climate-related engineering education and the mitigation analysis prepared for BTR1, provides a substantially stronger basis for linking technology priorities with investment, research, digitalisation and human-capacity needs.

The role of this section is therefore not to repeat the sectoral mitigation modelling. The Mitigation Report already identifies the technologies embedded in the WAM pathway and quantifies the scale of investment needed for implementation. Rather, this section translates that technology portfolio into the enabling conditions required for deployment: technology transfer and demonstration, research and innovation, digital infrastructure and artificial intelligence, and the technical, institutional, financial and educational capacities needed to convert modelled potential into implemented projects.

8.1 Technology Transfer

Under Article 10 of the Paris Agreement and the UNFCCC Technology Mechanism, technology development and transfer are central elements of climate implementation. Technology transfer should be understood as more than the import of equipment. For NDC 3.0 it includes access to technologies and components, technical know-how, standards and certification, engineering and design capability, software and data systems, operation and maintenance skills, local supply-chain development, demonstration projects, licensing and intellectual-property arrangements where relevant, and the financial and regulatory conditions that allow technologies to be deployed at scale.

The Republic of North Macedonia's 2026 TNA follows a country-driven and participatory approach and applies a multi-criteria assessment to technologies across energy and buildings, industry and IPPU, transport, agriculture, waste, and forestry and land use. Technologies are assessed against greenhouse-gas reduction potential, technical maturity and feasibility, economic viability, alignment with national policies, replication potential and wider socio-economic benefits. The resulting portfolio combines mature "no-regret" options with enabling infrastructure, nature-based solutions and digital technologies. This is important for NDC 3.0 because it creates an operational bridge between strategic targets and the practical sequence of technology deployment.

The final TNA portfolio confirms that the immediate technology priorities are concentrated around solar PV, industrial energy efficiency, wind power, heat pumps, deep building renovation and waste-heat recovery, while system transformation increasingly depends on battery storage, smart grids and advanced metering, industrial electrification, district-heating modernization, electric mobility, digital industrial processes, precision agriculture and strengthened forest monitoring. The TNA also treats hydrogen as a longer-term enabling option whose role depends on further assessment of cost, infrastructure, safety, system integration and access to low-carbon electricity. For hard-to-abate industrial processes, further research and feasibility assessment of carbon-management options, including CCUS where technically and economically justified, remains appropriate.

Table 22 Priority technology clusters for NDC 3.0 implementation

Technology cluster	Illustrative technologies	NDC 3.0 role
Power and system flexibility	Utility-scale and rooftop solar PV; wind; BESS; smart grids; AMI	Reduce fossil generation, enable higher RES penetration and strengthen system flexibility.
Buildings and heat	Heat pumps; deep renovation; district-heating modernization and decarbonization	Reduce final-energy demand and electrify heating while improving affordability and air quality.
Industry and IPPU	ISO 50001, high-efficiency motors/VSD; waste-heat recovery; industrial electrification and heat pumps; clinker substitution; process optimization and digitalization	Lower energy and process emissions and prepare industry for tighter EU climate and CBAM-related requirements.
Transport	Electric vehicles and charging infrastructure; digital mobility and system integration	Reduce oil dependence and transport emissions while linking mobility with power-system planning.
Agriculture, forestry and land	Precision fertilizer application; precision agriculture; afforestation/reforestation; sustainable forest management; drone and remote-sensing wildfire monitoring	Reduce non-CO2 emissions, strengthen sinks and protect carbon stocks from climate-related disturbances.

Technology cluster	Illustrative technologies	NDC 3.0 role
Longer-term emerging options	Hydrogen pilots and enabling infrastructure; selected CCUS feasibility work; advanced digital control and monitoring	Prepare post-2030 decarbonization options where maturity, economics and infrastructure justify deployment.

This technology portfolio is consistent with the Mitigation Report rather than additional to it. The WAM scenario already contains the major technology shifts and estimates approximately EUR 22.1 billion of incremental investment relative to WOM through 2040, with more than 92% of the investment concentrated in the energy sector. Average annual incremental investment is approximately EUR 1.47 billion. The technology chapter should therefore use the mitigation modelling as the quantitative investment backbone, while the TNA provides the prioritisation, deployment-readiness, barrier and enabling-condition layer. This avoids double counting and creates a clear chain from technology choice to policy, finance, project preparation and implementation.

International practice supports this structure. In UNFCCC terminology, the implementation-oriented follow-up to a Technology Needs Assessment is a Technology Action Plan (TAP). Recent examples include Brazil, which prepared a mitigation TNA and TAP in 2021; Fiji, which followed its 2020 mitigation and adaptation TNAs with TAPs in 2023; Jamaica, which prepared a TNA in 2020 and a TAP in 2021; and Papua New Guinea, which prepared new mitigation and adaptation TNAs in 2025 together with a mitigation TAP. These examples demonstrate the value of moving from technology prioritisation to an action plan that identifies barriers, responsible institutions, timing, financing sources and concrete project ideas. For the Republic of North Macedonia, the logical next step after the 2026 TNA is to translate the priority portfolio into technology-specific implementation packages and bankable projects linked to the NDC, NECP and climate-finance pipeline.

8.2 Research and Innovation

Research and innovation are required both to adapt international technologies to the Republic of North Macedonia's conditions and to create domestic capability for their operation, improvement and commercialization. The TNA is explicitly linked to the Smart Specialization Strategy 2024–2027, which identifies sustainable materials, smart buildings, process optimization and energy efficiency, digitalization and ICT, smart agriculture and "Energy for the Future" as priority areas. This creates a direct opportunity to align climate technology policy with economic modernization, industrial competitiveness and knowledge-based growth rather than treating research as a separate activity.

For NDC 3.0, research and innovation should be organized around a limited number of mission-oriented areas with a clear route from research to demonstration and deployment. Priority themes include: power-system integration of high shares of solar and wind; storage and flexibility; energy-efficient and low-carbon buildings; industrial electrification, waste-heat recovery and low-carbon materials; hydrogen pilots and long-term industrial decarbonisation options; sustainable mobility and charging infrastructure; precision agriculture; remote sensing and forest-fire management; circular-economy and methane-reduction technologies; and climate-risk, water and infrastructure modelling. Research programmes should increasingly require demonstration components, open performance data where appropriate, and pathways to replication by utilities, municipalities and private companies.

Universities and research institutions have a central role in this agenda, but the 2026 assessment of tertiary climate education identifies important structural gaps. Climate-relevant content exists in many engineering programmes, particularly in energy and environmental fields, but it remains fragmented, uneven across institutions and frequently elective. Advanced adaptation, climate-data and interdisciplinary content is more limited. The report therefore recommends stronger inter-faculty and inter-university cooperation, shared laboratories, field sites and datasets, joint supervision of climate-related master's and doctoral research, and regular curriculum updates aligned with emerging technologies and EU requirements.

A practical NDC 3.0 research-and-innovation framework should therefore connect government, universities, the Macedonian Academy of Sciences and Arts, research organisations, utilities, municipalities, industry and start-ups around demonstration projects and common data. Competitive support should favour projects that address a defined national technology need, quantify expected climate and economic benefits, include a credible scale-up pathway and strengthen domestic skills or supply chains. Participation in European and international research programmes should be used strategically to access infrastructure, knowledge networks, demonstration finance and technology partnerships that cannot be developed cost-effectively at national scale alone.

8.3 Digitalization and AI

Digitalization is a cross-cutting enabling layer for the entire NDC 3.0 implementation framework. The TNA identifies smart metering, industrial digitalization, remote sensing, GIS, advanced data analytics, digital twins, artificial-intelligence applications and monitoring platforms as tools that can improve energy efficiency, optimize resource use, support predictive maintenance, increase system flexibility and strengthen MRV. The highest-value applications for the Republic of North Macedonia are those that connect digital systems directly to operational decisions: smart-grid management

and renewable integration, industrial energy management, precision agriculture, forest and wildfire monitoring, climate-risk analytics and integrated climate and energy data platforms.

Artificial intelligence should be introduced selectively where it improves decisions rather than as a stand-alone climate measure. In the energy system, AI and machine learning can support short-term load, renewable-generation and electricity-price forecasting, grid congestion management, predictive maintenance of generation and network assets, building energy management and optimized EV charging. In climate and adaptation applications, AI can support high-resolution risk analysis, remote-sensing classification, drought and wildfire early warning, infrastructure stress monitoring and anomaly detection in environmental and MRV datasets. These applications are particularly relevant where conventional analytical capacity is constrained and large volumes of sensor, satellite or operational data need to be processed rapidly.

Digital and AI deployment must, however, be accompanied by data-governance, interoperability, cybersecurity and human-oversight requirements. Models used for public policy or critical infrastructure should be transparent enough to be validated, trained on quality-controlled datasets, and subject to documented performance checks. Capacity building should therefore combine data science and AI skills with domain expertise in energy, climate, engineering and public administration. The energy use and lifecycle footprint of digital infrastructure should also be considered so that digitalization delivers a net environmental benefit.

8.4 Capacity Building Needs

The central finding of the TNA is that technology availability alone will not deliver NDC implementation. The principal constraint is the ability to prepare projects, finance them, install and operate technologies, regulate them, monitor performance and maintain the required data systems. Capacity building should therefore be treated as an investment in implementation capability rather than as a stand-alone training activity. It needs to be continuous, targeted to specific technology pathways and linked to institutional mandates, project pipelines and measurable performance outcomes.

The required capacity is multi-layered. Engineers, installers, energy managers and auditors need technical training and certification; industrial operators and SMEs need energy-management, process-decarbonisation and digitalisation skills; ministries, municipalities, utilities and agencies need stronger capabilities for implementation planning, procurement, regulation, MRV and data management; banks and project developers need skills in climate-finance appraisal and project preparation; and universities and research institutions need stronger capacity for technology transfer, demonstration projects and innovation partnerships. Advanced technologies such as Battery Energy Storage System (BESS), industrial electrification, precision agriculture, remote sensing, GIS-based monitoring and wildfire early-warning systems require specialised expertise and operational readiness across several of these groups at the same time.

Table 23 Priority capacity-building areas for NDC 3.0

Capacity area	Main target groups	Priority actions
Technical skills	Engineers, installers, energy managers, auditors, operators	Professional certification; technical guidelines; commissioning, operation and maintenance; safety.
Industrial capacity	SMEs and industrial operators	Energy audits; ISO 50001; process optimization; electrification; decarbonization roadmaps; digital skills.
Digital and MRV capacity	Public institutions, utilities, municipalities, technical agencies	Integrated MRV and data platforms; GIS/remote sensing; smart metering; data analytics; cybersecurity and interoperability.
Financial and project-preparation capacity	Banks, investors, ministries, municipalities, project developers	Climate-finance appraisal; feasibility studies; cost-benefit analysis; procurement; bankable project pipelines; GCF/GEF/EU/IFI access.
Institutional and regulatory capacity	Ministries, regulators, municipalities, agencies	Coordination mechanisms; permitting and standards; implementation planning; monitoring and evaluation; EU-acquis alignment.
Research, innovation and education	Universities, research institutions, vocational schools, professional bodies	Technology transfer; demonstration projects; shared laboratories and data; curriculum modernization; academic-staff training; interdisciplinary research.

The tertiary-education assessment provides a specific response to the longer-term skills gap. It recommends a common climate-literacy baseline for engineering education, stronger mandatory content on mitigation, adaptation, climate data and modelling, and greater use of project-based and experiential learning. It also recommends an inter-university Climate Education Working Group, shared use of laboratories and climate datasets, and systematic staff development. Short in-service courses for academic staff, participation in international education and engineering networks, integration

of research into teaching, and cooperation with professional associations and non-formal training providers are particularly important for keeping curricula aligned with rapidly evolving technologies.

For implementation, NDC 3.0 should prioritise six capacity-building streams: (i) professional training and certification for engineers, installers, auditors and energy managers; (ii) project-preparation and feasibility capacity in ministries, municipalities, utilities and companies; (iii) climate-finance capability in public institutions, commercial banks and development-finance intermediaries; (iv) MRV, data, GIS, remote-sensing and digital-system capacity; (v) curriculum and academic-staff modernization in universities and vocational education; and (vi) institutional capacity for coordination, permitting, procurement, standards and monitoring. Capacity programmes should be developed together with technology deployment programmes so that training precedes or accompanies investment, rather than following it after equipment has already been procured.

The overall objective is to create a national climate-technology ecosystem in which modelling identifies the scale and timing of technology deployment, the TNA prioritises the most relevant options, research and innovation adapt and demonstrate them, finance mechanisms turn them into projects, and education and capacity building ensure that national institutions and the workforce can operate them. This integrated approach is essential for converting the NDC from a set of targets into a durable implementation capability through 2035 and beyond.

Chapter 9. Governance and Institutional Framework

9.1 Institutional Roles

The implementation of the Republic of North Macedonia's NDC 3.0 is supported by an established institutional framework that provides the foundation for coordinating climate action across sectors and levels of government. As climate change is a cross-cutting issue, effective implementation depends on the active involvement of multiple public institutions, each contributing within its respective mandate. Clear institutional responsibilities, strong leadership and effective cooperation among relevant authorities are essential for delivering the country's mitigation and adaptation commitments.

The Ministry of Environment and Physical Planning (MoEPP) is the lead institution responsible for coordinating the implementation of the NDC and for fulfilling the Republic of North Macedonia's obligations under the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement. The Ministry coordinates the preparation and implementation of national climate policies, oversees the preparation of greenhouse gas inventories and national climate reports, facilitates stakeholder consultations, and serves as the national UNFCCC focal point for international climate negotiations and reporting under the Enhanced Transparency Framework.

The implementation of sector-specific measures is shared among several ministries and public institutions. In addition to the MoEPP, key institutions include the Ministry of Energy, Mining and Mineral Resources, the Ministry of Agriculture, Forestry and Water Economy, the Ministry of Transport, the Ministry of Education and Science, the Ministry of Finance, the Ministry for European Affairs, and other competent authorities responsible for integrating climate objectives into sectoral policies. The Cabinet of the Deputy Prime Minister responsible for economic affairs contributes to policy coordination across economic sectors, while the State Statistical Office provides official statistical data required for greenhouse gas inventories, indicators and national reporting..

The Republic of North Macedonia benefits from well-established national technical expertise in greenhouse gas inventory preparation, emissions projections and mitigation modelling. The Research Centre for Energy and Sustainable Development at the Macedonian Academy of Sciences and Arts (MASA), together with universities, other academic institutions, research organizations and technical agencies, provides scientific and technical support for climate modelling, inventory preparation and policy analysis for energy and non-energy sectors.

While the institutional framework is well established, implementation of NDC 3.0 requires continued strengthening of institutional capacities, improved coordination among institutions, enhanced technical expertise, and adequate human and financial resources. Strengthening institutional capacity at both national and local levels will be essential for ensuring the effective implementation, monitoring and reporting of the Republic of North Macedonia's enhanced climate commitments.[4]

9.2 Coordination Mechanisms

Climate action requires effective coordination among government institutions to ensure coherent planning, implementation and monitoring of NDC 3.0. Well-functioning coordination mechanisms help avoid policy fragmentation, improve resource allocation, facilitate information exchange and ensure that climate objectives are integrated into national development planning.

The institutional coordination framework established during the preparation of the enhanced NDC provides a strong foundation for implementing NDC 3.0. The preparation process involved close cooperation among government institutions, technical experts and sectoral representatives through inter-institutional consultations and thematic working groups. This collaborative approach has strengthened institutional ownership of climate policies and provides an effective basis for continued coordination during implementation.

In parallel, the Republic of North Macedonia has been strengthening its high-level institutional coordination framework for climate action. Preparatory work supported by UNDP in 2023 focused on the operationalisation of the National Coordinating Council for Climate Action, including work on its legal and institutional arrangements. The Council is envisaged under the emerging climate-governance framework as a high-level advisory and coordination mechanism that could support the integration of climate objectives across sectors and strengthen inter-institutional coordination. As the relevant legal framework is still under development, the Council should be understood as a proposed institutional arrangement rather than an established operational body.

The preparation of the Republic of North Macedonia's NDC 3.0 is coordinated by the MoEPP with support from the United Nations Development Programme (UNDP). Following the launch of the NDC 3.0 preparation process, UNDP

[4] enhanced NDC

initiated the engagement of national experts, while the Research Centre for Energy and Sustainable Development at the MASA is responsible for coordinating the technical work. MASA facilitates cooperation among sectoral experts, organizes coordination meetings, and leads the collection and integration of information, data and analyses provided by the relevant ministries, public institutions, academia and other stakeholders. This collaborative process ensures that the NDC is developed based on the best available scientific evidence, sector-specific expertise and broad institutional participation.

Since 2022, the Republic of North Macedonia has been a member of the NDC Partnership, a global coalition supporting countries in the implementation of their Nationally Determined Contributions. Through this partnership, the country receives technical assistance and capacity-building support aimed at strengthening institutional coordination, mainstreaming climate objectives into national and subnational planning and budgeting, and promoting a whole-of-government and whole-of-society approach to climate action. Participation in the NDC Partnership complements national efforts to enhance governance arrangements and accelerate the implementation of NDC 3.0.[5]

Effective coordination also requires alignment between NDC implementation and other strategic planning documents, including the National Energy and Climate Plan, Long-Term Strategy on Climate Action and Action Plan, the National Development Strategy, Biennial Transparency Reports, National Communications, sectoral strategies and the country's obligations under the EU accession process. Integrating climate objectives across these policy frameworks promotes policy coherence and increases implementation efficiency.

9.3 Stakeholder Engagement

The successful implementation of the Republic of North Macedonia's NDC 3.0 depends on broad participation across society. Climate change affects all sectors of the economy and society, and achieving the country's climate objectives requires the active involvement of public institutions, local authorities, civil society organizations, academia, the private sector, financial institutions, development partners and citizens.

The Republic of North Macedonia has adopted an inclusive approach in the preparation of its climate policies, ensuring that stakeholders are consulted throughout policy development and decision-making processes. This participatory approach contributes to greater transparency, strengthens public ownership of climate policies and improves the quality and feasibility of proposed measures.

Stakeholders engaged throughout the NDC process included sectoral ministries, the Ministry for European Affairs, the State Statistical Office, Ministry of Energy, Mining and Mineral Resources, municipalities represented by the City of Skopje and the Association of Units of Local Self-Government (ZELS), chambers of commerce, industrial representatives, the Agency for Innovation Activity, Scientific and Technological Development and Entrepreneurship, environmental non-governmental organizations, youth-led environmental initiatives, universities, research institutions, international organizations, and financial institutions. In 2025, the Ministry of Environment and Physical Planning (MoEPP) established a project working group for the preparation of BTR1/BTR2 and NDC 3.0, bringing together representatives of the relevant institutions and stakeholders involved in the UNFCCC reporting process.

Civil society organizations play an important role in raising public awareness, promoting community-based climate action, supporting policy implementation and monitoring progress. Universities and research institutions contribute scientific expertise, climate modelling, socio-economic analysis and technological assessments that support evidence-based policymaking. Business associations and financial institutions provide valuable perspectives on investment needs, technological innovation and opportunities for green economic development. Special attention should continue to be given to ensuring the meaningful participation of women, youth, vulnerable groups and local communities, in line with the principles of social inclusion, gender equality and a just transition. Public consultations, stakeholder forums, digital engagement platforms and targeted communication campaigns should remain integral components of NDC implementation, monitoring and future revisions.

9.4 Local Authorities

Municipalities play a central role in implementing many of the measures included in the Republic of North Macedonia's NDC 3.0. Following the decentralization process, local self-governments have assumed significant responsibilities in areas directly relevant to climate action, including spatial planning, local infrastructure, public buildings, waste management, water services and local economic development. However, considerable differences in institutional, technical and financial capacities exist among municipalities, reflecting broader regional development disparities. These differences underline the importance of providing targeted support and strengthening local capacities to ensure that climate action is implemented effectively across the entire country.[6]

[5] https://ndcpartnership.org/country/mkd

[6] National development strategy 2024-2044

Local governments are increasingly integrating climate considerations into local development planning and implementing measures that contribute to greenhouse gas emission reductions and climate resilience. Many municipalities have already implemented energy efficiency projects and invested in renewable energy and sustainable urban mobility initiatives.

Municipal coordination is further supported through the Association of the Units of Local Self-Government (ZELS), which facilitates cooperation among municipalities, promotes the exchange of good practices and supports capacity development on climate-related issues. The City of Skopje, together with other municipalities, has already gained valuable experience through the preparation and implementation of sustainable energy and climate action plans that can serve as models for wider replication.

National institutions support municipalities through policy guidance, technical assistance, capacity-building programmes and access to financial resources. Cooperation between central and local authorities facilitates the implementation of national climate policies while allowing municipalities to address local priorities and specific climate risks.

Strengthening the role of municipalities will require continued efforts to enhance technical and administrative capacities, improve access to climate finance, develop local greenhouse gas inventories and climate risk assessments, and strengthen coordination with national institutions. Greater exchange of knowledge and good practices among municipalities can further accelerate local climate action and contribute to more effective implementation of national commitments.

9.5 Private Sector Engagement

The private sector is an indispensable partner in achieving the objectives of the Republic of North Macedonia's NDC 3.0. Businesses, financial institutions and investors play a critical role in mobilizing the investments, technologies and innovation needed to support the transition to a low-carbon and climate-resilient economy.

This sector already makes a significant contribution to the implementation of country's climate policies, particularly through investments in renewable energy, energy efficiency, industrial modernization and improved waste management. Private investment has been instrumental in expanding renewable energy capacity and introducing cleaner technologies, demonstrating the sector's growing role in supporting the country's decarbonization objectives.

Private sector participation is particularly important in sectors such as renewable energy, energy efficiency, industry, transport, construction, waste management and circular economy initiatives. Companies are increasingly integrating climate considerations into their business strategies through investments in clean technologies, resource efficiency, sustainable production processes and climate risk management.

The Government supports private sector engagement through the development of enabling policy and regulatory frameworks, financial incentives, investment support programmes and measures that improve access to climate finance. As the investment needs associated with the implementation of NDC 3.0 continue to grow, private capital is expected to provide a substantial share of the financing required, particularly in the energy, industrial and infrastructure sectors. Public-private partnerships, while safeguarding the public interest, together with blended finance approaches and innovative financing mechanisms can further accelerate the deployment of low-carbon technologies and climate-resilient investments.

Financial institutions also play an increasingly important role by developing green financial products, incorporating climate-related risks into investment decisions and facilitating access to sustainable finance. The further development of sustainable finance instruments, including green and sustainability-linked bonds, guarantee schemes and other innovative financing mechanisms, can help mobilize additional private investment for climate mitigation and adaptation. Strengthening cooperation between government, businesses, research institutions and development partners can stimulate innovation, improve competitiveness and support the creation of green jobs.

In addition, businesses are encouraged to strengthen corporate climate governance by assessing climate-related risks and opportunities, monitoring greenhouse gas emissions, adopting sustainability reporting practices and integrating decarbonization objectives into their long-term business strategies.[7]

[7] enhanced NDC and National development strategy 2024-2044

Chapter 10. Monitoring, Reporting and Verification

10.1 ETF Alignment

As a Party to the Paris Agreement, the Republic of North Macedonia is committed to implementing the Enhanced Transparency Framework (ETF) established under Article 13 of the Paris Agreement. The ETF provides a common framework for monitoring, reporting and reviewing information on greenhouse gas emissions and removals, progress towards NDCs, climate change adaptation actions, and support provided and received.

The Republic of North Macedonia has made significant progress in aligning its national transparency arrangements with the requirements of the ETF, building upon long-standing experience in preparing national greenhouse gas inventories, National Communications and Biennial Update Reports under the UNFCCC. The preparation of the country's first Biennial Transparency Report (BTR1) represents an important milestone in operationalizing the ETF and strengthening national capacities for transparent and consistent climate reporting. Furthermore, activities are ongoing for the preparation of the combined Second Biennial Transparency Report and Fifth National Communication (BTR2/NC5), which further supports the establishment of continuous and sustainable transparency arrangements under the Paris Agreement.

The implementation of the ETF requires the establishment of a comprehensive and sustainable national transparency system that ensures regular data collection, quality assurance, monitoring of climate policies and measures, and reporting in accordance with the Modalities, Procedures and Guidelines (MPGs) adopted under Decision 18/CMA.1. In the Republic of North Macedonia, several elements of such a system are already in place, including the national greenhouse gas inventory system, sectoral monitoring arrangements and established procedures for preparing climate-related reports. However, these elements are not yet fully integrated into a single, legally established and permanent transparency framework. For the Republic of North Macedonia, ETF implementation is also closely related to progressive alignment with the climate-reporting acquis applied through the Energy Community, particularly the Governance Regulation framework and the associated electronic reporting arrangements, including Reportnet 3 (the European Environment Agency (EEA) electronic platform for environmental and climate reporting (https://reportnet.europa.eu/)).

According to the assessment of the current MRV system, the Republic of North Macedonia has developed important technical foundations for transparency reporting, particularly through the preparation of national greenhouse gas inventories, but the overall MRV framework remains in a transition phase from a project-based approach towards a permanent institutionalized system. Existing MRV elements are functioning in practice, but they are not yet fully integrated into a single legally established framework covering all climate policies, measures and reporting requirements.

The national transparency system is currently undergoing a transition towards a more systemic and institutionalized framework. The amendments to the Ministry's internal organization and systematization approved in 2026 establish dedicated functions for climate monitoring, reporting and greenhouse gas emissions permitting, addressing an important part of the previously identified institutional gap. Remaining challenges include completion of the legal and secondary-legislation framework, adequate staffing, formalized inter-institutional data exchange, and improved digital data-management mechanisms among relevant institutions.

To support this transition, capacity-building activities are being implemented to strengthen institutional and technical capacities for the establishment and operation of an effective MRV/ETF system. Within the project supporting the preparation of BTR1 and BTR2/NC5, dedicated training modules have been organized focusing on the fundamentals of MRV and ETF requirements, institutional responsibilities, coordination in the preparation of BTRs, application of the TACCC principles (transparency, accuracy, completeness, consistency and comparability), and reporting on policies, measures and projections. These activities aim to improve understanding among relevant institutions and strengthen the foundations for a coordinated national transparency system.

The national transparency system relies on cooperation among multiple institutions involved in climate-related data collection, analysis and reporting. The new 2026 organizational arrangements strengthen the permanent MRV/MRVA functions within the Ministry of Environment and Physical Planning, while effective implementation will continue to depend on designated reporting responsibilities in sectoral institutions, formal data-sharing procedures and continuous capacity development.

The Climate Action Law framework under development is expected to provide the broader legal basis for ETF alignment by defining institutional responsibilities and reporting obligations, while the secondary legislation should operationalize inventory preparation, data provision, monitoring plans, annual emissions reporting, verification, accreditation and permitting. Continued development of this framework should ensure reliable monitoring of NDC implementation and effective fulfilment of the Republic of North Macedonia's international reporting obligations under the Paris Agreement.

10.2 BTR Linkages

The monitoring framework for the implementation of the NDC is closely linked with the reporting requirements under the Enhanced Transparency Framework and the preparation of BTRs. The BTR process serves as the primary mechanism for compiling and reporting information on greenhouse gas emissions and removals, progress in implementing and achieving the NDC, mitigation policies and measures, projections, adaptation actions, and support needed and received.

The preparation of the first Biennial Transparency Report has contributed to strengthening national capacities for data collection, management and reporting, while also identifying existing gaps and challenges in institutional arrangements and data availability. The information and datasets developed through the BTR process provide an important basis for tracking NDC implementation and for improving consistency between national climate planning, implementation and international reporting obligations.

The continued preparation of future BTRs will further contribute to the institutionalization of transparency arrangements and support the establishment of a more integrated and sustainable system for monitoring climate actions and assessing progress towards national climate objectives.

To reduce duplication, the datasets used for NDC tracking should be mapped to the information required for BTR reporting and, where applicable, to the relevant Reportnet 3 dataflows. The national MRV assessment recommends a methodological crosswalk linking ETF requirements with corresponding electronic reporting fields and using practical system-performance tests, such as timely preparation of BTR tables from validated national datasets.

10.3 Indicators

Monitoring NDC implementation is based on a set of quantitative and qualitative indicators covering greenhouse gas emissions, implementation of mitigation measures, adaptation actions and enabling conditions. The primary indicator for assessing progress towards the mitigation targets is the level of greenhouse gas emissions and removals, as reported through the national greenhouse gas inventory.

Additional indicators include sector-specific parameters such as primary and final energy consumption, energy intensity, the share of renewable energy sources in gross final energy consumption, energy savings achieved through implemented measures, transport activity indicators, waste generation and treatment data, land use and forestry indicators, and other relevant socioeconomic parameters.

The MRV assessment highlights that indicator availability and monitoring capacity differ significantly among sectors. The energy sector has the most developed monitoring practices due to existing energy efficiency and renewable energy reporting obligations, while other sectors require further development of systematic data collection and indicator tracking mechanisms.

Data for these indicators are obtained from existing national information systems, including the State Statistical Office, sectoral ministries and agencies, administrative databases, energy balances, and other official sources. Although indicator systems are relatively well developed in certain sectors, particularly energy, further efforts are needed to establish a harmonized and comprehensive set of indicators covering all sectors relevant for NDC implementation and to ensure their regular monitoring and reporting.

The development of reliable emissions monitoring and reporting systems is also becoming increasingly important in the context of the Republic of North Macedonia’s economic integration with the European Union and the implementation of the EU Carbon Border Adjustment Mechanism (CBAM). Although CBAM obligations apply to importers placing covered goods on the EU market, companies from the Republic of North Macedonia exporting CBAM-covered products to the EU may be required to provide verified information on embedded greenhouse gas emissions. Strengthening the availability, quality and traceability of emissions data will therefore support both compliance with international transparency requirements under the ETF and preparedness for emerging EU climate-related regulatory requirements.

10.4 Institutional Responsibilities

The institutional framework for monitoring, reporting and verification of climate actions in the Republic of North Macedonia currently involves several institutions, with the Ministry of Environment and Physical Planning serving as the central coordinating authority responsible for climate policy development and international reporting under the UNFCCC and the Paris Agreement. In 2026, this role was strengthened through amendments to the internal organization and systematization of the Ministry, which establish a dedicated Climate Action Sector within the Environmental Administration, including a Unit for Monitoring and Reporting and a Unit for Issuing Greenhouse Gas Emissions Permits.

10.5 Institutionalisation of MRV/MRVA Functions in 2026

The amended organizational rulebook assigns the Climate Action Sector functions covering monitoring and reporting of greenhouse gas emissions, coordination of the MRVA system, preparation of national inventories and annual greenhouse gas reports, reporting on policies and measures and adaptation measures, participation in the future

emissions-trading mechanism, issuance of greenhouse gas emissions permits, and cooperation with relevant national and international institutions.

The Unit for Monitoring and Reporting is assigned responsibilities for managing the MRV system, preparing national inventories and reports, supporting greenhouse gas calculation methodologies, cooperating with industry and other data providers, supporting accredited bodies and verifiers, developing training programmes and providing information to institutions and the public. The Unit for Issuing Greenhouse Gas Emissions Permits is assigned installation-level functions related to permit procedures, monitoring plans, operator compliance, emissions reporting, verification and coordination with competent authorities and verifiers. The systematization rulebook creates dedicated managerial, advisory, data-processing, legal/regulatory and administrative posts for these functions.

Various sectoral institutions contribute to data collection and reporting within their respective areas of competence, including institutions responsible for energy, transport, agriculture, forestry, waste management, industry and statistics. The State Statistical Office plays an important role in providing official statistical data and indicators used in greenhouse gas inventories, projections and monitoring of climate policies and measures.

Responsibilities for climate-related data remain distributed among several institutions, but the 2026 organizational changes provide a clearer permanent structure for MRV/MRVA functions within the Ministry of Environment and Physical Planning. The main remaining coordination need is therefore to connect this internal structure with sectoral data providers through clear mandates, nominated contact persons, agreed reporting formats, formal data-sharing procedures and a common reporting calendar.

The new internal organization addresses part of the previously identified fragmentation within the Ministry, but institutional responsibilities across the wider national MRV system remain partly distributed. Experience and technical capacities developed through national communications, biennial reports and greenhouse gas inventories should therefore be embedded in permanent procedures for inventory preparation, policies and measures, projections, adaptation reporting and support tracking.

The adoption of the Climate Action Law is expected to significantly strengthen the institutional framework by defining responsibilities, establishing legal obligations for data provision and reporting, and improving coordination mechanisms. Strengthening administrative capacities remains one of the main priorities for successful ETF implementation. The MRV assessment identifies limited human resources, insufficient specialized expertise and the need for continuous capacity development as important challenges for maintaining a sustainable transparency system.

Stakeholder participation constitutes an important element of the national climate governance system. Representatives of academia, civil society organizations, the private sector and development partners have regularly contributed to the preparation of national reports and strategic documents. However, further efforts are needed to establish more formalized and continuous mechanisms for stakeholder engagement in monitoring and reporting processes.

10.6 Alignment with the EU MRV/MRVA Framework

EU alignment involves two related but distinct transparency layers. Economy-wide national climate monitoring and reporting is framed by Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action and Commission Implementing Regulation (EU) 2020/1208, which covers reporting on national greenhouse gas inventories, policies and measures, projections, adaptation and related information. For the Republic of North Macedonia, these requirements are progressively reflected through the adapted Energy Community governance and reporting framework, including use of Reportnet 3.

Installation-level MRVA for alignment with the EU Emissions Trading System should be distinguished from economy-wide NDC accounting. The relevant EU benchmark is Directive 2003/87/EC together with Commission Implementing Regulation (EU) 2018/2066 on monitoring and reporting of greenhouse gas emissions and Commission Implementing Regulation (EU) 2018/2067 on verification of data and accreditation of verifiers. National secondary legislation on monitoring plans, annual emissions reports, verification, accreditation and greenhouse gas emissions permits should be aligned with this framework.

The EU Carbon Border Adjustment Mechanism is closely related to the need for reliable installation- and product-level emissions data, but it should not be treated as identical to NDC MRV. The national MRV system should therefore maintain a clear methodological distinction between economy-wide inventory and NDC indicators, EU ETS-style installation MRVA data, and CBAM-related embedded-emissions information, while enabling appropriate data interoperability between these components.

10.7 Reporting Schedule

The reporting schedule for monitoring NDC implementation is aligned with the reporting requirements under the Paris Agreement and should also be coordinated with the Energy Community and relevant EU-aligned climate reporting obligations in order to avoid parallel requests for the same national data.

Greenhouse gas inventories are prepared and updated regularly, providing information on emission trends and the effects of implemented policies and measures. Biennial Transparency Reports are prepared every two years in accordance with the requirements of the Enhanced Transparency Framework and represent the main instrument for communicating progress in NDC implementation.

The preparation of BTR1 and the planned preparation of subsequent BTR cycles mark the transition towards a regular reporting cycle under the ETF. The Republic of North Macedonia submitted its BTR1 in July 2026, marking the country's transition to the regular reporting cycle under the ETF. Continued improvement of data collection procedures, institutional coordination and quality assurance processes will be required to ensure timely and consistent reporting in future cycles.

Monitoring of sectoral indicators and implementation of policies and measures is undertaken continuously, depending on data availability and institutional reporting cycles. Future reporting arrangements are expected to become more systematic through the establishment of a permanent legal and institutional framework under the Climate Action Law. The national MRV system is currently being further developed and institutionalized, with ongoing work under the BTR2/NC5 process addressing institutional coordination, data collection, reporting procedures and capacity development.

As the secondary legislation and digital reporting arrangements are operationalized, the national MRV calendar should specify the responsible institution, dataset, validation step, reporting channel and deadline for each recurring submission. The MRV framework is being developed with the aim of ensuring alignment with the Modalities, Procedures and Guidelines (MPGs) of the ETF, while further operationalization and institutionalization will be required to ensure full and consistent application of the ETF requirements in future reporting cycles. This would allow the same validated information to be reused consistently for NDC monitoring, BTR preparation, NECP/Energy Community reporting and other applicable reporting requirements.

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Chapter 11. Proposed NDC 3.0 Target

A BTR-grounded, progression-compliant target architecture for 2030-2035

EXECUTIVE TARGET RECOMMENDATION
2030 - preserve the absolute commitment and recalculate the percentage: the NDC 2.0 / Energy Community benchmark of approximately 2,203 Gg CO2-eq net emissions in 2030 is retained. Under the revised BTR1 1990 net inventory of 10,711 Gg CO2-eq, this corresponds to approximately 79.4% below 1990. The historical 82% formulation should be retained in the reconciliation narrative, not mechanically applied to the new denominator.
2035 - modest unconditional progression, higher conditional ambition: the unconditional target is to reduce net GHG emissions to approximately 2,142 Gg CO_2-eq by 2035, corresponding to at least 80% below the revised 1990 net level. Subject to substantially stronger policy implementation and, in particular, sufficient international financial and technical support, the conditional target is to reduce net GHG emissions further, to approximately 1,928 Gg CO_2-eq, corresponding to an 82% reduction below the revised 1990 net level.
Technology sequencing - avoid an unrealistic pre-2035 jump: the updated NECP retains one additional gas-fired CHP plant around 2030 as transitional capacity, while deeper substitution of natural gas by hydrogen and other low-carbon technologies is expected mainly after 2035. The 2035 target should therefore remain relatively close to the 2030 level, with stronger reductions after 2035.
2050 - legally and strategically anchored endpoint: the Climate Action Law and updated NECP establish climate/carbon neutrality by 2050 as the long-term endpoint. The 2035 target is an intermediate milestone on that trajectory.

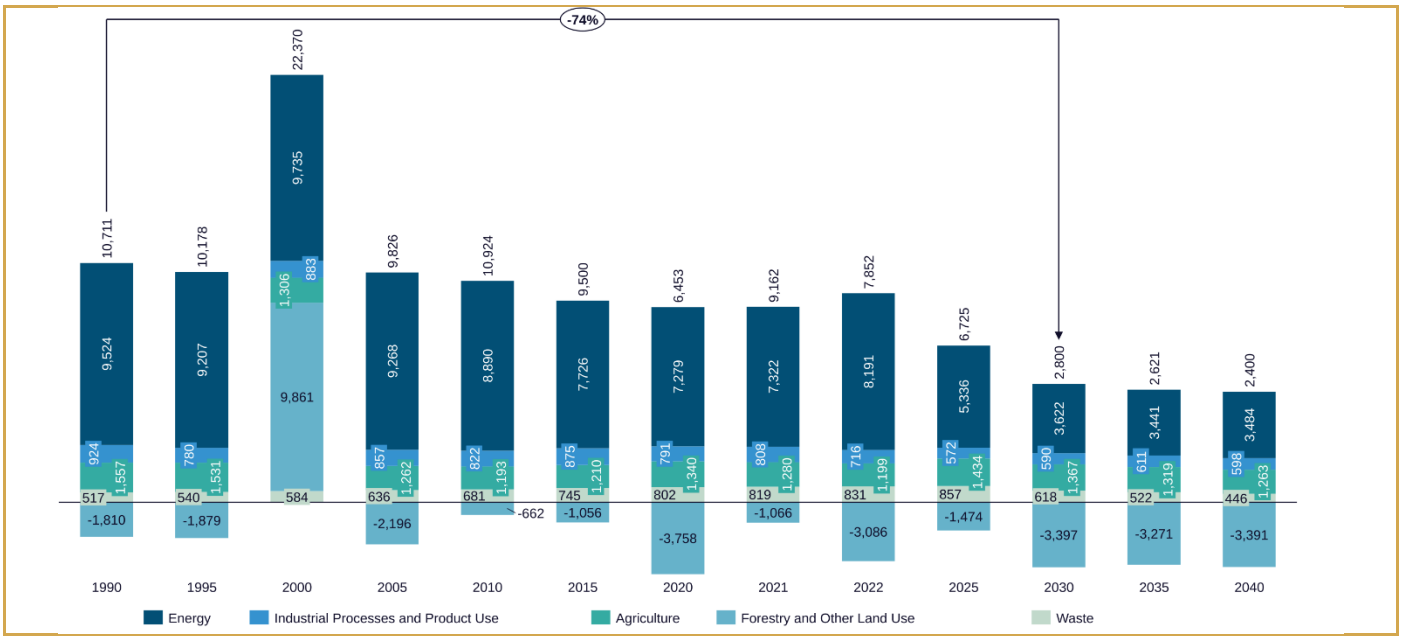
Why this architecture matters. The source documents contain three different but legitimate perspectives: NDC 2.0 is the existing international commitment; the BTR1 mitigation analysis is the most up-to-date integrated technical pathway; and the updated NECP is the principal energy-and-climate planning instrument. In addition, the 2050 climate-neutrality objective provides the long-term endpoint against which the 2035 contribution must be judged. A high-integrity NDC 3.0 should reconcile these elements explicitly rather than select one set of numbers and discard the others.

11.1 Methodology for Target Setting

The proposed NDC 3.0 target should be set through a transparent hierarchy of evidence: first, preserve the legal and political continuity of the existing NDC; second, anchor feasibility in the latest national inventory and BTR1 mitigation modelling; third, test consistency with the updated NECP and Energy Community obligations; fourth, apply the Paris Agreement progression and highest-possible-ambition tests; and fifth, identify the incremental package of measures and support required to close any remaining ambition gap. This sequence separates the question “what can the current modelled package deliver?” from the distinct question “what should the country communicate as its next NDC?”

The BTR1 mitigation assessment provides the strongest current technical foundation because it applies a common scenario framework - Without Measures (WOM), With Existing Measures (WEM) and With Additional Measures (WAM) - across the main IPCC sectors. The WAM portfolio analyses 69 mitigation policies and measures across Energy, IPPU, Agriculture, Forestry/Land Use and Waste, supported by 16 horizontal enabling measures. Its results therefore capture interactions across the whole system rather than treating individual measures in isolation. The BTR1 reports net emissions of approximately 2,800 Gg CO2-eq in 2030, 2,621 Gg CO2-eq in 2035 and 2,400 Gg CO2-eq in 2040 under WAM (Figure 37).

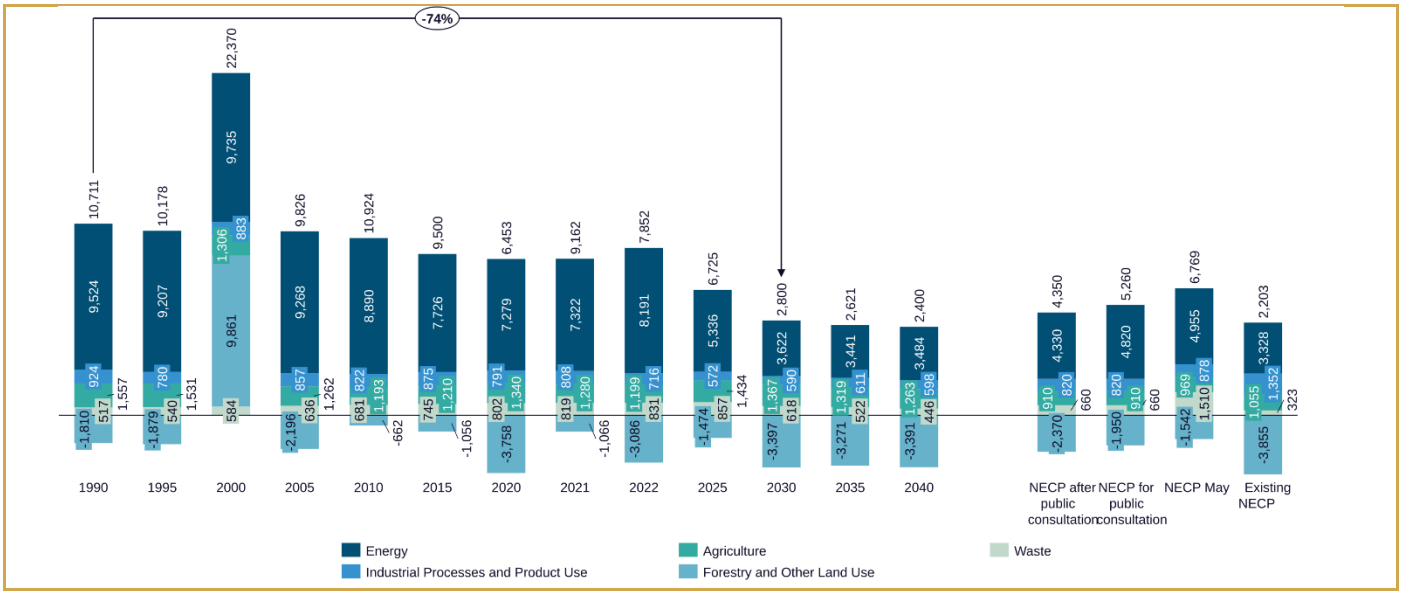
Figure 37 BTR1 WAM emissions pathway by sector, including FOLU removals



Source: Climate Change Mitigation Report - First Biennial Transparency Report (2026), original Figure 58.

The updated NECP is used as a policy-consistency and implementation test rather than as a substitute for the NDC target. Its current headline table reports 2030 gross GHG emissions of 6.72 Mt CO2-eq (-46.1% from 1990) and net emissions including removals of 4.35 Mt CO2-eq (-60.2% from the NECP 1990 net reference of 10.93 Mt CO2-eq) (Figure 38). The BTR1 explains that the two documents were developed with different modelling logics: the BTR1 uses integrated whole-energy-system optimisation, while the NECP uses a more sector-specific framework with electricity-system optimisation and a number of exogenous assumptions. The largest differences occur in the Energy and FOLU sectors, including treatment of electricity exports, forest and land-use data, perennial plantations and burned areas.

Figure 38 BTR1 WAM pathway compared with successive NECP results



Source: Climate Change Mitigation Report - First Biennial Transparency Report (2026), original Figure 61.

The target-setting calculation should use one frozen inventory methodology and one explicit accounting convention. The recommended formulation is:

Reduction (%) = [1 - (target-year net GHG emissions / 1990 net GHG emissions)] x 100

Crucially, the same inventory methodology must be applied to the 1990 base year and the target year. NDC 2.0 itself anticipated this situation: its ICTU information states that the 1990 national GHG value may be updated and recalculated as inventory methodologies improve, with such updates reported through Biennial Transparency Reports. Accordingly, NDC 3.0 should never present a percentage target without the associated absolute emissions value and the inventory vintage used to calculate it. This is especially important for a net target because revisions to FOLU/LULUCF removals can materially change the 1990 net denominator even when gross emissions change only marginally.

11.1.1 Recalculation of the 1990 Reference Year and Absolute-Value Reconciliation

The recalculation of the 1990 inventory is not a technical footnote; it changes how the headline percentage must be interpreted. In NDC 2.0, 1990 gross emissions were 12,478 Gg CO2-eq and 1990 net emissions were 12,271 Gg CO2-eq. The implied 1990 LULUCF sink was therefore only about -207 Gg CO2-eq. The 2030 values shown in that submission were 6,058 Gg gross and 2,203 Gg net, corresponding to the communicated 51% gross and 82% net reductions.

The BTR1 mitigation assessment uses the revised national inventory series. In the BTR1 sectoral balance for 1990, gross emissions sum to approximately 12,522 Gg CO2-eq, FOLU removals are approximately -1,810 Gg CO2-eq, and net emissions are approximately 10,711 Gg CO2-eq. Relative to the NDC 2.0 inventory vintage, the gross 1990 value changes by only about 44 Gg (+0.35%), whereas the net 1990 value decreases by about 1,560 Gg (-12.7%). The difference is overwhelmingly explained by the much larger recalculated 1990 land-sector sink. The updated NECP uses a closely related but not identical 1990 reference of 12.48 Mt gross and 10.93 Mt net, again demonstrating why the final NDC must lock one inventory vintage before fixing absolute target values.

The updated NECP itself already documents this evolution of the base year. Its Table 6 shows that the 1990 gross total remained close to 12.5 Mt CO2-eq across successive reports, while the estimated 1990 sink became progressively larger: -0.21 Mt in the 3rd BUR, -1.21 Mt in the first NECP and -1.55 Mt in the Fourth National Communication. The NECP then restated the Fourth National Communication using AR5 global warming potentials, giving 10.93 Mt CO2-eq net in 1990. BTR1 advances the inventory one step further, with approximately 12.522 Mt gross, -1.810 Mt FOLU and 10.711 Mt net in 1990. BTR1 also recalculates the full historical time series using updated activity data, improved emission factors and AR5 GWP values. This evolution must be explained explicitly in the NDC because it materially affects percentage reductions expressed against net 1990 emissions.

Table 24 Evolution of the 1990 GHG reference point across national reporting vintages

Reporting / inventory vintage	1990 gross (Mt CO2-eq)	1990 FOLU/LULUCF (Mt)	1990 net (Mt CO2-eq)	Why it matters
3rd BUR / NDC-era basis	12.48	-0.21	12.27	Basis closest to the original 82% net-target denominator.
NDC 2.0	12.48	-0.21	12.27	Reference basis for the 51% gross and 82% net reduction targets communicated under NDC 2.0.
1st NECP	12.48	-1.21	11.27	Major upward revision of the estimated 1990 sink.
4th National Communication	12.32	-1.55	10.78	Further inventory and land-sector refinement.
4th NC restated with AR5 in updated NECP	12.48	-1.55	10.93	Metric harmonisation with AR5 changes the CO2-eq total.
BTR1 revised inventory	12.522	-1.810	10.711	Latest integrated basis used by the BTR1 mitigation pathway; full time-series recalculation.

Target-accounting implication. Inventory recalculation is normal good practice and should not be interpreted as a real-world emissions reduction or increase. For NDC 3.0, the 2030 commitment should therefore be reconciled by preserving the absolute emissions level communicated in NDC 2.0 while restating its percentage equivalent against the latest recalculated 1990 inventory. The submission should report the original NDC 2.0 formulation, the revised 1990 reference value, the unchanged absolute 2030 ceiling, and a short methodological reconciliation explaining why the percentage changes when the base-year inventory is revised.

Using this approach, the NDC 2.0 net-emissions level of approximately 2,203 Gg CO2-eq in 2030 remains the reference absolute ceiling. Under the inventory vintage used for NDC 2.0, this value was presented as an 82% reduction relative to 1990. The BTR11 recalculates 1990 net emissions to approximately 10,711 Gg CO2-eq; against this revised base, the same 2,203 Gg absolute level corresponds to a reduction of approximately 79.4%. Accordingly, NDC 3.0 should present 82% as the historical expression of the NDC 2.0 target and approximately 79.4% as its updated percentage equivalent under the BTR1 inventory basis. The change in percentage is an accounting consequence of the revised 1990 inventory, not a weakening of the absolute 2030 commitment.

Table 25 Reconciliation of the 1990 reference point and equivalent absolute targets

Indicator	NDC 2.0 (2021 vintage)	BTR1 revised inventory	Updated NECP	NDC-design implication
1990 gross GHG emissions	12,478 Gg	12,522 Gg	12,480 Gg	Gross base is essentially stable across vintages.
1990 FOLU/LULUCF balance	-207 Gg (implied)	-1,810 Gg	-1,550 Gg (implied)	Land-sector recalculation is the

Indicator	NDC 2.0 (2021 vintage)	BTR1 revised inventory	Updated NECP	NDC-design implication
				main driver of the changed net base.
1990 net GHG emissions	12,271 Gg	10,711 Gg	10,930 Gg	Net percentage targets are not directly comparable without a common inventory vintage.
51% gross reduction - equivalent 2030 ceiling	6,058 Gg (communicated)	6,136 Gg (recalculated equivalent)	6,115 Gg (equivalent)	Only a small absolute shift because the gross base changed little.
NDC 2.0 net 2030 absolute ceiling	2,203 Gg (historical 82% formulation)	2,203 Gg = ~79.4% below revised 1990 net base	2,203 Gg = ~79.8% below NECP 1990 net base	Preserve the absolute 2030 level; update the percentage expression when the 1990 inventory is recalculated.
Illustrative 2035 target architecture	n/a	80% unconditional = 2,142 Gg; 82% conditional = 1,928 Gg	80% = 2,186 Gg; 82% = 1,967 Gg	Use one final inventory vintage for the official NDC values; higher ambition is explicitly conditional on additional support.

Interpretation: the change from the historical 82% formulation to approximately 79.4% under the BTR1 inventory basis is caused by the recalculation of the 1990 net reference value, particularly the revised FOLU/LULUCF sink. It should therefore be separated from the assessment of real mitigation progress. Once the 2030 benchmark is expressed consistently as 2,203 Gg CO2-eq, the BTR1 WAM and updated NECP projections can be compared directly with the standing absolute target and the implementation gap can be assessed without conflating it with inventory revisions.

11.2 Target-setting protocol

Step	Test	Evidence	Decision rule
1	Inventory lock	Latest national GHG inventory/BTR1 inventory series	Recalculate the 1990 reference and all target-year values using one inventory vintage.
2	Continuity	NDC 2.0 and Energy Community 2030 obligation	Preserve the standing 2030 absolute ceiling and restate its percentage equivalent using the final inventory vintage.
3	Feasibility	BTR1 WAM and sectoral measures	Use WAM as the technical anchor and quantify the gap to the proposed NDC target.
4	Policy consistency	Updated NECP	Explain modelling differences; align measures and assumptions where possible without forcing identical results.
5	Progression	Paris Agreement Article 4.3 and international NDC 3.0 practice	Set a modest unconditional progression beyond the reconciled 2030 target and a higher conditional level only where implementation and support are credible.
6	Finance/conditionality	Measure-level investment and financing status	Tag each measure as domestic/secured, committed support, or additional support required; link the higher 2035 ambition explicitly to the additional package.
7	Integrity	Gross versus net emissions; FOLU sink	Report gross and net outcomes separately and avoid reliance on an assumed sink to carry the target.

11.3 International NDC 3.0 design benchmark

Recent NDCs show a consistent design pattern that is directly relevant for the Republic of North Macedonia: the previous 2030 target is retained, a new post-2030 target is added, the target is economy-wide and quantified, and the treatment of inventory recalculations and conditionality is made explicit. The table below summarizes the most useful comparators.

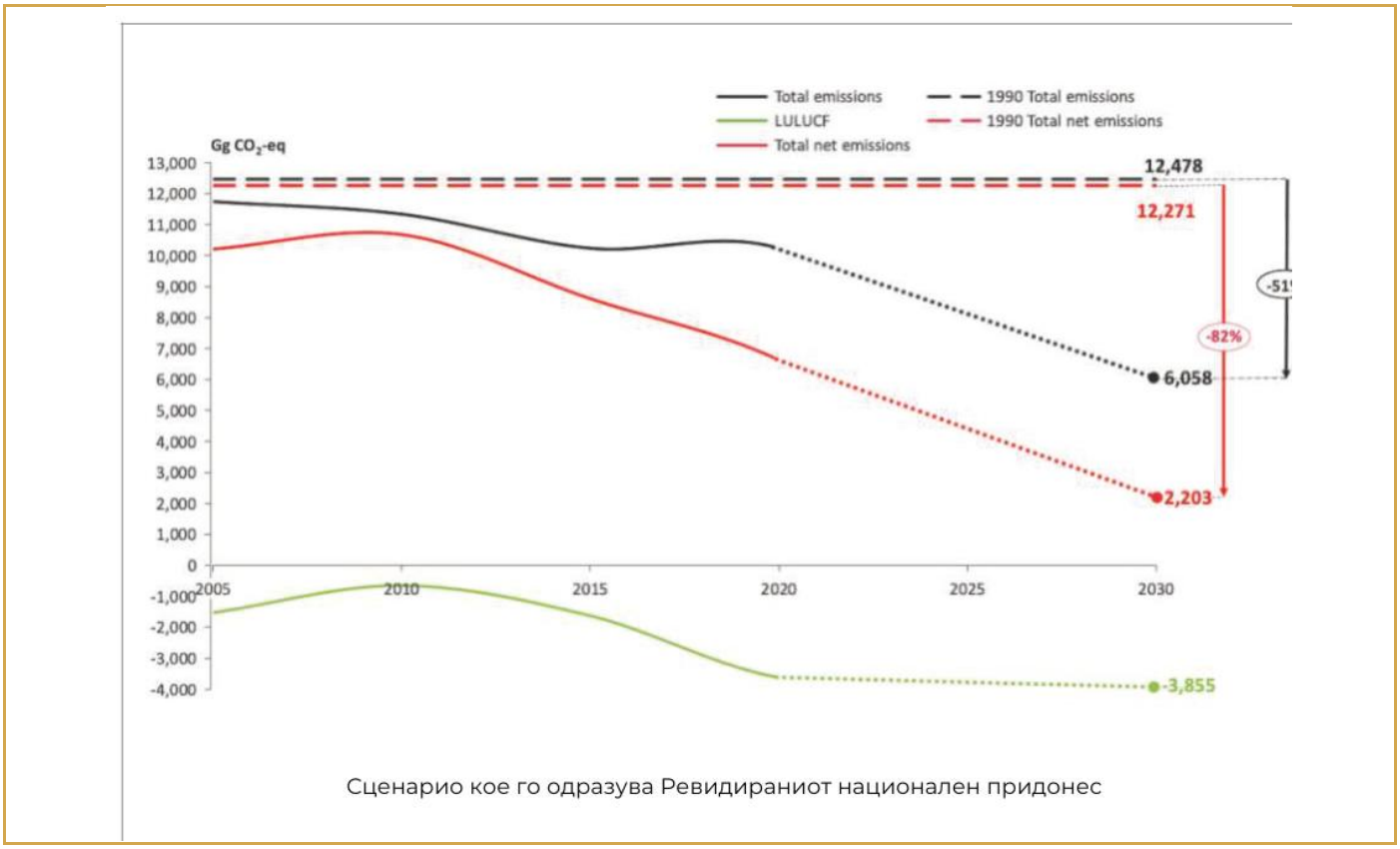
Party	2030 position	New target	Conditionality / accounting	Design lesson for the Republic of North Macedonia
United Kingdom	68% below 1990 remains in place	At least 81% by 2035	Economy-wide net target; base/target values updated with inventory revisions	Retain 2030; add a stronger 2035 single-year target; state recalculation rules.
Norway	At least 55% below 1990 maintained	At least 70-75% by 2035	Domestic action + EU cooperation; Article 6/ITMOs if necessary	Use a transparent ambition range only where implementation architecture is clear.
European Union	At least 55% net by 2030 retained	Indicative 66.25-72.5% by 2035; binding 90% by 2040	Inventory values may be updated; limited high-quality Article 6	Connect the 2035 milestone to a credible longer-term

Party	2030 position	New target	Conditionality / accounting	Design lesson for the Republic of North Macedonia
			credits from 2036 for 2040	pathway rather than treating 2035 in isolation.
Serbia	Previous 2030 benchmark remains relevant	40.1% below 1990 by 2035, excluding LULUCF	Explicitly conditional on finance; BTR1 used as supporting evidence	Be explicit when the target is conditional and link the target to the BTR1/NECP evidence base.

11.4 2030 Target

The 2030 target communicated in the Revised NDC (NDC 2.0) remains the standing near-term benchmark for NDC 3.0. NDC 2.0 communicated a 51% reduction in gross GHG emissions and an 82% reduction in net GHG emissions relative to 1990, corresponding in the inventory vintage used at that time to approximately 6,058 Gg CO2-eq gross emissions and 2,203 Gg CO2-eq net emissions in 2030. Because the national inventory has subsequently been recalculated, the percentage expression of the net target must be updated if the absolute level is kept unchanged. Using the BTR1 revised 1990 net value of 10,711 Gg CO2-eq, the same 2,203 Gg 2030 ceiling is equivalent to approximately a 79.4% reduction. NDC 3.0 should therefore retain the 2,203 Gg absolute benchmark, while transparently explaining that the historical 82% formulation corresponds to about 79.4% under the latest inventory basis (Figure 39).

Figure 39 How the 2030 target was presented in NDC 2.0: gross emissions, net emissions and the LULUCF sink



Source: Revised Nationally Determined Contribution of the Republic of North Macedonia (2021), ICTU section, original graphic on p. 8.

The BTR1 and NECP evidence should be used to assess the delivery gap against this reconciled 2030 benchmark. BTR1 WAM reaches approximately 2,800 Gg CO2-eq net emissions in 2030, while the updated NECP reports 4,350 Gg CO2-eq net emissions. Both values are above the standing 2,203 Gg absolute benchmark. The comparison should therefore be made primarily in absolute terms. This avoids the misleading conclusion that a change in the 1990 inventory has by itself changed the level of real-world effort. In NDC 3.0, the 2030 target should be reported as approximately 2,203 Gg CO2-eq net emissions, equivalent to about 79.4% below the revised BTR1 1990 net level, with the original 82% formulation retained in the methodological reconciliation for continuity with NDC 2.0 and the Energy Community target-setting framework.

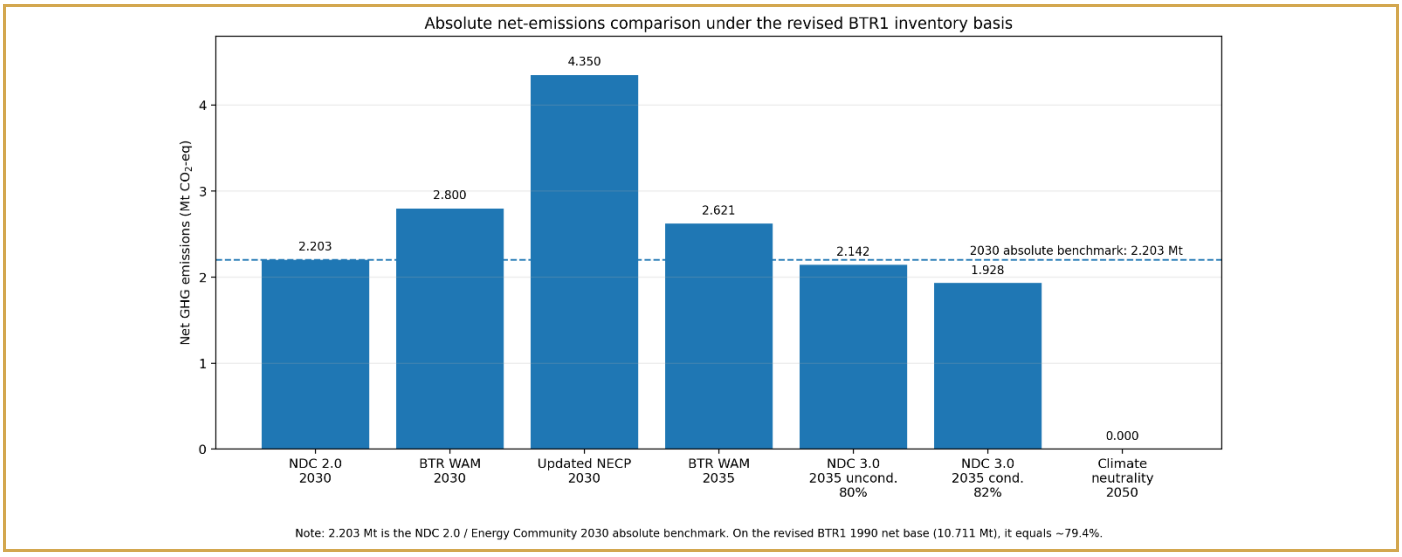
11.5 Absolute-value comparison

Absolute emissions values provide the clearest basis for comparing the standing 2030 commitment with current modelled pathways and possible 2035 target levels. The table and Figure 40 below therefore use the 2,203 Gg CO2-eq

2030 absolute benchmark as the reference point. Percentage values for 2030 and 2035 are then expressed against the revised BTR1 1990 net inventory of 10,711 Gg CO2-eq.

Framework / value	Year	Net GHG emissions (Gg CO2-eq)	Difference vs 2.203 Gg 2030 benchmark	Status / interpretation
Existing NDC 2.0 / EnC absolute benchmark	2030	2,203	0	Standing 2030 absolute benchmark; equivalent to ~79.4% below the revised BTR1 1990 net base.
BTR1 WAM	2030	2,800	597	Current modelled WAM outcome; above the standing 2030 absolute target.
Updated NECP	2030	4,350	2,147	Planning pathway based on different assumptions and a 10,930 Gg 1990 net reference.
BTR1 WAM	2035	2,621	418	Technical reference for 2035; not automatically the NDC target.
Proposed NDC 3.0 unconditional target - 80%	2035	2,142	-61	Modest progression beyond the reconciled 2030 target; 479 Gg below BTR1 WAM 2035.
Proposed NDC 3.0 conditional target - up to 82%	2035	1,928	-275	Higher ambition requiring substantial additional international finance, technology and implementation support; 693 Gg below BTR1 WAM 2035.
BTR1 WAM	2040	2,400	197	Directional continuation of current WAM; deeper post-2035 reductions are needed for 2050 climate neutrality.
Climate-neutrality endpoint	2050	0,	-2,203	Long-term legal/strategic endpoint; residual emissions balanced by removals.

Figure 40 Absolute net-emissions comparison across NDC 2.0, BTR1 WAM, the updated NECP and the 2050 climate-neutrality endpoint



Source: NDC 2.0 (2021); Energy Community Decision 2022/02/MC-EnC; BTR1 Climate Change Mitigation Report (2026); updated NECP; team calculations using the revised BTR1 1990 net value of 10,711 Gg CO2-eq.

Three conclusions follow from the absolute-value comparison. First, preserving the NDC 2.0 absolute 2030 level of 2,203 Gg CO2-eq changes its percentage expression from the historical 82% to approximately 79.4% under the revised BTR1 1990 net inventory. Second, the BTR1 WAM 2030 result of 2,800 Gg and the updated NECP 2030 result of 4,350 Gg remain above the standing absolute benchmark, so an implementation gap persists independently of the inventory revision. Third, the 2035 target is best structured as a modest unconditional progression beyond the reconciled 2030 level, complemented by a higher conditional level explicitly linked to additional political commitment, international finance, technology transfer and accelerated implementation of BTR1 measures.

2030 TARGET RECONCILIATION RULE
The 2030 absolute net-emissions ceiling of approximately 2,203 Gg CO2-eq remains the reference commitment.
Under the BTR1 revised 1990 net inventory of 10,711 Gg CO2-eq, the same absolute level corresponds to approximately 79.4% below 1990, rather than the historical 82% formulation.
NDC 3.0 should disclose both figures and explain that the change in percentage results from inventory recalculation, principally the revised land-sector sink.
The BTR1 WAM and NECP projections should then be assessed against the unchanged absolute 2030 ceiling so that accounting changes are not confused with real mitigation performance.

11.6 2035 Target

The BTR1 WAM scenario is the appropriate technical starting point for defining the 2035 target because it provides the latest integrated cross-sectoral mitigation pathway through 2035 and 2040. Under WAM, net GHG emissions decline to approximately 2,800 Gg CO2-eq in 2030, 2,621 Gg in 2035 and 2,400 Gg in 2040. These values are modelled outcomes under the current package of additional measures and should be interpreted as an implementation pathway rather than as automatically predetermined NDC target levels.

The 2035 target must also reflect the sequencing of the post-2030 energy transition. The updated NECP envisages one additional gas-fired combined heat and power plant entering operation around 2030 as transitional dispatchable capacity during the phase-out of lignite. At the same time, the longer-term decarbonisation pathway assumes that natural gas can progressively be replaced by hydrogen and complemented, where technically and economically justified, by carbon capture, use and storage and other low-carbon solutions. These options are expected to become more relevant after 2035 rather than delivering their full mitigation effect immediately. For this reason, the 2035 target should represent a credible but limited progression beyond the reconciled 2030 target, while the steeper decline required for climate neutrality is expected in the period after 2035 as these technologies and enabling infrastructures mature.

On this basis, NDC 3.0 should use a two-tier 2035 target architecture. The unconditional component should be set at least an 80% reduction in economy-wide net GHG emissions relative to the revised 1990 inventory, corresponding to a net-emissions ceiling of approximately 2,142 Gg CO2-eq on the current BTR1 basis. A higher conditional component of up to 82% below the revised 1990 level, corresponding to approximately 1,928 Gg CO2-eq, can be communicated subject to the mobilisation of additional international support and accelerated implementation of the mitigation package. This structure preserves progression beyond the recalculated 2030 level of approximately 79.4% without assuming an unrealistic step-change by 2035.

PROPOSED 2035 TARGET ARCHITECTURE
Unconditional target: by 2035, reduce economy-wide net greenhouse gas emissions by at least 80% relative to the revised 1990 inventory. On the current BTR1 basis, this corresponds to approximately 2,142 Gg CO2-eq.
Conditional target: with substantially increased international financial and technical support, raise the 2035 ambition to up to 82% below the revised 1990 net level, corresponding to approximately 1,928 Gg CO2-eq.
Rationale: the reconciled 2030 benchmark is approximately 79.4% and 2,203 Gg CO2-eq. The 2035 target therefore progresses beyond 2030 without assuming a technologically unrealistic step-change before hydrogen and other post-2035 low-carbon options become widely deployable.
2050 consistency: both levels are intermediate milestones on the pathway to climate/carbon neutrality by 2050.

Relative to the current BTR1 WAM projection of 2,621 Gg CO2-eq in 2035, an 80% unconditional target would require approximately 479 Gg CO2-eq of additional annual net reductions, while an 82% conditional target would require approximately 693 Gg CO2-eq. These gaps are substantial and require stronger implementation than in the current WAM pathway. The additional effort is expected to come from accelerated implementation of the BTR1 measures, stronger policy enforcement, faster project preparation and investment mobilisation, and targeted reinforcement of measures in the energy, transport, buildings, waste and land-use sectors.

11.7 Proposed target architecture

Milestone	Status	Metric / value	Role in NDC 3.0	Interpretation
2030	Existing absolute commitment	2,203 Gg net; historical 82%, recalculated to ~79.4% on BTR1 1990 base	Retain and reconcile	Standing benchmark. Preserve the absolute level and transparently update the percentage expression.
2030	Current modelled pathway	BTR1 WAM: ~2,800 Gg net	Track delivery gap	597 Gg above the standing 2030 absolute benchmark.
2030	Current NECP planning value	NECP: 6,720 Gg gross; 4,350 Gg net	Policy-consistency reference	Different model/assumptions; requires reconciliation with NDC/BTR1.

Milestone	Status	Metric / value	Role in NDC 3.0	Interpretation
2035	BTR technical reference	~2,621 Gg net (~75.5% below revised BTR1 1990 net emissions)	Technical anchor	Current WAM outcome; stronger implementation is needed to achieve the NDC target.
2035	NDC 3.0 unconditional target	At least 80% net below revised 1990; ~2,142 Gg	Headline minimum	Modest progression beyond the reconciled 2030 benchmark; 479 Gg below BTR1 WAM 2035.
2035	NDC 3.0 conditional target	Up to 82% net below revised 1990; ~1,928 Gg	Higher conditional ambition	Requires substantially stronger political implementation and international financial/technical support; 693 Gg below BTR1 WAM 2035.
2040	BTR directional reference	~2,400 Gg net	Indicative checkpoint	Post-2035 pathway must accelerate as hydrogen and other low-carbon solutions mature.
2050	Climate-neutrality endpoint	Net GHG balance = 0	Long-term legal/strategic anchor	Residual emissions balanced by removals; endpoint under the Climate Action Law / updated NECP.

11.8 2035 as a Bridge to 2050 Climate Neutrality

The 2035 target should be evaluated against the country's long-term endpoint, not only against the 2030 NDC. National long-term policy has evolved from the earlier Long-Term Strategy objective of a 72% reduction in national net GHG emissions by 2050 to an explicit commitment to climate neutrality by 2050. The updated NECP states that carbon neutrality is the objective for the post-2030 period, and the Climate Action Law anchors the 2050 climate-neutrality objective in the national legal framework. NDC 3.0 should therefore treat 2050 climate neutrality as the operative endpoint for the national mitigation pathway.

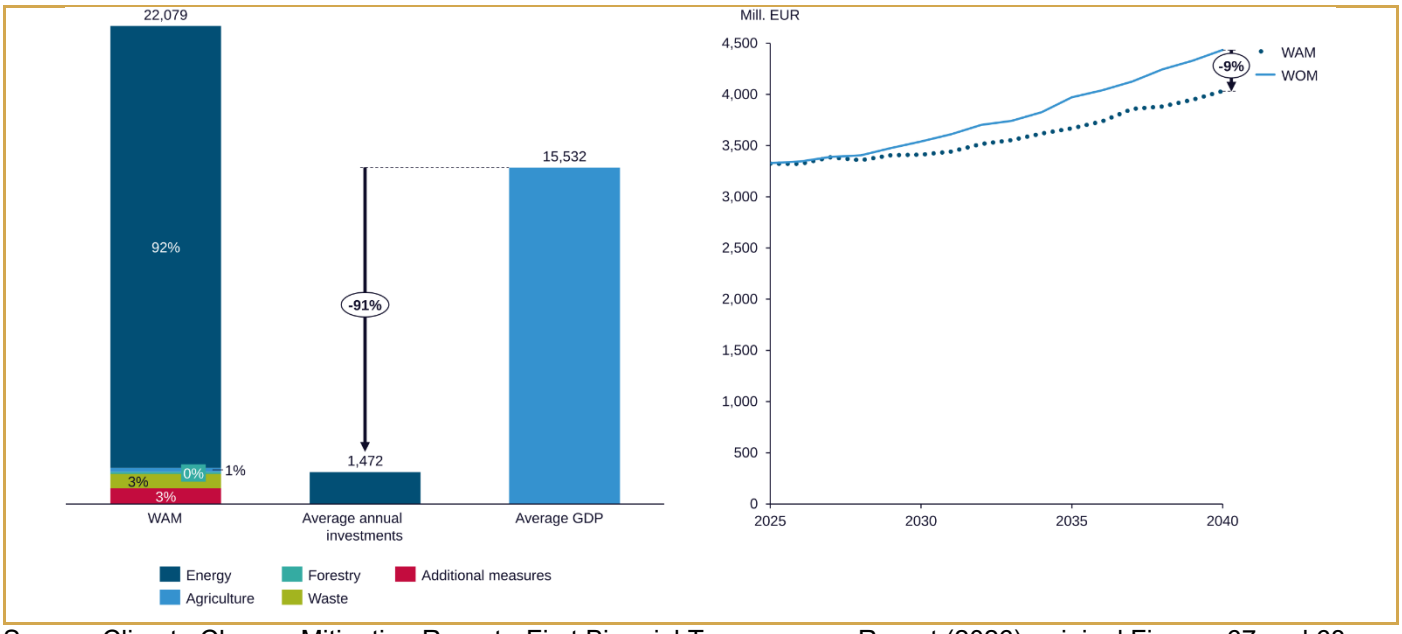
This long-term endpoint does not require the entire decarbonisation effort to be front-loaded into 2035. The period to 2035 is expected to remain a transition phase in which renewable energy, storage, grids and energy efficiency expand rapidly while a limited role for gas-fired dispatchable generation supports the phase-out of lignite and system security. The deeper substitution of natural gas by hydrogen, together with possible use of carbon capture and other low-carbon technologies in hard-to-abate applications, is more likely to deliver additional reductions after 2035. Accordingly, the 2035 milestone should remain close to the reconciled 2030 level, while the post-2035 trajectory must steepen sufficiently to reach a balance between residual anthropogenic emissions and removals by 2050. The proposed 80% unconditional / 82% conditional structure is consistent with this sequencing and maintains a clear progression toward the legally and strategically anchored climate-neutrality objective.

2050 TRAJECTORY CONSISTENCY RULE
2030: retain the approximately 2,203 Gg absolute net-emissions benchmark and restate it as ~79.4% below the revised BTR1 1990 net value.
2035: establish a modest unconditional progression to at least 80%, with a conditional level of up to 82% where additional international support is mobilised.
2035-2050: accelerate the rate of decline as hydrogen, advanced storage, industrial low-carbon technologies and other enabling infrastructure become available at scale.
2050: climate neutrality / net-zero GHG balance is the endpoint; residual emissions must be balanced by durable removals.

11.7 Conditional Component

The conditional component reflects the fact that delivery of a mitigation pathway beyond the currently modelled WAM outcome requires resources and implementation capacity that exceed what can reasonably be secured from ordinary domestic public budgets alone. The BTR1 estimates approximately EUR 22 billion of incremental investment for WAM implementation over the analysed period, with more than 92% directed to the energy sector (Figure 41). The updated NECP likewise identifies large capital requirements across power generation, networks, buildings, transport and enabling infrastructure, to be financed through a combination of domestic resources, private capital, EU and other donor support, international financial institutions and climate-finance instruments.

Figure 41 Investment requirement and total-system-cost effect of the BTR1 WAM pathway



Source: Climate Change Mitigation Report - First Biennial Transparency Report (2026), original Figures 67 and 68.

The conditional component is therefore linked to a clearly identifiable additional implementation package rather than to a simple WEM/WAM scenario label. WEM and WAM are policy scenarios, not financing categories. Measures should be classified according to whether their implementation is supported by domestic resources and commercially viable investment, already committed EU/IFI/donor financing, or additional international support that has not yet been secured. This finance tagging provides the basis for distinguishing the unconditional and conditional components of the 2035 target while keeping the mitigation logic consistent with the BTR1 and NECP.

The conditional 2035 component is formulated as a reduction of up to 82% in economy-wide net GHG emissions relative to the revised 1990 inventory, corresponding to approximately 1,928 Gg CO2-eq on the current BTR1 basis. ThaAchievement of this higher level requires strong and sustained domestic political support, but above all substantially increased international financial and technical support. The Republic of North Macedonia will also investigate innovative climate finance instruments, including mechanisms that can help mobilise additional private and public investment for mitigation actions. Priority needs include concessional and grant finance for accelerated renewable-energy deployment, grid reinforcement, storage and system flexibility, deep building renovation, low-emission mobility, rail infrastructure, industrial decarbonisation, regional waste infrastructure, afforestation and forest-fire prevention, as well as technology transfer and project-development support for hydrogen and other post-2035 low-carbon solutions. Carbon-market mechanisms will also be explored as a potential source of climate finance, in line with the Republic of North Macedonia's commitments under the Western Balkans Green Agenda and subject to the applicable international rules and requirements. International support should accelerate measures already identified in the BTR1 rather than create a separate mitigation architecture.

11.8 Unconditional Component

The unconditional component is formulated as at least an 80% reduction in economy-wide net GHG emissions by 2035 relative to the revised 1990 inventory, corresponding to a net-emissions ceiling of approximately 2,142 Gg CO2-eq on the current BTR1 basis. This represents a modest but real progression beyond the reconciled 2030 target of approximately 79.4% and 2,203 Gg CO2-eq, while recognising the technological and infrastructure sequencing of the post-2030 transition. The unconditional component is based on domestic policy instruments, public resources, commercially viable private investment and international financing that is already secured or firmly committed.

Delivery of the unconditional component requires full implementation of the mature and economically justified measures already identified in the BTR1 and NECP: accelerated renewable-energy deployment, energy-efficiency improvements, electrification where cost-effective, grid and storage development, improved waste management, agricultural mitigation, protection and enhancement of the land-sector sink, and the institutional and regulatory reforms required for

implementation and MRV. The target does not assume that large-scale hydrogen substitution or other technologies whose commercial deployment is expected mainly after 2035 will provide major reductions before the target year.

RECOMMENDED FINAL-SUBMISSION FORMAT
2030 benchmark: approximately 2,203 Gg CO2-eq net emissions; historical NDC 2.0 expression -82%; recalculated expression on the current BTR1 1990 net base -79.4%.
2035 unconditional target: at least 80% net reduction from the revised 1990 base, corresponding provisionally to ~2,142 Gg CO2-eq.
2035 conditional target: up to 82% net reduction from the revised 1990 base, corresponding provisionally to ~1,928 Gg CO2-eq, subject to additional international finance, technology transfer and implementation support.
Technology sequencing: explain the transitional role of one additional gas-fired CHP plant around 2030 and the expected stronger contribution of hydrogen and other low-carbon technologies after 2035.
2050 endpoint: state explicitly that climate/carbon neutrality by 2050 is the legally and strategically anchored destination.
Accounting safeguard: use one final inventory vintage for both base-year and target-year values and include a reconciliation table whenever inventory recalculations change the percentage expression of an existing absolute target.

11.9 Fairness and Ambition Assessment

The fairness and ambition assessment combines responsibility, capability, mitigation potential, development needs, energy-security constraints and implementation cost. The Republic of North Macedonia contributes only a small share of global emissions, while its transition requires major changes in the energy system, transport, buildings, industry, waste management and land use. At the same time, the BTR1 identifies substantial cost-effective mitigation potential and long-term system benefits. The proposed target architecture therefore seeks the highest level of ambition that can be credibly implemented within national circumstances, while making the additional ambition enabled by international support fully transparent.

Progression is assessed on a common inventory basis. The historical NDC 2.0 net target of 82% corresponded to approximately 2,203 Gg CO2-eq in 2030; following the BTR1 recalculation of the 1990 net inventory, the same absolute target corresponds to approximately 79.4%. Against that reconciled benchmark, an unconditional 2035 target of at least 80% constitutes a measurable progression, while the conditional level of up to 82% provides a further step in ambition where additional support is mobilised. This formulation preserves progression while remaining consistent with the present technology, investment and infrastructure timetable and the pathway toward climate neutrality.

Capability and cost are central to the fairness assessment. The BTR1 shows that the WAM pathway requires very large upfront investment but can reduce total energy-system costs over the long term. The scale of investment - approximately EUR 22 billion of incremental expenditure in the BTR1 assessment - demonstrates why the upper end of the 2035 ambition cannot reasonably be treated as a purely domestic obligation. International climate finance, EU and IFI support, concessional lending, grants, guarantees, technology transfer and project-preparation assistance are therefore integral to the conditional component, while domestic political commitment remains essential for permitting, regulation, institutional reform and timely implementation.

The land sector is the third test. The BTR1 confirms that FOLU is a critical net sink but also documents strong interannual variability driven in part by forest fires. Fairness and ambition should therefore not be demonstrated by assuming that the sink alone will deliver the target. NDC 3.0 should publish both gross and net outcomes, specify the contribution expected from FOLU, and include forest-fire prevention, restoration and sustainable forest management as mitigation measures with their own implementation indicators.

11.10 Alignment with 1.5°C Pathways

The first Global Stocktake encourages the next NDCs to contain ambitious, economy-wide emission-reduction targets covering all greenhouse gases, sectors and categories and to be aligned with limiting global warming to 1.5°C, informed by the latest science and national circumstances. The IPCC AR6 global pathways that limit warming to 1.5°C with no or limited overshoot reduce net global GHG emissions rapidly through 2030 and 2035 and reach net-zero CO2 around mid-century. These global pathway statistics are not a country-specific fair-share allocation and should not be mechanically applied to the Republic of North Macedonia. For the Republic of North Macedonia, the nationally binding strategic direction is provided by the 2050 climate-neutrality objective under the Climate Action Law and the updated NECP.

The national pathway is consistent with a 1.5°C-oriented transition in its direction and structural transformation: rapid expansion of renewable energy, accelerated energy efficiency, coal phase-out, electrification, stronger grids and storage, improved land management, waste mitigation and continued reduction of emissions after 2030. At the same time, national circumstances require a sequenced transition. One additional gas-fired CHP plant is retained around 2030 to support security of supply during the coal phase-out, while the deeper substitution of natural gas by hydrogen and

other low-carbon technologies is expected to become more material after 2035. This sequencing explains why the 2035 target should show credible progression without assuming that the full 2050 technology portfolio is available by 2035.

NDC 3.0 therefore links the 2035 milestone explicitly to climate neutrality by 2050. The unconditional target of at least 80% and the conditional level of up to 82% are intermediate steps, not the end state of national decarbonisation. A substantially steeper decline is required after 2035 as hydrogen, advanced storage, industrial decarbonisation technologies and other low-carbon solutions mature and as land-sector removals are protected and strengthened. This creates a coherent trajectory in which near-term ambition is grounded in implementable measures and long-term ambition remains fully aligned with the 2050 carbon-neutrality objective.

The available national source documents do not contain a country-specific carbon budget or an independent scientific test demonstrating that a single numerical 2035 target is quantitatively 1.5°C compatible. The NDC should therefore avoid an unqualified certification claim. A defensible formulation is that NDC 3.0 is designed to contribute to a 1.5°C-oriented global pathway and to place the Republic of North Macedonia on a credible national trajectory toward climate neutrality by 2050, with the level of conditional ambition explicitly linked to the international support required to accelerate implementation.

1.5°C INTEGRITY TEST FOR THE FINAL NDC
Coverage: economy-wide; all material gases, sectors and categories in the national inventory.
Progression: the 2035 target must improve on the reconciled 2030 target on a common inventory basis.
Feasibility: the target should reflect realistic technology and infrastructure sequencing through 2035, including the transitional role of gas and the later deployment of hydrogen and other low-carbon solutions.
Support: any higher conditional ambition must be matched by an explicit international finance, technology and capacity package.
Trajectory: the rate of decarbonisation must accelerate after 2035 sufficiently to reach climate neutrality by 2050.
Science statement: distinguish global IPCC benchmarks from a national fair-share claim unless a dedicated national carbon-budget analysis is undertaken.

11.11 Recommended wording for the NDC 3.0 decision text

DRAFT DECISION TEXT
"The Republic of North Macedonia retains the absolute level of its existing 2030 mitigation commitment at approximately 2,203 Gg CO2-eq of economy-wide net greenhouse gas emissions. The historical NDC 2.0 formulation expressed this level as an 82% reduction relative to the 1990 inventory available at the time. Following recalculation of the national greenhouse gas inventory, the BTR1 revised 1990 net level is approximately 10,711 Gg CO2-eq; on this basis, the same 2030 absolute emissions level corresponds to a reduction of approximately 79.4%. This recalculation reflects improved inventory information and does not constitute a weakening of the absolute 2030 commitment.

For 2035, the Republic of North Macedonia communicates an unconditional economy-wide net greenhouse gas emissions reduction target of at least 80% relative to the revised 1990 inventory, corresponding provisionally to approximately 2,142 Gg CO2-eq on the current BTR1 basis. Subject to substantially increased international financial support, technology transfer, capacity building and accelerated implementation of the mitigation measures identified in the BTR1 and the National Energy and Climate Plan, the Republic of North Macedonia will seek to increase the 2035 reduction to up to 82%, corresponding provisionally to approximately 1,928 Gg CO2-eq.

The 2035 target is designed as an intermediate milestone toward climate neutrality by 2050, as established by the national climate-policy framework. The post-2030 transition recognises the temporary role of limited gas-fired dispatchable generation in maintaining energy-system security during the coal phase-out, while deeper decarbonisation through hydrogen, advanced storage, industrial low-carbon technologies and other solutions is expected to become increasingly important after 2035. Progress toward both the unconditional and conditional components will be tracked through the Enhanced Transparency Framework and Biennial Transparency Reports."

Chapter 12. Source notes and international benchmarks

1. Republic of North Macedonia, Revised Nationally Determined Contribution (2021). Source for the standing 2030 target, ICTU, target coverage and fairness/ambition assessment.

2. Climate Change Mitigation - First Biennial Transparency Report (2026). Source for WOM/WEM/WAM methodology, WAM emissions pathway, BTR1-NECP comparison, investment needs and co-benefits.

3. Updated National Energy and Climate Plan 2025-2030 / final consultation version. Source for the evolution of the 1990 base-year values (Table 6), the updated 2030 planning values of 6,720 Gg gross and 4,350 Gg net (-46.1% and -60.2% respectively), sectoral revisions, and the explicit outlook to climate neutrality by 2050.

4. UNFCCC, Decision 1/CMA.5 - Outcome of the first Global Stocktake. Paragraphs 37-40 establish the expectation for progression and encourage next NDCs to be ambitious, economy-wide, cover all gases/sectors/categories and align with 1.5°C. Official source

5. IPCC AR6 Synthesis Report / WGIII. Global 1.5°C pathways provide the scientific benchmark of approximately 43% GHG reduction from 2019 by 2030 and 60% by 2035; these are global pathway statistics, not country-specific allocations. Official source

6. United Kingdom 2035 NDC (2025). At least 81% below 1990 by 2035; the 68% 2030 NDC remains in place; inventory recalculations are explicitly accommodated. Official source

7. Norway 2035 NDC (2025). At least 70-75% below 1990 by 2035; the 2030 target of at least 55% is maintained; Article 6 cooperation may support achievement. Official source

8. European Union NDC (2025) and amended European Climate Law (2026). The EU retains its 2030 target, communicates an indicative 2035 range of 66.25-72.5% in the 2025 NDC, and adopted a binding 90% net reduction target for 2040 in March 2026. Official source

9. Republic of Serbia NDC 3.0 (2025). Conditional economy-wide 40.1% reduction by 2035 compared with 1990, excluding LULUCF; BTR1 is referenced in the quantification framework. Official source

10. Energy Community Ministerial Council Decision 2022/02/MC-EnC. The Republic of North Macedonia 2030 net GHG target: -82.0% compared with 1990 and 2,200 Gg CO2-eq.

11. Climate Action Law of the Republic of North Macedonia. Long-term national legal framework for climate action; NDC 3.0 should reflect the 2050 climate-neutrality objective and use the final promulgated text for the legal citation in the submission.

Chapter 13. Country Review of NDC 3.0 Developments in Selected Countries

13.1 Introduction

As part of the preparation of the Republic of North Macedonia's NDC 3.0, a review of recent NDC developments in selected countries has been undertaken to provide a comparative basis for assessing the evolution of climate ambition and the design of the next NDC. The Republic of North Macedonia's current NDC 2.0 commits the country to an 82% reduction in net greenhouse gas (GHG) emissions by 2030 compared with 1990 levels, corresponding to a 51% reduction in gross GHG emissions. The review focuses on Serbia, Slovenia, Germany and Bulgaria, as well as Brazil, Norway, Türkiye, the United Kingdom, Peru and Azerbaijan, combining regional, EU and broader international perspectives. Particular attention is given to changes between NDC 2.0 and NDC 3.0, including GHG emission reduction targets, target years, the treatment of the 2030 target, the introduction of 2035 milestones or targets, longer-term objectives, and the overall progression of ambition.

The selected countries provide different approaches relevant to the Republic of North Macedonia. Serbia offers a particularly relevant regional comparison as a non-EU Western Balkan country with an individual national NDC, while Slovenia, Germany and Bulgaria are covered by the joint NDC of the European Union and its Member States. Brazil provides a broader international perspective, particularly relevant for its approach to establishing a quantified 2035 mitigation target and linking the NDC with a longer-term pathway towards climate neutrality by 2050. Norway and the United Kingdom provide clear examples of retaining existing 2030 commitments while introducing stronger 2035 targets. Türkiye illustrates how a revised business-as-usual (BAU) framework can complicate direct comparison between successive NDCs. Peru provides a contrasting case in which the same conditional emissions ceiling communicated for 2030 is carried forward as the 2035 target. Azerbaijan is included because an earlier NDC update did not retain its previous 2030 target, making it especially relevant to the question of whether ambition can be weakened between NDC cycles. The comparison therefore shows several different ways in which countries have treated existing 2030 commitments and defined targets beyond 2030.

The review aims to identify key developments and approaches in the third NDC cycle that can be considered in the preparation of the Republic of North Macedonia's NDC 3.0. In particular, it looks at how countries treat their existing 2030 commitments, whether ambition is maintained, strengthened or weakened, how new 2035 and longer-term targets are set, and how these targets are linked with broader climate-neutrality and low-emission development objectives.

For consistency, this review uses “NDC 2.0” for the previous NDC cycle centred on 2030 targets and “NDC 3.0” for the new cycle centred on 2035 or post-2030 targets, regardless of the official title used by each Party.

13.2 Serbia

Serbia’s NDC 3.0 represents a further increase in national climate ambition compared with NDC 2.0. Under the NDC submitted in 2022 (NDC 2.0), Serbia committed to reducing greenhouse gas (GHG) emissions by 33.3% by 2030 compared with 1990 levels, excluding the LULUCF sector. This represented a substantial increase compared with the initial 2015 commitment of a 9.8% reduction by 2030. The latest NDC 3.0, submitted to the UNFCCC in September 2025, further increases Serbia's mitigation ambition by establishing a 40.1% reduction in GHG emissions by 2035 compared with 1990, also excluding LULUCF. The target is economy-wide and covers the energy, industrial processes and product use, agriculture and waste sectors. Importantly, the NDC 3.0 target is explicitly described as conditional, with its achievement depending on the availability of financial resources for a just and energy transition by 2035.

There is therefore a clear upward trend in Serbia's climate ambition: from 33.3% by 2030 under NDC 2.0 to 40.1% by 2035 under NDC 3.0. However, NDC 3.0 does not introduce a new separate 2030 quantitative target. Instead, it establishes a new 2035 target, while the previously adopted 2030 commitment of 33.3% remains the relevant benchmark for the 2030 period. Consequently, the new 2035 target is more ambitious in absolute percentage terms than the previous 2030 target, increasing the reduction ambition by 6.8 percentage points over an additional five-year period.

Serbia's NDC 3.0 should therefore be assessed as an increase in climate ambition, rather than a revision or weakening of the 2030 target. The main change is the extension of the mitigation pathway towards 2035 with a higher emissions-reduction level. At the same time, the conditional nature of the 2035 target is an important qualification when assessing the strength and implementation prospects of the commitment. The NDC is aligned with Serbia's Integrated National Energy and Climate Plan and is intended to support the country's energy transition and longer-term decarbonisation pathway.

13.3 Slovenia, Germany and Bulgaria

Unlike Serbia, Slovenia, Germany and Bulgaria do not submit separate national NDCs to the UNFCCC. As EU Member States, they participate in the jointly submitted NDC of the European Union and its Member States. The 2025 NDC explicitly identifies its geographical scope as the EU and its Member States, including Bulgaria, Germany and Slovenia. The NDC also requests that the UNFCCC maintain the new NDC as active for the EU and each Member State, while retaining the existing 2030 NDC alongside it.

Under the EU's previous NDC 2.0, updated in October 2023, the EU and its 27 Member States committed to achieving a net domestic reduction of at least 55% in greenhouse gas (GHG) emissions by 2030 compared with 1990 levels. The target is economy-wide and is supported by the EU Climate Law and the Fit for 55 legislative framework. The 2023 NDC notes that, when fully implemented, the Fit for 55 framework could enable the EU and its Member States to overachieve the 55% target.

The EU's NDC 3.0, submitted in November 2025, does not change the numerical 2030 target: the commitment to reduce net GHG emissions by at least 55% compared with 1990 remains in place. Importantly, NDC 3.0 explicitly requests that the existing 2030 NDC remains active in the UNFCCC NDC Registry. Therefore, there is neither an increase nor a decrease in the 2030 numerical target itself. Rather, the new NDC represents a progression beyond the existing commitment by establishing the post-2030 mitigation pathway.

The main new element is the introduction of an indicative contribution for 2035 of a 66.25–72.5% reduction in net GHG emissions compared with 1990. This range is based on indicative linear trajectories linking the existing 2030 target with the EU's 2050 climate-neutrality objective and the Council's 2040 climate target. It is important to note that 66.25–72.5% is an indicative 2035 contribution rather than a standalone formal 2035 target. The formal NDC timeframe is a single-year target for 2040, with the 2035 range serving as an indicative milestone along the pathway.

The NDC 3.0 also introduces an important additional element for the 2040 target: the economy-wide net emissions reduction target may include an adequate contribution from high-quality international credits under Article 6 of the Paris Agreement, in a manner intended to remain ambitious and cost-efficient. The NDC was developed in the context of the EU's proposed 2040 climate target and the Council's position on a 90% net GHG emissions reduction by 2040 compared with 1990. At the time of the NDC submission, the legislative process on the 2040 target was still ongoing. This process has since been completed: on 5 March 2026, the Council formally adopted the amended European Climate Law, introducing a binding target to reduce net GHG emissions by 90% by 2040 compared with 1990.

In terms of coverage, NDC 3.0 remains economy-wide, covering energy, aviation, maritime transport, industrial processes and product use, agriculture, waste and LULUCF, as well as CO_2, CH_4, N_2O, HFCs, PFCs, SF_6 and NF_3. Therefore, there is no indication of a narrowing of the scope between NDC 2.0 and NDC 3.0. Instead, the new NDC maintains comprehensive economy-wide coverage while extending the mitigation pathway beyond 2030.

Although Slovenia, Germany and Bulgaria share the same international NDC commitments, their national climate targets and implementation pathways differ. Germany is particularly notable because its national Climate Change Act establishes a target of reducing GHG emissions by at least 65% by 2030 compared with 1990, followed by at least 88% by 2040 and climate neutrality by 2045. Germany's national 2030 target is therefore more ambitious than the common 55% EU NDC target. This national target should nevertheless be distinguished from Germany's international NDC, which remains part of the joint EU submission.

For Slovenia and Bulgaria, the EU NDC provides the common international framework against which their NDC commitments are assessed. Their national policies and measures contribute to the achievement of the collective EU targets, but the 66.25–72.5% figure should not be interpreted as an individual national target for either country. The same applies to Germany: the EU NDC target is common, while Germany has adopted additional and more ambitious national targets.

The comparison of NDC 2.0 and NDC 3.0 indicates a progression in climate ambition for Slovenia, Germany and Bulgaria beyond 2030, while the 2030 target remains unchanged. The key transition is from the existing 55% net reduction by 2030 towards an indicative 66.25–72.5% net reduction by 2035, within a formal NDC framework centred on a 2040 target and ultimately leading towards climate neutrality by 2050. The main difference between the three countries is therefore not their international NDC, which is jointly established at EU level, but the level of ambition reflected in their respective national climate policies and targets.

13.4 Brazil

Brazil's Second NDC, submitted to the UNFCCC in November 2024, establishes a new mitigation pathway towards 2035 and represents a progression beyond the country's previous NDC. The relevant baseline for comparison is Brazil's NDC adjustment submitted in 2023, under which Brazil committed to an absolute net GHG emissions target of 1.20 $GtCO_2e$ by 2030, corresponding to a 53.1% reduction compared with 2005 levels. The 2023 NDC also included an

interim 2025 target of 1.32 $GtCO_2e$, equivalent to a 48.4% reduction compared with 2005, and reiterated Brazil's long-term objective of achieving climate neutrality by 2050.

Brazil's Second NDC establishes a 2035 target of reducing net GHG emissions by 59–67% compared with 2005 levels, corresponding to an absolute emissions level of 850 million to 1.05 billion tonnes CO_2e. The target is economy-wide and covers all greenhouse gases, sectors and categories, including LULUCF. The NDC describes the target as an absolute economy-wide emissions reduction and states that it was informed by the outcomes of the first Global Stocktake and developed with a pathway towards climate neutrality by 2050.

Compared with the previous 2030 commitment of 53.1%, the new 2035 target represents a clear increase in mitigation ambition over time, with the minimum 2035 reduction reaching 59% and the upper end reaching 67% below 2005 levels. However, the 2035 target is not directly comparable to the previous 2030 target solely on the basis of the percentage reduction, as the target years differ. The NDC establishes 2035 as the new target year, rather than introducing a separate revised 2030 percentage target. Brazil explicitly states that its subsequent NDC targets surpass previous NDC communications and represent progression over time and its highest possible ambition.

A distinctive feature of Brazil's NDC is the strong emphasis on land-use change and forestry, deforestation reduction and forest restoration as key components of its mitigation strategy. The NDC identifies the elimination of illegal deforestation, restoration of native vegetation and nature-based removals as central to achieving climate neutrality. It also links mitigation with a broader ecological transformation, including energy transition, sustainable agriculture, low-carbon industry, biofuels, low-emission hydrogen, sustainable mobility and carbon capture and storage. Brazil's Second NDC demonstrates a progressive approach from a 2030 target towards a more ambitious 2035 mitigation pathway, while maintaining the long-term objective of climate neutrality by 2050.

13.5 Norway

Norway is a clear example of keeping its existing 2030 commitment while adding a stronger target for 2035. Under the NDC 2.0 cycle, Norway’s updated 2030 submission sets a target of at least 55% GHG reduction by 2030 compared with 1990. In June 2025, Norway submitted its NDC 3.0 for 2035, setting a new target of at least 70–75% reduction by 2035 and explicitly confirming that the 2030 NDC remains in place.

The 2035 target is economy-wide and covers the main emitting sectors. The reference indicator is based on national GHG emissions excluding LULUCF, while additional emissions and removals from LULUCF are taken into account when achievement of the target is assessed. Norway’s climate targets are anchored in its Climate Change Act and support the transition towards a low-emission society by 2050.

The comparison is therefore straightforward: the 2030 target is not revised or weakened, and the new 2035 target raises the level of ambition by 15–20 percentage points over an additional five years.

Norway plans to meet the 2035 target through domestic measures and cooperation with the European Union under Article 6 of the Paris Agreement, with the possible use of internationally transferred mitigation outcomes if needed. For this review, Norway is therefore a strong example of retaining the NDC 2.0 commitment for 2030 while setting a more ambitious NDC 3.0 target for 2035.

13.6 Türkiye

Under the NDC 2.0 cycle, Türkiye’s Updated First NDC, submitted in April 2023, set an economy-wide target to reduce GHG emissions by 41% by 2030 compared with its business-as-usual (BAU) scenario. This corresponded to 695 Mt CO_2e in 2030, compared with a projected BAU level of 1,175 Mt CO_2e, including LULUCF.

Türkiye’s NDC 3.0, submitted in November 2025, sets a new 2035 target of 643 Mt CO_2e. This is 466 Mt CO_2e below the updated 2035 BAU level of 1,109 Mt CO_2e. The target is economy-wide and covers energy, industrial processes and product use, agriculture, waste and LULUCF.

The 2030 and 2035 figures should not be compared as a simple percentage-point change because Türkiye revised the BAU scenario and the underlying reference data for NDC 3.0. The important point for this review is that the new NDC does not introduce a lower 2030 target and keeps the sources, sinks and activities covered by the previous NDC.

Türkiye therefore represents a different type of progression from Norway or the United Kingdom: the country extends its mitigation pathway to 2035 using an updated BAU framework rather than a directly comparable percentage target. The 2035 target is linked to Türkiye’s climate strategies and its objective of net-zero emissions by 2053.

13.7 United Kingdom

The United Kingdom’s updated 2030 NDC, submitted in September 2022 under the NDC 2.0 cycle, commits the country to reducing economy-wide GHG emissions by at least 68% by 2030 compared with 1990 levels. The target supports the UK’s legally binding objective of reaching net-zero emissions by 2050.

In January 2025, the United Kingdom submitted its NDC 3.0 for 2035, setting a new economy-wide target of at least 81% GHG reduction by 2035. International aviation and shipping remain outside the NDC scope, consistent with the 2030 submission.

The comparison is clear: the existing 2030 target is retained, the overall scope remains consistent, and the reduction level rises from at least 68% in 2030 to at least 81% in 2035. This is a 13 percentage-point increase over five years.

The United Kingdom therefore provides a simple example of NDC progression: the NDC 2.0 commitment for 2030 remains in place, while NDC 3.0 adds a stronger 2035 target within the same long-term framework towards net zero by 2050.

13.8 Peru

Peru is a useful contrasting case. Under the NDC 2.0 cycle, its 2020 updated NDC set an unconditional 2030 emissions limit of 208.8 Mt CO_2e and an additional conditional aspiration of 179 Mt CO_2e by 2030, subject to international support.

Peru's NDC 3.0, submitted in November 2025, sets 179 Mt CO_2e as the national mitigation target for 2035. The target remains conditional on international climate finance, technical cooperation, technology transfer and capacity-building.

Peru presents this as progression because the 179 Mt CO_2e level was previously an aspiration and is now a formal 2035 target, supported by additional sector-specific mitigation commitments. However, the same conditional emissions level is now reached five years later than in the previous NDC.

For this reason, Peru is not a simple case of higher ambition. It shows that NDC progression depends not only on the headline number, but also on the target year, whether the target is conditional, and whether a previous aspiration becomes a formal commitment.

13.9 Azerbaijan

Azerbaijan is particularly relevant to the question of whether an existing 2030 commitment can be weakened. Its first NDC set a target to reduce greenhouse gas emissions by 35% by 2030 compared with 1990. In its updated NDC submitted in 2023, Azerbaijan communicated a conditional target to reduce greenhouse-gas emissions by up to 40% by 2050 compared with 1990, subject to international support through finance, technology transfer and capacity-building.

Because the earlier 35% reduction target for 2030 was no longer included, Climate Action Tracker assessed the 2023 update as weaker than Azerbaijan's previous NDC. This makes Azerbaijan different from most other cases in this review, where the existing 2030 target was retained.

Azerbaijan's NDC 3.0, submitted in November 2025, sets an economy-wide target to reduce greenhouse gas emissions by 40% by 2035 compared with 1990. The target is conditional on factors including international financial support, technology availability and technology transfer. Compared with the 2023 NDC 2.0, this brings the same 40% reduction forward from 2050 to 2035 and therefore represents a clear strengthening of the post-2030 pathway.

Azerbaijan is therefore an important comparison for the Republic of North Macedonia. It shows that a previously communicated 2030 target has, in practice, been left out of a later NDC, and Climate Action Tracker assessed this as a weakening of ambition. Its NDC 3.0 then moved towards stronger ambition by bringing the 40% reduction target forward from 2050 to 2035.

13.10 Comparative overview

The table below provides a comparative overview of the mitigation commitments under NDC 2.0 and NDC 3.0 for the Republic of North Macedonia and the selected countries. It highlights the evolution of 2030 commitments and the introduction of 2035 and longer-term mitigation pathways, providing a reference point for the preparation of the Republic of North Macedonia's NDC 3.0.

Table 26 Summary of NDC 2.0 and NDC 3.0 targets

Country	NDC 2.0 – 2030 target	Treatment of the 2030 target in NDC 3.0	NDC 3.0 – 2035 / longer-term target	Overall change in ambition	Target accounting basis
Republic of North Macedonia	**82% reduction in net GHG emissions compared with 1990, corresponding to 51% reduction in gross GHG emissions**	**NDC 3.0 under preparation**	**To be defined under NDC 3.0**	**To be determined**	**Net (incl. LULUCF); gross shown separately**
Serbia	**33.3% reduction in GHG emissions**	**Existing 33.3% target retained as**	**40.1% reduction by 2035 compared with**	**Increased**	**Gross (excl. LULUCF)**

Country	NDC 2.0 – 2030 target	Treatment of the 2030 target in NDC 3.0	NDC 3.0 – 2035 / longer-term target	Overall change in ambition	Target accounting basis
	compared with 1990, excluding LULUCF	the relevant 2030 benchmark	1990, excluding LULUCF		
Brazil	53.1% reduction in net GHG emissions compared with 2005, corresponding to 1.20 $GtCO_2e$	Previous 2030 target remains the reference	59–67% reduction by 2035 compared with 2005; climate neutrality by 2050	Increased beyond 2030	Net (incl. LULUCF)
Norway	At least 55% reduction in GHG emissions by 2030 compared with 1990	Existing 2030 NDC explicitly maintained	At least 70–75% economy-wide reduction by 2035 compared with 1990	Clear progression beyond 2030	Gross base; LULUCF separate
Türkiye	41% reduction by 2030 compared with BAU; 695 Mt CO_2e compared with 1,175 Mt CO_2e BAU	No revised or lower 2030 target communicated	643 Mt CO_2e by 2035; 466 Mt CO_2e below updated BAU of 1,109 Mt CO_2e	Progression beyond 2030; direct percentage comparison limited by revised BAU	Net (incl. LULUCF)
United Kingdom	At least 68% economy-wide net reduction by 2030; IAS excluded from NDC scope	Existing 2030 target retained; accounting scope remains broadly consistent	At least 81% economy-wide net reduction by 2035; IAS excluded; net zero by 2050	Clear progression; 13 percentage-point increase	Net (incl. LULUCF; excl. IAS)
Peru	2030: 208.8 Mt CO_2e unconditional; additional 179 Mt CO_2e conditional aspiration	No revised 2030 target; the 179 Mt CO_2e conditional level becomes the 2035 target	179 Mt CO_2e by 2035, conditional on international support	Mixed/contested progression: the same conditional emissions ceiling shifts from 2030 to 2035	Net cap (incl. LULUCF)
Azerbaijan	No separate 2030 target in the 2023 NDC 2.0; earlier NDC: 35% reduction by 2030 compared with 1990	Earlier 2030 target was not retained; NDC 3.0 does not set a separate economy-wide 2030 target	40% reduction by 2035 compared with 1990; conditional on international support and technology	2023 update assessed as weaker; NDC 3.0 strengthens the post-2030 pathway	Net (incl. LULUCF)
Slovenia	EU-wide 55% net reduction by 2030 compared with 1990	55% retained at EU level	66.25–72.5% indicative reduction by 2035; pathway towards climate neutrality by 2050	Increased beyond 2030	Net—EU (incl. LULUCF)
Germany	EU-wide 55% net reduction by 2030 compared with 1990	55% retained at EU level	66.25–72.5% indicative EU reduction by 2035; national target of 88% reduction by 2040 and climate neutrality by 2045	Increased beyond 2030; higher national ambition	Net—EU (incl. LULUCF)
Bulgaria	EU-wide 55% net reduction by 2030 compared with 1990	55% retained at EU level	66.25–72.5% indicative reduction by 2035; pathway towards climate neutrality by 2050	Increased beyond 2030	Net—EU (incl. LULUCF)

ANNEX I Documents Reviewed for the Preparation of the Republic of North Macedonia's NDC 3.0

This annex lists the documents, reports, datasets and consultation inputs reviewed and used in the preparation of the Republic of North Macedonia's NDC 3.0 and its technical background document.

1. National Climate Policy Documents

Enhanced NDC (2021)

This is the starting point because Chapter 3 assesses implementation of the existing NDC.

- The Republic of North Macedonia Enhanced NDC (UNFCCC)

NDC Implementation Roadmap

Critical for assessing implementation progress and identifying gaps.

- NDC Implementation Roadmap 2020–2030

First Biennial Transparency Report (BTR1)

This is the most important technical input for:

- Chapter 2
- Chapter 3
- Chapter 4
- Chapter 11
- Chapter 12

National Energy and Climate Plan (NECP)

Essential for:

- mitigation pathways
- PaMs
- energy targets
- 2030 projections
- National Energy and Climate Plan (Official EN Version)

National Development Strategy 2024–2044

Important for:

- long-term development priorities
- just transition
- resilience
- adaptation
- National Development Strategy 2024–2044

2. Adaptation Documents

Climate Action Strategy

This should be one of the main sources for:

- Chapter 5
- adaptation targets
- resilience priorities

National Communications (NC3, NC4)

Needed for:

- vulnerability assessments
- adaptation assessments
- Loss and Damage
- biodiversity analysis

Biennial Update Reports (BUR1–BUR3)

Particularly useful for:

- historical vulnerability analysis
- adaptation actions
- institutional arrangements
- Third Biennial Update Report

3. Finance and Just Transition

Climate Public Finance Review (CPFR)

Mandatory source for:

- Chapter 8
- financing gaps
- domestic finance landscape

Country Climate and Development Report (CCDR)

Mandatory source for:

- investment needs
- transition costs
- resilience priorities

Just Transition Roadmap

Mandatory source for:

- Chapter 6
- employment impacts
- social implications
- vulnerable regions

4. Biodiversity and Loss and Damage

National Biodiversity Strategy and Action Plan (NBSAP)

Needed for:

- Chapter 7
- ecosystem-based adaptation
- protected areas

National Adaptation Plan

Needed for:

- adaptation targets
- adaptation indicators

Loss and Damage Assessments

Extracted from:

- National Communications
- BTR1
- Disaster risk assessments
- Sendai reporting

Used for:

- Chapter 5.3
- Loss and Damage response measures

5. Social Inclusion Inputs

Youth Consultant Report

(Provided by UNDP)

Feeds:

- Chapter 6.6

Gender Consultant Report

(Provided by UNDP)

Feeds:

- Chapter 6.5

Vulnerable Groups Assessment

(Provided by UNDP)

Feeds:

- Chapter 6.4

6. UN System Inputs

UN Agencies Stocktake

Explicitly requested in the ToR.

Used for:

- Chapter 1.3.4
- Chapter 5
- Chapter 6
- Chapter 8

UN Country Analysis 2024

Useful for:

- youth
- gender
- resilience
- SDG alignment
- UN Country Analysis 2024 – North Macedonia

7. International Reference Documents (NDC 3.0 Design)

- UNDP NDC 3.0 Quality Assurance Checklist
- Global Stocktake Outcome (decision 1/CMA.5)
- Decision 4/CMA.1 (ICTU Guidance)
- Enhanced Transparency Framework (ETF) Reference Manual
- Adaptation-related CMA Decisions

8. Additional Documents and Sources Used in the Preparation of the NDC 3.0

The following documents, datasets and consultation inputs were cited in the text and in the review comments of the technical background document and are consolidated here.

8.1 Gender inputs

- Analysis of Gender Policies and Data in Connection to Climate Policies for BTR/NDC (2020–2024), 2025
- Gender Gap Analysis on Climate Change and Environment in the Republic of North Macedonia, UN Women, 2025
- Set of Gender Indicators for NDC 3.0 of the Republic of North Macedonia, May 2026
- Integrating Gender-Responsive Indicators into the Republic of North Macedonia's NDC 3.0: Findings from the Stakeholder Consultation on Gender Indicators
- Policy Brief: Integrating Gender into the Republic of North Macedonia's Just Transition Planning, May 2026

8.2 Youth inputs

- Annex 1 – Youth Mainstreaming Analysis, NDC 3.0 (v4.1)
- Field Research Report D1, NDC 3.0 (v4.1)
- Youth Indicators NDC 3.0, D2 (v4.1)
- D3 – Policy Brief: Just Transition and Youth in the Republic of North Macedonia (v2)
- Izveshtaj – Konsultaciski sredbi so mladi za NDC (Report on consultation meetings with youth on the NDC)
- 2025 Local Conference of Youth (LCOY) North Macedonia – National Youth Statement

- UNICEF Story of Impact 2024 – Western Balkans: Sustainability-driven education (https://www.unicef.org/media/172136/file)

8.3 National reporting and policy documents

- First Biennial Transparency Report (BTR1) of the Republic of North Macedonia
- Third Biennial Update Report (TBUR) on Climate Change
- Information on Financial, Technology Development and Transfer and Capacity-Building Support Needed and Received under Articles 9–11 of the Paris Agreement
- National Energy and Climate Plan for the Period 2021–2030
- NDC 3.0 Implementation Plan for the Social Sector
- Annual Implementation Plan for the Just Transition 2026
- Just Transition Diagnostic (Just Transition Roadmap), including the summary table of flagship projects

8.4 International organisation reports

- World Bank, North Macedonia Country Climate and Development Report (CCDR), 2024
- World Bank, North Macedonia Climate Public Finance Review, 2024
- World Bank, Business Ready 2024
- United Nations, World Investment Report 2025
- UN North Macedonia Country Analysis 2024
- UNDP, Climate Promise: From Pledge to Impact
- UNDP North Macedonia Country Office Profile 2026 (https://www.undp.org/north-macedonia/publications/undp-north-macedonia-country-office-profile-2026)
- ILO, Decent Work Country Programme – North Macedonia 2023–2025 (https://www.ilo.org/sites/default/files/wcmsp5/groups/public/@europe/@ro-geneva/@sro-budapest/documents/genericdocument/wcms_887216.pdf)

8.5 Data sources and methodological tools

- State Statistical Office of the Republic of North Macedonia (MAKStat database; Labour Force Survey)
- Eurostat
- INSTAT (Albania) and MONSTAT (Montenegro)
- 2006 IPCC Guidelines for National Greenhouse Gas Inventories and the 2019 Refinement; IPCC Inventory Software
- Modelling tools and Excel-based models developed by the project team