

Pursuant to Article 7(3) of the Law on Climate Change (Official Gazette of RS, No 26/21), Art. 38 and 50 of the Law on the Planning System of the Republic of Serbia (Official Gazette of RS, No 30/18) and Article 4(19) of the Law on ratification of the Paris Agreement (Official Gazette of the RS – International Agreements, No. 4/17),

Government adopts

LOW CARBON DEVELOPMENT
STRATEGY OF THE REPUBLIC OF SERBIA
FOR THE PERIOD 2023- 2030 WITH PROJECTIONS UNTIL 2050

1. INTRODUCTION

The risks that climate change poses to Serbia’s sustainable development are evident. The effects of climate change are already a threat, while future risks could jeopardise, among else the infrastructure, agriculture productivity, water availability and public health.

The latest data show an average temperature increase of 0.36°C per decade between 1961 and 2017, while climate change scenarios predict an increase between 2°C and 4.3°C until 2100, compared to the period 1986-2005. Average precipitation decreased up to 10% in the period between 1961 and 2017, while according to climate change scenarios, average annual precipitation may decrease up to 4.5% by 2100 compared to the reference period 1986-2005¹.

On the other hand, existing high carbon (fossil fuel) dependency may jeopardise the competitiveness of Serbia’s economy in the medium and long-term.

In addition, the obligations of the Republic of Serbia under the Law on ratification of the Paris Agreement (hereinafter referred to as: the Paris Agreement) and the United Nations Framework Convention on Climate Change (hereinafter referred to as the UNFCCC), require a long-term huge shift of the Serbian economy towards the low-carbon and climate resilient development

Serbia is actively contributing to global efforts against climate change, in accordance with the principle of common but differentiated responsibilities, as a Non-Annex I Party to the United Nations Framework Convention on Climate Change. Serbia is also signatory to the Kyoto Protocol and to the Paris Agreement.

Under the Paris Agreement Serbia is committed to reduce its greenhouse gas emissions (hereinafter referred to as GHG) by 9.8% until 2030 compared to 1990 levels. This Nationally Determined Contribution (hereinafter referred to as NDC) under the Paris Agreement states that: “Climate Change Strategy with Action Plan [...] will further define the precise activities, methods and implementation deadlines.”

¹ Appendix 1: Observed climate change and projections of future climate for Serbia

The Paris Agreement requires the countries to revise and update their NDCs periodically (starting from 2020), gradually increasing their ambitions or GHG emission reduction commitments, depending on the national circumstances and capacities.

Therefore, the first goal of the Low Carbon Development Strategy of the Republic of Serbia set for the period 2023-2030 with projections until 2050 (hereinafter referred to as the Strategy) is to support Serbia in the fulfilment of obligations under the Paris Agreement. The results of the Strategy served as a basis for the review of the first Nationally Determined Contribution, which, after being adopted by the Government, was submitted to the Secretariat of the United Nations Framework Convention on Climate Change in August 2022. In accordance with the updated Nationally Determined Contribution, Serbia undertook to reduce GHG emissions by 33.3% until 2030 compared to 1990 levels.

As a candidate country for accession to the European Union (hereinafter referred to as the EU), Serbia is already making an effort to align with the EU policies and actions. The EU 2030 Climate and Energy Framework sets three key targets to be achieved by 2030: at least 40% cuts in GHG emissions (compared to 1990 levels); at least 32% share for renewable energy; and at least 32.5% improvement in energy efficiency.

Similar to the European Union, Energy Community (hereinafter referred to as EnC) Contracting Parties², including Serbia, are committed to monitoring and reporting in the areas of renewables, energy efficiency, and GHG emissions as well as other information relevant to climate change. The Paris Agreement further defines reporting obligations for the period after 2020 by establishing an enhanced transparency framework for action and support. In this context, the Energy Community adopted Recommendation 2018/01/MC-EnC on preparing for the development of Integrated National Energy and Climate Plans addressing the five dimensions of the Energy Union by the Energy Community Contracting Parties. In addition, the Energy Community Treaty has been expanded to include Regulation (EU) 2018/1999 on the governance of the Energy Union and Climate Action.

Thus, the second goal of the Strategy is to present possibilities and recommend preferable options for alignment of Serbia's GHG emissions pathway to the EU's in an affordable and socially fair way.

For the mentioned purposes and in order to evaluate different mitigation options, six GHG emission scenarios have been developed, while the Strategy determines the pathway until 2030 and suggests a range of possible options until 2050.

Additionally, in the first NDC, Serbia underlines its vulnerability, losses and damages associated with extreme weather events and needs for adaptation. The Strategy also identifies adaptation options relevant for the GHG emissions reduction and the mitigation actions.

The drafting of the Strategy was coordinated by the Ministry of Environmental Protection as the responsible institution. It was developed with financial and technical support of the EU, through IPA 2014 project: "Climate Strategy with Action Plan", while the Strategy is mostly the

² The Law on the ratification of the Energy Community Treaty between the European Community and the Republic of Albania, the Republic of Bulgaria, Bosnia and Herzegovina, the Republic of Croatia, the Former Yugoslav Republic of Macedonia, the Republic of Montenegro, Romania, the Republic of Serbia and the United Nations Interim Administration Mission in Kosovo in accordance with United Nations Security Council Resolution 1244 (Official Gazette of RS, No. 62/06).

result of a close cooperation and constant consultations with relevant stakeholders (governmental authorities, public and private sectors and CSOs³).

The Action plan for the implementation of the Low Carbon Development Strategy for the period 2024-2030, as well as the Integrated National Energy and Climate Plan, which will be adopted within a year, will define activities for the implementation of actions and achievement of objectives of the Strategy.

Appendix 1 - Observed climate change and projections of future climate for Serbia, Appendix 2 - Information on consultations process in the preparation of the Strategy, Appendix 3 - Information on regulations to be adopted or amended, and Appendix 4 – Thebreakdown of emissions scenarios by sector, which are printed with this Strategy and make its integral part.

2. CURRENT SITUATION AND STRATEGY VISION

2.1. Policy framework

Serbia ratified the United Nations Framework Convention on Climate Change on 12 March 2001, and the Paris Agreement on 25 July 2017. Under the Paris Agreement Serbia has commitment, through its first Nationally Determined Contribution submitted on 30 June 2015 to “reduce GHG emissions by 9.8%⁴ until 2030 compared to 1990”, while the updated Nationally Determined Contribution, submitted on 28 August 2022, defined the objective of 33.3% compared to 1990. Net GHG emission reduction targets for Serbia, including the reduction and elimination of emissions from the land use, land use change and forestry (hereinafter referred to as LULUCF) were adopted in December 2022, under the Energy Community Treaty.

Thus far, country activities related to climate change were mostly analysed and described in the national and biannual updated reports, developed to meet the reporting obligations to the UNFCCC.

The process of EU integration speeded up the preparation of the Law on Climate Change, which was adopted in March 2021. This Law transposes EU relevant legislation⁵, providing, among other things, a legal basis for the development and updating of low-carbon development and adaptation strategies, monitoring, reporting and verification of GHG emissions and implementation of climate policies and measures.

Besides this Law, Serbia introduced certain sectoral policies and measures that contribute to GHG emission reduction and efficient adaptation.

³ Appendix 2: Information on consultations process in the preparation of the Strategy

⁴ For defining the NDC, targets from Energy Sector Development Strategy of the Republic of Serbia for the period until 2025, with projections to 2030 were considered (Official Gazette of RS, No. 101/15)

⁵ Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading (EU-ETS)

Decision 406/2009/EC on the effort of Member States to reduce their greenhouse gas emissions to meet the Community’s greenhouse gas emission reduction commitments

Regulation 525/2013/EC on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change

Directive 1999/94/EC of the European Parliament and of the Council of 13 December 1999 relating to the availability of consumer information on fuel economy and CO₂ emissions in respect of the marketing of new passenger cars

However, as identified in the process of development of the Strategy, there is still a lack of adequate mechanisms and instruments, especially financial ones, as well as capacity constraints for fostering low-carbon and climate-resilient development.

2.1.1. Sectoral policies

Intergovernmental Panel on Climate Change (hereinafter referred to as IPCC) has classified economy sectors relevant for GHG emissions such as: Energy (including energy industries, transport and the residential and services buildings sector); Industrial Processes (including, among others, the mineral, chemical and metal industry) and Product Use (hereinafter referred to as the IPPU); Agriculture, Forestry and Other Land Use; and Waste (including solid waste disposal and wastewater treatment). The EU reports emissions of these sectors as sectors that are included in the Emission Trading System (hereinafter referred to as the EU ETS) and emissions that are not included in the ETS (hereinafter referred to as non-ETS).

At the same time, sectoral policies relevant for GHG emission reduction, and therefore for the Strategy, concern those economy sectors with the largest GHG emissions (based on the data about historical GHG emissions).

As is the case in almost all countries of the world, the energy sector (including transportation) is the most important GHG-emitting sector in Serbia since GHG emissions from the energy sector accounted for 80.6% of total national emissions in 2015⁶.

The legal and strategic framework in the field of energy recognises the importance of ensuring secure energy supply and energy availability, and within that framework, the efficient use of energy and changing the structure of production towards low-carbon technologies by increasing the share of renewable energy sources (hereinafter referred to as RES) in final consumption.

The legal framework consists of:

1) The Energy Law (Official Gazette of RS, Nos. 145/14, 95/18 - other law, 40/21 and 35/23 - other law), which defines the main long-term targets of the energy policy and the Energy Sector Development Strategy, as the main document that defines the energy policy, as well as the obligation of drafting the Integrated National Energy and Climate Plan, which will determine the national energy-climate targets, as well as policies and measures for their implementation;

2) The Law on Energy Efficiency and Rational Use of Energy (Official Gazette of RS, No. 40/21);

3) The Law on the Use of Renewable Energy Sources (Official Gazette of RS, No. 45/21 and 35/23).

These laws are harmonised with EU regulations, as required under the Energy Community Treaty.

In accordance with the Energy Law, the following were adopted:

1) The Energy Sector Development Strategy of the Republic of Serbia for the period until 2025, with the projections up to 2030, which defines the three main priorities: improvement of energy security, development of the energy market and sustainable development, and implementation of the obligations under the Energy Community Treaty;

⁶ The last year for which GHG emissions data were available during Strategy preparation process

2) Decree on establishing the Programme for the Implementation of the Energy Sector Development Strategy of the Republic of Serbia for the period up to 2025, with projections until 2030 (Official Gazette of RS, No. 104/17), for the period from 2017 until 2023, which defines all measures, activities and projects which should be done in all energy sectors;

3) The new Energy Sector Development Strategy for the period until 2040 and the Integrated National Energy and Climate Plan for the period until 2030 is underway. In line with the Energy Sector Development Strategy, the Integrated National Energy and Climate Plan will definitely determine the objectives for the RES share in the gross final energy consumption and the increase in energy efficiency in 2030, as well as the policies and measures to achieve them.

Furthermore, in 2022, the Long-term strategy for mobilising investments in renovating Serbia national building stock up to 2050 was adopted (Official Gazette of RS, No. 27/22).

In compliance with the obligation under the Energy Community Treaty, the National Renewable Energy Action Plan and the National Energy Efficiency Action Plans introduce measures and actions that contribute to GHG emissions reduction.

The GHG emissions from agriculture, which accounted for 8.5% of total national emissions in 2015, stem from the use of fertilizers, enteric fermentation and emission from manure management.

The Agriculture and Rural Development Strategy of the Republic of Serbia for the period 2014-2024 (Official Gazette of RS, No. 85/14) takes into account the importance of climate change as an external factor that is relevant for the agricultural production. The relevance of adaptation and use of biomass residues and waste for renewable energy is mentioned in this Strategy, as well as general impacts of agriculture on GHG emissions.

The Serbian agricultural policy combines different types of subsidies. Some of these (e.g. better machinery, improved manure management and use of renewable energy sources) will potentially contribute to GHG emissions reduction and support adaptation (e.g. irrigation systems). However, there are no defined objectives in terms of GHG emissions reduction or reduction of vulnerability or adaptation.

Serbian forests contribute to the removal of carbon dioxide from the atmosphere through photosynthesis (so-called carbon sink or carbon sequestration). In 2015, the CO₂ removed from the atmosphere by the Serbian forests⁷ amounted to 4 533 kt CO₂, which can compensate for 7.4% of Serbia's emissions.

“Forestry Development Strategy of the Republic of Serbia emphasises the importance of conservation and improvement of the state of forests and the development of forestry as an economy branch”. The draft Forestry Development Programme with Action Plan (2010) provides guidance to stakeholders in relation to the development of the sector and includes targets, primarily for afforestation. Such approaches and/or targets are aligned with the need to increase carbon sinks in Serbia but there are no GHG emissions reduction targets and they are not drivers for forestry related actions.

In addition, the Sustainable Spatial Development Strategy of the Republic of Serbia up to 2030 (Official Gazette of RS, No. 47/19) in the field of forestry determines the long-term basis and objectives of development and use of forests and forest land management, management of hunting opportunities and the protection of natural resources. The Law on Planning and Construction (Official Gazette of RS, Nos. 72/09, 81/09 - corr., 64/10 - CC, 24/11, 121/12, 42/13 - CC, 50/13 - CC, 98/13 - CC, 132/14, 145/14, 83/18, 31/19, 37/19 - other law, 9/20 and 52/21)

⁷ This corresponds to the land use category > Forest remaining a forest in the National GHG Inventories.

stipulates that area under the forests should be 41.4% of the total area of Serbia, which is considered an extremely ambitious target.

Serbian forests are particularly vulnerable to biotic (such as pests and diseases) and abiotic (such as fires) factors, which will be aggravated by climate change. In order to minimise impacts, sustainable forest management requires the adoption of practices that take into account scenarios of future climate conditions.

In 2015, emissions from the waste sector accounted for 4.2% of national total emissions. Solid waste management in Serbia is generally based on landfilling. Several cities have facilities for manual waste separation, with low efficiency (maximum separation of recyclables is 6%), mostly due to the lack of separation at source. This means that most organic waste is sent to landfill, thus contributing to GHG emissions. There are no systems for the collection and treatment of landfill gas, meaning that it is directly released into the atmosphere in the form of methane (CH₄). Emissions would be reduced if methane was combusted⁸ for electricity and/or heat production and released into the atmosphere as CO₂ (CO₂ has lower impact on global warming than CH₄). The current waste policy framework in Serbia is partially aligned with the EU legislation. However, implementation is assessed weaker than prescribed. Waste management policies still do not recognise GHG emissions reduction as an important driver of strategic development in the sector.

According to the Specific Implementation Plan for Council Directive 91/271/EEC concerning urban wastewater treatment, about 55% of the overall population has access to public sanitation. There are 32 operational urban wastewater treatment plants, of which relatively few operate according to design criteria, while the remainder are non-compliant. Sludge treatment is currently present in Subotica and Sombor, while few other wastewater treatment plants have no treatment option, which has significant impact on GHG increase. Serbia is planning to achieve compliance with the EU urban wastewater treatment directive by 2044 (under the assumption that it enters the EU in 2025).

2.2. Climate change vulnerability and adaptation

The risks that climate change poses to Serbia's sustainable development are evident. The Second National Communication (SNC) to the UNFCCC and the draft National Adaptation Plan confirm the temperature increases during the period 1960-2012, by an average of 0.3°C per decade. Moreover, climate scenarios project future temperature increase in the range from 3.8 to 4.6°C (depending on climate scenarios). For the period 2071-2100, and for the majority of the country significant decrease in precipitation compared to the reference period (1961-1990) during most seasons (except in spring) is projected. It goes up to 30% in the summer season across almost the whole territory of Serbia.

Moreover, the impacts of climate change may, among else, jeopardise infrastructure, agriculture productivity, water availability and public health. Vulnerability reduction and adaptation options for the purpose of the Strategy were identified also based on the draft Second National Communication to the UNFCCC and the draft National Adaptation Plan. These documents underline three most vulnerable sectors: Agriculture, Forestry and Hydrology and

⁸ <https://upravazasume.gov.rs/wp-content/uploads/2015/12/Strategija-razvoja-sumarstva.pdf>

Water Resources. These sectors are important from the Strategy's perspective due to their relation with mitigation potentials and options.

Thus, using the Adaptation Planning Framework, adaptation measures up to 2030 and 2050 for each of the following three priority sectors have been identified:

- 1) Agriculture – food production;
- 2) Forestry – biomass supply;
- 3) Hydrology and Water Resources – hydro-electric production utilisation.

These three priority sectors have been selected as particularly vulnerable to climate change, and due to their importance for the achievement of climate change mitigation goals, respecting social and environmental aspects.

The production of energy from hydro potential, forest or agricultural biomass depend on, among else, climate change impacts on these sectors and sub-sectors. At the same time, these sectors significantly contribute to economic and environmental aspects of the Serbian society. Therefore, adaptation of these sectors and sub-sectors to climate change contribute to sustainable planning under the Strategy.

The Adaptation Planning Framework was developed during the process of development of the Strategy. The main purpose of the Framework development was to provide a tool for assessment of the adaptation requirements of future projects, policies and measures.

2.3. GHG emission historical trends

Total GHG emissions in 2015⁹ without LULUCF amounted to 61,233 kt CO₂eq, which represents a 2.3% decrease of emissions compared to 2010, and 24.9% compared to 1990. In 2015, CO₂ removed from the atmosphere in the LULUCF sector amounted to 4,533 ktCO₂, which represents a 19.4% decrease compared to 2010 and a 216.6% increase compared to 1990 (Figure 1).

⁹Year 2015 is the last year used for entering historical data in the model. This means that GHG emissions until 2015 are based on actual GHG emissions, estimated on the basis of the National Inventory of GHG emissions, prepared by the Environmental Protection Agency, and that emissions from 2016 onwards are the result of modelling.

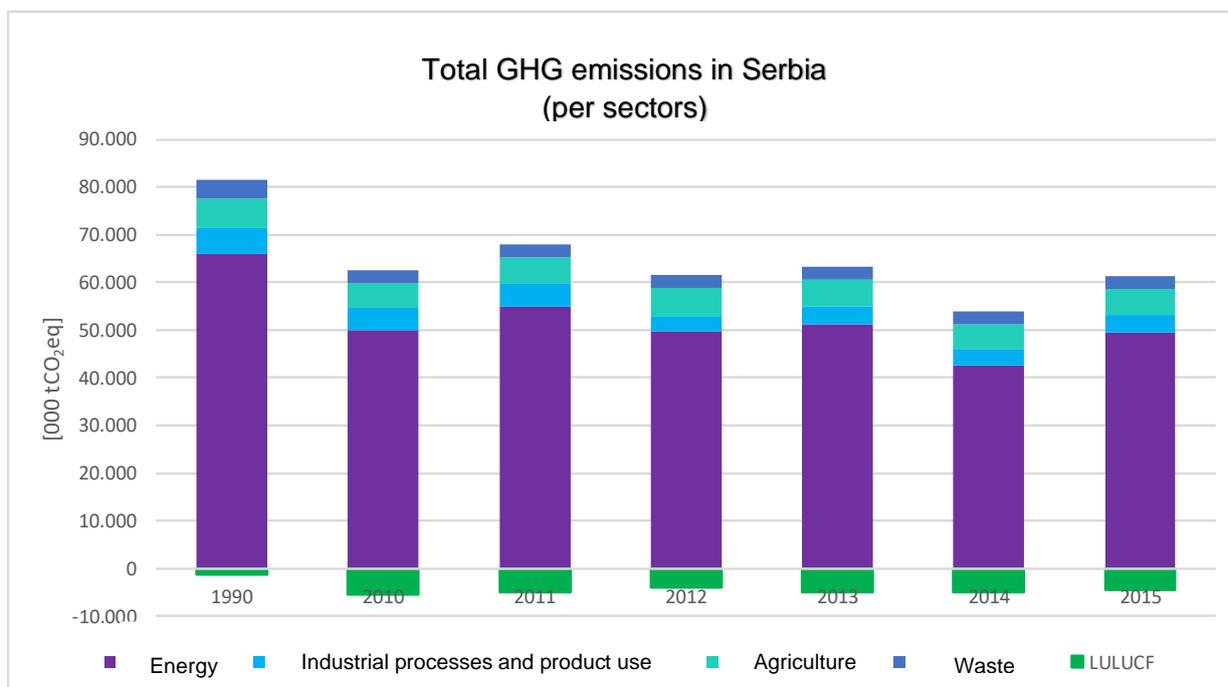


Figure 1: Serbia's total GHG emissions¹⁰ (1990-2015) (kt CO_{2eq})

Energy sector is by far the biggest source of GHG emissions in Serbia accounting for 80.6% of overall emissions, of which, energy industry as a sub-sector comprising public electricity and heat production, refineries and manufacturing of fuels (representing 70% of the energy sector emissions and 56% of the national totals) is the most important. A decreasing trend since 1990 (21.4%) can be attributed more to lower production than to structural reforms in the sector. Compared to 2010, emissions have decreased by 5% in 2015.

GHG emissions in sub-sectors/categories of the energy sector in 2015 were:

- 1) In Transport sector 31.4% higher than in 1990 and 11.1% below 2010 levels;
- 2) Emissions from Manufacturing Industries and Construction were 46.2% lower than in 1990¹¹ and 19.3% lower compared to 2010. This trend is due to decrease in manufacturing industry activity and, to some extent, to the increase of biomass consumption for 137% since 2010;
- 3) Emissions in "Other sectors" (commercial, residential and other institutional buildings and fuel combustion in agricultural stationary equipment) were 61.5% lower compared to 1990 and 22% lower compared to 2010;
- 4) Fugitive emissions from mining and oil and gas production and processing (the main source of CH₄ emissions in the Energy sector) were 4.7% higher than in 2010 and 34.3% lower than in 1990.

GHG emissions in the Industrial Processes and Product Use (IPPU) sector follow, step by step, the economic activities. In 2015, these emissions were 28.8% lower than in 1990 and 16.7% lower than in 2010. The use of products as substitutes for ozone depleting substances increased by 72% in the period until 2015 in comparison to 2010¹². The trend is dominated by

¹⁰ Source: Report on Result 2: Basic national GHG emission scenarios for 2020, 2030 and 2050 (IPA Project Climate Change Strategy with Action Plan), based on information received from the Environmental Protection Agency.

¹¹ Industrial combined heat and power plants are included in the energy sector.

¹² The first use of F-gases was reported for Serbia in 1997.

the stationary refrigeration and air conditioning using HFC-125, HFC-134a and HFC-143 and by mobile refrigeration using HFC-134a.

Agriculture emissions accounted for 8.6% of total emissions in 2015 and were 15% below 1990 and 0.9% below 2010 levels. Emissions of CH₄ from enteric fermentation were 42% lower compared to 1990 levels and 2.5% compared to 2010. The main driver of the observed decrease is the dairy cattle population. Emissions from manure management have decreased by 38.3% compared to 1990 and 5.5% compared to 2010. Direct N₂O emissions, have increased by 51.8% by 2015, compared to 1990 and 0.4% compared to 2010. Indirect N₂O emissions, which are caused by atmospheric deposition of volatilised Nitrogen (N) and by leaching/runoff of N compounds into water, have increased by 47.2% compared to 1990 and by 1.7% compared to 2010.

In the LULUCF sector, negative emissions mean that CO₂ sequestration¹³ (removal from the atmosphere through, for example, photosynthesis or organic matter accumulated in soil) is larger than GHG emissions in each land use category, such as forest land, cropland, grassland, wetlands, settlements, and other types of land. Carbon content of harvested wood products (such as furniture) also falls under this sector.

In 2015, the CO₂ removed from the atmosphere in the LULUCF sector amounted to 4,533 ktCO₂, which is a 19.4% decrease compared to 2010 and a 216.6% increase compared to 1990. The net negative emissions (sinks) are mostly a result of the positive ratio between the increase of forest biomass on the one hand, and deforestation, wildfires, etc. on the other hand, in the forestry sector (which is only one of the sectors of the LULUCF). According to the data from the National Inventory of GHG Emissions, prepared by the Environmental Protection Agency, the net sink of the forest sector in the period 2010-2015 has decreased by 19%, due to increased consumption of the solid biomass (fuel wood) and increased use of technical wood. The GHG emissions from waste sector have declined since 1990 by 29.9%, and since 2007 by 0.7%, mainly due to a decrease in the degradable industrial waste disposal on land and reduction of emissions from wastewater. Namely, wastewater emissions have decreased by 29.9% since 1990 and by 3.9% compared to 2010, mostly owing to reduction of emissions from industrial wastewater.

2.4. Vision

The above described situation, the long-term requirements of the Paris Agreement in terms of balancing global GHG emissions and sinks in the second half of the 21st century, as well as the EU accession process, are the basis for a long-term vision of the Strategy.

The vision is that, by 2050, Serbia will be a low-carbon society with a competitive and resource-efficient economy which provides to citizens new, green jobs and a quality life in a climate-resilient society.

The vision and strategy imply that combating the causes and impacts of climate change should be done in a socially just and cost-effective way, following a sustainable development approach based on which a fairer, more equal and climate resilient society will be built; the economy will successfully compete with other economies under the same conditions, and the environment will be protected for the benefit of future, but also current generations.

¹³ Sequestration is also referred to as sinks or removals.

3. GHG EMISSION SCENARIOS

For the Strategy purposes and achievement of the climate vision, six GHG emission scenarios have been analysed¹⁴: B1 and B2 baseline scenarios (meaning without the introduction of any new measures aimed at reducing GHG emissions) and four mitigation scenarios (aimed at reducing GHG emissions, including through the implementation of the EU acquis).

B1 and B2 scenarios assume there will be no other climate policies and measures than those adopted by 2015, while B1 does not consider full implementation of the Third Energy Efficiency Action Plan (Official Gazette of RS, No. 1/17) and the National Renewable Energy Action Plan (Official Gazette of RS, No. 53/13), that are obligations under the Energy Community Treaty. Therefore, B1 scenario will not be considered as relevant for the Strategy.

All scenarios have been developed using models¹⁵ that are also used for definition of the EU targets and pathways up to 2020, 2030 and 2050 and respective policies and measures, while national circumstances were taken into account. The base year used as a benchmark to show GHG emissions reduction is 2010. Therefore, the GHG emissions reduction efforts are presented in comparison to GHG emission levels recorded in 2010. In addition, in order to compare the GHG emission reduction with the first NDC, these efforts are shown also compared to 1990. However, achievement of the goals will be monitored and reported compared to 2010.

3.1. B2 – Baseline scenario

The B2 baseline scenario¹⁶ assumes that no other policies and measures with impact on GHG emissions will be adopted up to 2050¹⁷ than those in 2015 plus full implementation of the Third Energy Efficiency Action Plan (hereinafter referred to as the EEAP) and the National Renewable Energy Action Plan (hereinafter referred to as the NREAP), as committed.

According to the B2 scenario, emissions will increase by 0.9% in 2020; 2.5% by 2025; 3.2% by 2030; and 10.7% by 2050 compared to 2010 (Figure 2). For 2030, the disaggregation¹⁸ of emissions by sectors shows a projected increase of emissions in energy industries, transport, fugitive emissions and emissions from the IPPU sector. Manufacturing industries and construction, other sectors (residential and commercial), agriculture and waste show the GHG emission decrease for the same period. By 2050, emissions from manufacturing industries, other sectors and the waste sector will decrease. Emissions from all other sectors will increase.

Compared to 2005, emissions are projected to decrease by 5.1% until 2030 and increase by 1.9 % until 2050, while compared to 1990, emissions are projected to decrease by 20.7% until 2030 and by 14.9% up to 2050.

¹⁴ Scenario analysis is a process of analysing possible future events by considering alternative possible outcomes (sometimes called “alternative worlds”). Thus, scenario analysis does not try to show one exact picture of the future. Instead, it presents several alternative future developments. Unlike forecasts, the scenario analysis is not based on extrapolation of the past or the extension of past trends and does not expect past observations to remain valid in the future. *Aaker, David A. (2001). Strategic Market Management. New York: John Wiley & Sons. p. 108, ISBN 978-0-471-41572-5. / Bea, F.Ks., Haas, J. (2005). Strategisches Management. Stuttgart: Lucius & Lucius. p. 279 and 287 et seq.*

¹⁵ For the preparation of the Strategy, GEM-E3, PRIMES and CAPRI models were used.

¹⁶ The B2 baseline scenario has been selected as a basis against which mitigation scenarios will be compared. B2 scenario can be considered as non-EU accession scenario, since it is not taking into account all relevant EU acquis.

¹⁷ Please refer to the chapter on mitigation scenarios (below) for a description of the scenarios analysed.

¹⁸ Detailed information for baseline scenario is available in Appendix D: Sectoral breakdown of emissions scenarios.

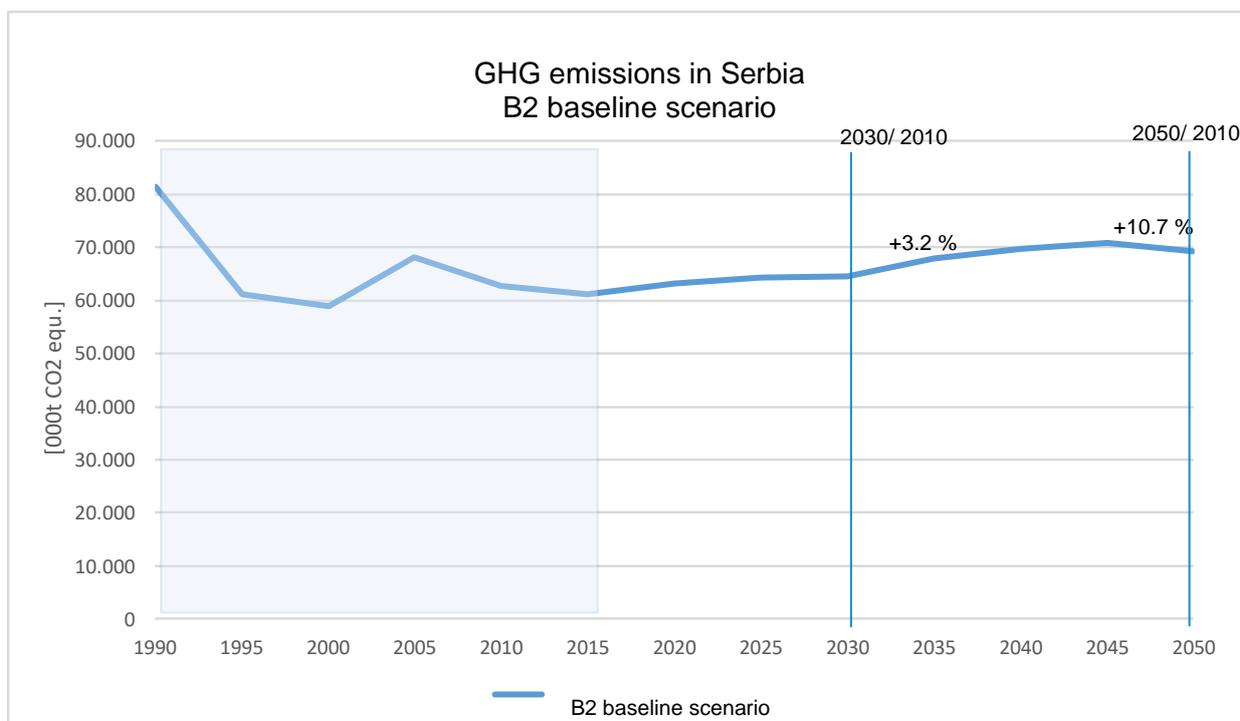


Figure 2: GHG emissions in the Baseline Scenario B2 (kt CO₂eq)

B2 scenario shows an expected steady increase of GHG emissions from 2020 through 2030 until 2045, which is followed by a temporary decrease of emissions until 2050. The temporary decreasing trend is the result of the expected decommissioning¹⁹ of the existing major lignite power plants and due to the absence of climate policies and lack of measures for deployment of renewable energy sources, their gradual replacement with new ones with higher efficiency standards, throughout the period 2040-2050.

3.2. GHG mitigation scenarios

GHG emissions mitigation scenarios considerably deviate from Serbia emissions trajectory defined in the B2 baseline scenario, starting from GHG emissions reductions in 2020. Those are:

- 1) **M1 scenario:** B2 baseline scenario plus implementation of the EU-ETS;
- 2) **M2 scenario:** Implementation of all EU acquis, fully transposed and implemented, achieving 33.3% GHG emissions reduction compared to 1990, and 32.3% RES²⁰ by 2030, while the final targets for RES share in gross final energy consumption and the increase in energy efficiency in 2030 will be defined by the Integrated National Energy and Climate Plan. For the purpose of increasing its ambition and contribution to the achievement of 1.5°C target, two additional scenarios are developed;
- 3) **M3 scenario:** Serbia achieves the EU 2030 individual targets (meaning -40% GHG emissions compared to 1990; 32% RES by 2030 and 32.5% enhanced energy efficiency);
- 4) **M4 scenario:** Serbia aiming to achieve 80% GHG cuts in 2050 compared to 1990 levels.

¹⁹ Based on data received from Public Enterprise Elektroprivreda Srbije

²⁰ RES share in gross final energy consumption as determined in accordance with the provisions of Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources and due to recalculation of biomass consumption share in households.

The M1 scenario shows that carbon pricing alone is not sufficient to promote the introduction of renewable energy sources by 2030, not even to meet the current commitment under the Energy Community, which is set at 27% of gross final consumption by 2020. Therefore, this scenario is excluded from further consideration under the Strategy. In regard to the EU-ETS, alignment with the EU Emissions Trading System must be continued and/or the introduction of other carbon pricing instruments considered between 2025 and 2029, in order to ensure smooth implementation of the EU-ETS upon EU accession and to enable gradual adaptation of stakeholders (energy industry, households) to climate constrained environment.

In the M2 scenario, the modelling results show that the gradual transposition and application of the full EU acquis reduces GHG emissions by 13.2% up to 2030 and by 55% until 2050, compared to 2010. This scenario represents the likely contribution of the EU to 2030 GHG emissions reductions, to the introduction of RES and improvement of energy efficiency.

Taking into account that M2 scenario assumes the achievement of GHG emission reduction by 33% compared to 1990, until 2030, and since the first NDC showed its potential for GHG emission reduction by 9.8%, this scenario shows significantly increased ambition of Serbia, as recommended by the Paris Agreement. Neither commitment includes the LULUCF sector.

Scenario M3 includes additional measures and represents an increase of ambition by 2030, with 40% emissions reduction compared to 1990, that is 28.7% emissions reduction compared to 2010, and 59.7% by 2050 compared to 2010, and at the same time, 45.2% compared to 1990. Greater contribution to achievement of EU 2030 targets lies in increased efforts in the energy, agriculture and waste sectors, compared to the M2 scenario.

Finally, the most ambitious M4 scenario implies reduction of GHG emissions by 80% compared to 1990 up to 2050. However, with currently available technologies and in a cost-effective manner, it is virtually impossible to achieve such deep emission cuts in the next 30 years. With currently available technologies, the GHG emissions reduction could reach 76.2% compared to 1990 by 2050.

Modelling results show that the M4 scenario is a cost-effective (optimal) pathway towards achieving 80% emissions reduction by 2030, having a similar pathway to that in the M3 scenario. Both scenarios achieve equally cost-effective RES potential in 2030, that is 36.0%. Therefore, 36.0% RES share by 2030 is the upper limit for achieving emissions reduction in a cost-effective manner.

It must be noted that all cost-effective emission reduction pathways aim to phase out coal as soon as possible. Therefore, coal will stop being used in Serbia no later than 2050. In general, GHG emission reduction that could be achieved by different scenarios is presented in Table 1.

Table 1: GHG emission reduction potential by different scenarios

Scenario	Target year/Year for Comparison	GHG emission reduction (%)	Target year/Year for Comparison	GHG emission reduction (%)	Target year/Year for Comparison	GHG emission reduction (%)
M2	2030/2010	13.2	2030/2005	20.1	2030/1990	33.3
	2050/2010	55.0	2050/2005	58.6	2050/1990	65.4
M3	2030/2010	28.7	2030/2005	34.4	2030/1990	45.2
	2050/2010	59.7	2050/2005	62.9	2050/1990	69.0
M4	2030/2010	26.4	2030/2005	32.2	2030/1990	43.4

	2050/2010	69.1	2050/2005	71.6	2050/1990	76.2
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Depending on the mitigation scenario, the GHG emissions level in 2070 will be 22,917 Mt CO₂eq with M1, 17,309 Mt CO₂eq with M2, 9,222 Mt CO₂eq with M3 and 7,627 Mt CO₂eq with M4, while it will be at 48,002 Mt CO₂eq if there no measures are applied(B2 baseline scenario).

3.3. Costs and key social, economic and environmental indicators

3.3.1. Costs

All GHG emission reduction scenarios are associated with certain costs.

Modelling shows that, the **costliest** scenario for Serbia is to ignore the climate related costs in its strategic decisions, **continuing an emissions pathway as assumed under the B2 baseline scenario** while joining the EU. In case of such “non-action”, the total additional system costs²¹ for the energy sector are estimated at the level of EUR 108bn in the period 2020-2050. EU-ETS emission costs are applied from the assumed date of the full implementation of the EU-ETS (2030).

Figure 3 shows that these **system costs of “non-action” are higher than the additional system costs of action under any M2 and M3 mitigation scenarios**. The additional system costs in the energy sector alone, in case of “non-action”, are **EUR 48bn higher than the additional system costs of action (in all sectors) under M2, EUR 32bn higher than in M3 and EUR 2bn lower than the costs of the M4 scenario, over the period 2020-2050** (Table 2).

It must be noted, however, that these estimates of costs of non-action do not take into account the EU’s Carbon Border Adjustment Mechanism (hereinafter referred to as the CBAM), which would be applied after 2026 to exports of certain goods to the EU (iron and steel, cement, aluminium, fertilisers and electricity). As such, costs of non-action are likely higher than those modelled.

Table 2: System costs of non-action compared to total energy system costs and investment costs in non-energy sectors in the different GHG emission scenarios for the period 2020-2050 (Bln EUR)

Scenario	B2	M2	M3	M4
Costs of “non-action”	108	-	-	-
Additional energy system costs and investment costs in non-energy sectors	-	60	76	110
Difference from “non-action”		-48	-32	2

²¹ Total system costs include all costs incurred by the operators (such as annuity payments and for direct energy efficiency investments, variable costs for operation and maintenance, fuel, electricity and distributed steam/heat purchasing costs - which reflect all costs incurring by energy suppliers, carbon emission costs, etc; direct tax payments and disutility costs - income compensating variation of utility applicable for residential, services and transport of individuals), as well as the costs incurred by the rest of the economy in order to get the required energy services. Total additional system costs are estimated in comparison with the baseline scenario.

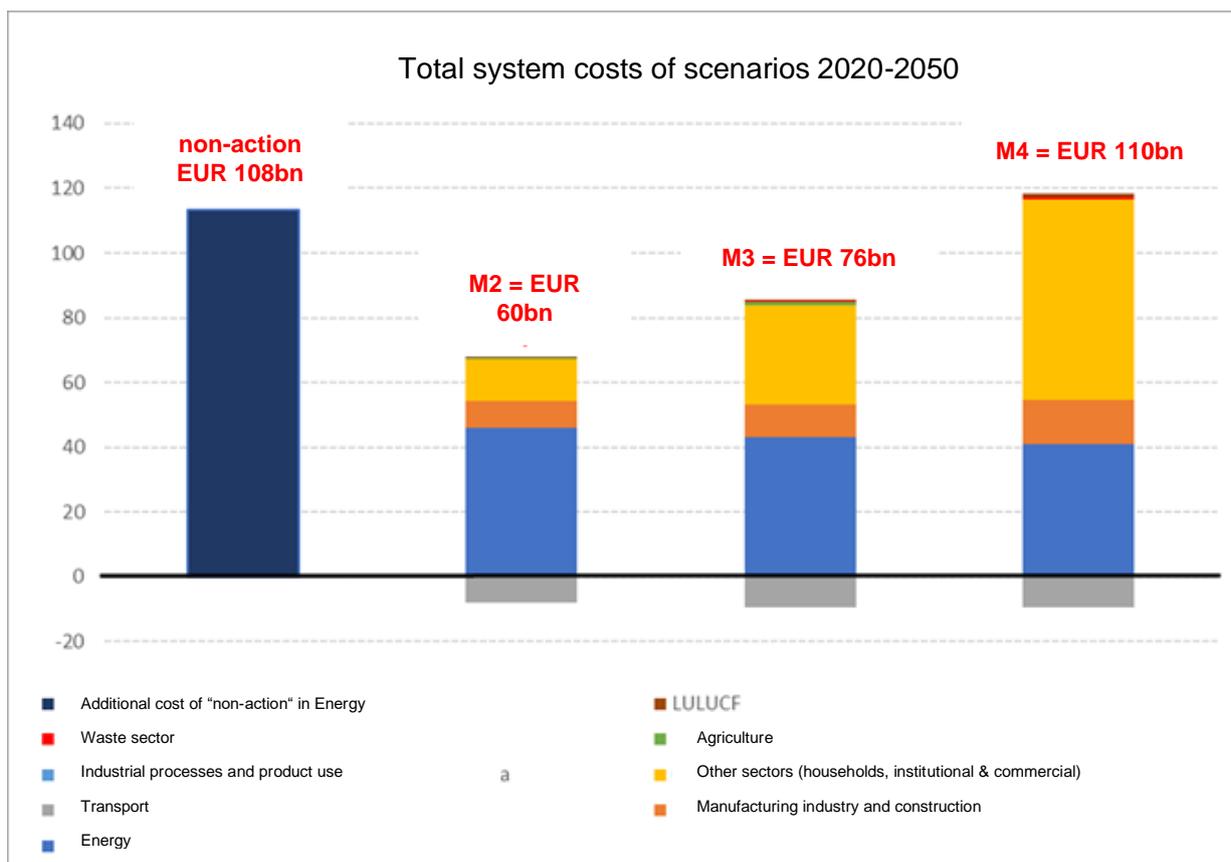


Figure 3: System costs of non-action and costs²² of mitigation scenarios (bn EUR)

The majority of additional system costs in the M2 scenario are the additional system costs of the Energy sector (EUR 46.2 bn), which can fully or in part be passed to consumers taking into account market conditions.

Other sectors (residential, institutional and commercial) with EUR 12.7bn and manufacturing industry and construction with EUR 8.3bn follow.

The additional system costs of all remaining sectors (IPPU, Agriculture, Forestry, Waste) are estimated at EUR 0.9bn, while transport sector is having a negative additional system costs²³ in the period 2020-2050, due to future fuel savings imbedded in EU climate acquis.

With increasing ambition (as in the M3 and M4 scenarios) in the period 2020-2050, the additional system costs of the Energy sector slightly decrease (due to higher introduction of RES, which, for example, have no running costs associated with carbon, and many of them have no costs associated with fuel – such as hydro, wind, solar), while the additional costs of the residential and commercial sector are increasing (due to the increase of the price of electricity). In the remaining sectors (IPPU, Agriculture, Forestry and Waste), additional costs increase from EUR 0.9bn in M2 to EUR 1.8bn in M3 and EUR 3.4bn in M4, due to the introduction of additional measures and an increased intensity of existing measures (in particular in the Agriculture sector).

3.3.2. Social, economic and environmental impacts

Identification of the most appropriate GHG emissions reduction pathway depends on costs, as well as on social, economic and environmental impacts. Therefore, in order to define

²² For the energy sector, total system costs are included.

²³ This means that system costs for the transport sector are lower in M2 than in B2.

the socially fair and cost-effective trajectory of the GHG emission reductions curve, effects on the gross domestic product (GDP) growth, on employment and on the share of energy costs in household expenditure were assessed for different mitigation scenarios. The results on the economic impact of the implementation of measures were obtained by using GEM E3 model, with respect to national circumstances. However, the results of applying this model may be different depending to what extent the national circumstances were taken into account as well as the possibilities of their quantification.

The impact of scenarios M2, M3 and M4 on GDP growth is very limited. In the period 2020-2050, the yearly average GDP growth rate in Serbia is projected to be:²⁴ 3.77% in B2, 3.68% in M2, 3.68% in M3 and 3.64% in M4, while effects on GDP growth are: -1.0% in M2, -3.5% in M3 and -3.4% in M4 by 2030, while these effects are -1.6% in M2, -1.8% in M3 and -3.9% in M4 up to 2050. Taking into account the GDP growth, such effects are small.

In all scenarios there is a certain net job loss²⁵: -1.4% in M2, -2% in M3, and -2.1% in M4 in 2030 and -2% in M2, -1.7% in M3, and -2.5% in M4 in 2050. This net job loss is mainly due to the reduction of jobs in the sectors related to fossil fuels and, to a certain extent, in agriculture²⁶. However, these losses can be transformed into new jobs in sectors related to renewable energy sources, energy efficiency, construction, in the forestry and forestry related sectors, if revenues from EU ETS and/or other carbon pricing instruments are recycled, when they are applied (see sub-chapter 5.2.1).

If investments are financed through loans, while revenues of ETS auctioning²⁷ or other instruments for determining carbon price, when they are applied, are used to support the implementation of climate change measures²⁸, then instead of being used to reduce public debt, effects on GDP can be slightly positive in M2 and M3 scenarios as well as on net employment (meaning that more jobs are created than lost). Other impacts of relevance for the assessment of the most cost effective and socially fair transition of the Serbian society are presented in the Table 3 below.

Table 3: Key social, economic and environmental impacts of the mitigation scenarios in comparison with the baseline scenario B2

Indicator	2030			2050		
	M2	M3	M4	M2	M3	M4
GHG emission reduction [ktCO _{2e} compared to B2]	10,254	19,958	18,510	41,195	44,105	50,009
Cumulative additional energy system costs [million EUR]	2,397	7,403	5,344	58,999	74,436	106,942
Exposure to ETS prices [million EUR]	809	621	675	33,050	26,521	27,109
Effects on GDP growth [%]	-1.0%	-3.5%	-3.4%	-1.6%	-1.8%	-3.9%

²⁴The macro-economic scenarios have been modelled using the GEM-E3 model, which is an applied general equilibrium model that provides details on the macro-economic situation and its interaction with the environment and the energy system

²⁵Net jobs equal jobs created minus jobs lost in a given period.

²⁶The reduction of labour needs in the agriculture sector is much more significant in the baseline scenario due to structural reforms and efficiency gains in the sector, than in the mitigation scenarios due to the implementation of climate change measures.

²⁷Auctioning is the default method of allocating allowances within the EU emissions trading system. This means that businesses have to buy, through auctions, an increasing proportion of allowances i.e. in an amount equal to that of their yearly respective GHG emissions.

²⁸This is usually referred to as recycling of EU ETS revenue.

Indicator	2030			2050		
	M2	M3	M4	M2	M3	M4
Share of energy costs in household expenditure (compared to B2) [%]	+1.1%	+2.3%	+2.0%	+2.7%	+2.8%	+5.3%
Environmental impacts (PM2.5) [%]	-7.0%	-26.7%	-23.5%	-28.7%	-49.1%	-39.7%

The environmental impacts of climate action could be expressed through the relation between GHG and PM2.5 emissions²⁹. In general, the greater the reduction of GHG emissions through the replacement of solid fuels, the greater the reduction of emissions of PM2.5. An exception is, for example, the use of biomass in households that reduces GHG emissions, but increases emissions of PM2.5. This is the reason behind the greater emissions of PM2.5 in M4 scenario than in M3 scenario, by 2050. Also, the environmental impacts (expressed in emission of PM2.5), are positive in all scenarios.

Based on the previous data presented in Table 3, it is evident that the scenario M2 can be considered “inevitable” when the Republic of Serbia joins the EU, and that it represents the smoother emission reduction pathway and has the least additional costs for the Serbian economy and society, and in terms of effects on GDP growth, on employment and on the share of energy costs in household expenditure especially by 2030.

However, by 2050, the M2 and M3 scenarios achieve comparable emission reductions using two different pathways. While M3 achieves deeper emission reductions in the short term (until 2030), the M2 scenario starts with a slower pace and increases the depth of emissions reductions in the period 2030-2040. Reducing emissions at a faster pace (as in case of M3), compared to the same emission reductions at a slower pace (M2) over the same time period, requires additional resources and intensifies the socio-economic impacts. Thus, the M3 scenario, would entail, by 2030, additional system costs of about EUR 5bn compared to the M2 scenario.

The scenario M4 defines the highest emission reductions by 2050 and requires the highest additional costs. Based on that, it has the greater impacts on GDP and on employment than the M2 and M3 scenarios. The scenario M4 also results in the highest increase of the share of energy costs in household expenditure, both in 2030 and in 2050. The whole pathway towards the implementation of M3 and M4 scenarios (from 2020 to 2050) could be achieved with significant financial and technological support of the international community and the EU, in addition to that required for the implementation of M2.

4. GENERAL AND SPECIFIC OBJECTIVES

Based on results, the GHG emission pathway, as defined in M2 up to 2030, as well as a range of options, as in the M2 to M4 scenarios until 2050, are recommended as the cost-effective and socially fair pathways to achieve climate vision.

Taking into account the previously presented results (the potential for the GHG emission reduction, the impacts on social, economic and environmental parameters) the M2 scenario is recommended for the period up to 2030.

²⁹ Emissions of particles that have aerodynamic diameters less than or equal to 2.5 µm

From 2030 to 2050, the range of possible mitigation pathways defined in the M2 to M4 scenarios, leave options open for future decisions which could be based on the beneficial experience with implementation of this Strategy..

In addition, this approach is in line with the result of the Strategic Environmental Impact Assessment, whose report mentions that “the scenarios M3 and M4 have by far the greatest positive environmental impact, but their realistic feasibility must be valued through other analyses as well (above all economic, but also social)” as well as principles of the Paris Agreement (increasing ambition over time).

Starting from this approach, the general objective of this Strategy is:

Reduction of national GHG emissions (excluding LULUCF) by 13%, up to 2030, and at least by 55% to 69% up to 2050 compared to 2010.

These GHG emission reductions (excluding LULUCF) are equivalent to emission reductions of 20% in 2030, and at least 59% to 72% in 2050 compared to 2005 and to emissions reduction of 33% in 2030, and at least 65% to 76% by 2050, compared to the level of GHG emissions in 1990. When applying those emission reductions to the sectors covered by EU effort sharing decision, the Republic of Serbia can reduce emissions covered by the EU effort sharing decision for 11.2% by 2030 compared to 2005.

Such national GHG emissions reduction, without the LULUCF sector, is the result of the reduction of GHG emissions in electricity and heat production by 17% by 2030 and between 78% and 89% by 2050, compared with 2010 and the increase of energy efficiency and RES in the industrial sector by 15% by 2030 and between 37% to 55% by 2050, and in the residential and commercial sectors by 40% by 2030 and between 70% to 78% by 2050, compared to 2010. Contribution of other sectors is presented through specific objectives.

The total reduction of the GHG emissions is based on the GHG emission reduction in different economic sectors and its absorption by forests.

To be compliant with the EU legislation and practices, **specific objectives** for fulfilment of the general objective of the Strategy could be defined as:

Specific objective 1: The reduction of the GHG emissions covered by the EU-ETS by 15.0% up to 2030 and between 66.4% and 76.8% by 2050 compared to 2010.³⁰

This specific objective is equivalent to reducing GHG emissions covered by the EU-ETS by 24.4% in 2030 and between 70.1% and 79.4% by 2050 compared to 2005³¹.

Specific objective 2: The reduction of the GHG emissions not covered by the EU-ETS by 9.7% in 2030 and between 33.5% and 54.5% by 2050 compared to 2010.

This specific objective is equivalent to reducing GHG emissions not covered by the EU-ETS by 11.2% in 2030 and between 34.6% and 55.2% by 2050 compared to 2005.

Within this specific objective, the following sectoral targets, compared to 2010, are defined:

³⁰Due to the market-based nature of the EU-ETS, the targeted result included in this specific objective is indicative.

³¹Emission reductions are compared to 2005 since this is a base for splitting national GHG emission to emissions covered by the EU-ETS Directive and emissions covered by EU Effort Sharing Decision (non-ETS)

1) Reduce GHG emissions, through the increase of energy efficiency and use of RES, in the industrial sector³² by 15% until 2030 and between 37% and 55% until 2050, and in the residential and commercial sectors by 40% until 2030 and between 70% and 78% until 2050, which will be definitively determined by the Integrated Energy and Climate Plan;

2) Limit GHG emissions growth in the transportation sector by 10% until 2030 and reduce emissions by 30% to 54% by 2050;

3) Limit GHG emissions growth from industrial processes and product use³³ by 7% by 2030 and keep emissions in the range between +3% and -3% by 2050;

4) Reduce GHG emissions in agriculture up to 15% by 2030 and keep its emissions in the range from +2% to -24% by 2050;

5) Reduce GHG emissions in the waste sector by 13% until 2030 and between 29% and 69% by 2050 compared to 2010.

Emissions and its removal from LULUCF sector are not included in the emissions covered by the specific objectives 1 and 2. In this context, a specific objective is created, focused on forestry:

Specific objective 3: Increase the carbon sink in forests by 17% until 2030 and between 22% and 132%³⁴ by 2050, compared to 2010.

Specific objective 4: Preserve the potential of mitigation measures, determined for 2030 and 2050, by increasing the resilience to climate change of the priority sectors³⁵.

The following adaptation measures and options are identified as the most important up to 2030/2050 for each of these three sectors:

1) agriculture – food production:

(1) New irrigation systems and more efficient use of the existing ones,

(2) Multi-purpose small reservoirs and standing water (lakes, ponds) and multi-purpose reservoirs for water supply, irrigation, erosion control, ecosystem services,

(3) Adaptation of cultivation technologies (selection of species and agricultural-technical measures);

2) Forestry – biomass supply:

(1) Afforestation of new land using site mapping and use of climate change adapted tree species,

(2) Change of forest management practices towards “Closer to Nature Forest Management”,

(3) Introduction of "Climate Smart Forestry" approach;

3) Hydrology and water resources – hydroelectricity production:

³²Part of the manufacturing industries not covered by the EU-ETS

³³Products used to replace ozone depleting substances

³⁴The increase necessary to achieve target of 41.4% of optimal forest cover as set by the Law on Spatial Plan of the Republic of Serbia from 2010 to 2020 (“Official Gazette of the Republic of Serbia”, No. 88/10).

³⁵The priority sectors are: agriculture – food production; forest – bioenergy production; and water resources – hydroelectricity production.

- (1) Construction of water structures for protection against floods, erosion and torrents and undertaking additional protection measures in the basin,
- (2) Improvement of the system for observation, data collection and early warning systems,
- (3) Increase in water storage capacity.

Specific objective 5: Promote transition to climate neutral economy and climate resilient society

Activities regarding the promotion are horizontal activities and will be implemented, among else, through education, training for new skills, capacity building and awareness raising. A list of different measures is developed, the implementation of which will ensure the fulfilment of specific, and thereby general objectives of the Strategy.. These measures, their effects, impacts, responsible institutions, timelines and other information ensuring monitoring and reporting of measures are described in detail in the “Description of measures included in the Strategy”, while basic information are provided in the following chapters of the Strategy.

5. MEASURES AND THEIR IMPACTS

5.1. Measures

Specific measures were proposed to ensure the achievement of the Strategy vision, through fulfilment of specific and general objectives, presented in Table 4. This table also identifies the stakeholders covered by and affected by these measures³⁶.

Table 4: Measures to achieve the goals and identification of stakeholders

Specific objective	Measure	Stakeholders
Specific objective 1: The reduction of the GHG emissions covered by the EU-ETS by 15% in 2030 and between 66.4% and 76.8% by 2050 compared to 2010.	Compliance with the EU emissions trading system and/or introduction of other instruments for carbon pricing	Public utility companies and the respective value chain (the mining sector), independent producers, transmission and distribution system operator, industry covered by ETS, consumers of electricity and other products subject to carbon pricing and stakeholders in biomass supply chain
	Increasing the use of RES in electricity production	
	Improving energy efficiency and increasing the use of Combined Heat and Power (CHP) and RES in district heating systems	Municipalities, local self-government units, as well as all relevant stakeholders in biomass supply chain
Specific objective 2: The reduction of the GHG emissions not covered by the EU-ETS by 9.7% in 2030	The introduction of carbon pricing and excise duties on final energy consumption	All end consumers of energy from fossil fuels in industrial ³⁷ , household and tertiary sectors
	<i>Industry</i>	
	Improving energy efficiency and increasing the use of RES in industry	Companies, consumers
	<i>Households and tertiary sector</i>	

³⁶ This identification excludes the public administration (at national, provincial or local level) that have responsibility for the implementation and/or monitoring of such measures as they are identified in the “Description of measures included in the Strategy”.

³⁷Excluding industrial facilities covered by the EU-ETS

Specific objective	Measure	Stakeholders	
and between 33.5% and 54.5% by 2050 compared to 2010.	Improving the efficiency in electrical appliances for households ³⁸	Consumers	
	Improving the thermal integrity ³⁹ of households	Construction companies and respective value chain (suppliers of materials); consumers (household owners)	
	Energy efficiency improvement of heating and cooling infrastructure and promotion of use of RES in households	Suppliers of equipment, installation entities, consumers	
	Improving the energy efficiency and increasing the use of RES in the tertiary sector	Tertiary sector private entities; consumers	
	Improving the thermal integrity in the tertiary sector	Tertiary sector private entities, construction companies and respective value chain (suppliers of materials), consumers	
	<i>Transport sector</i>		
	Renewal of the passenger fleet and promotion of sustainable passenger transport (Efficiency improvements of vehicle fleet and usage of vehicles; Promotion of public transport and non-motorised transport; Promotion of usage of alternative fuels and bio-fuels)	Automotive industry, including production, import and sales; consumer	
	Renewal of the freight fleet and promotion of sustainable freight transport	Heavy and light duty vehicle industry, including production, import and sales; consumers (transport companies)	
	<i>Industrial Process and Product Use</i>		
	Implementation of the F-gas regulation and Directive on Mobile Air Conditioning systems (MACs directive)	Manufacturing industry, producers of equipment containing F-gases, equipment maintenance providers	
	<i>Agriculture</i>		
	Winter cover crops	Farmers (seed suppliers); consumers	
	Increasing legume share in fodder area		
	Improving the genetic potential for higher milk production per head of cattle	Livestock producers, additive suppliers, consumers	
	Linseed as feed additive for cattle (after 2030)		
	Additional measures after 2030 if mitigation pathway is to be consistent with scenarios M3 or M4: Precision farming and anaerobic digestion.		
	Additional measures after 2030 if mitigation pathway is to be consistent with scenario M4: anti-methanogenic vaccination (foreseen only in the period after 2030 if it is to be consistent with regulations related to the animal health care); breeding for ruminant efficiency; nitrification inhibitors; and nitrate as a feed additive.		
	<i>Waste sector</i>		

³⁸The measure “Improving the efficiency of electrical appliances for households” is not included in the “Description of measures included in the Strategy”, as the Energy Labelling Directive 2009/125/EC is already transposed into Serbian legislation and the transposition of the Eco-Design Directive is already included in other measures.

³⁹Set of measures addressing the energy demand needed for heating or cooling of buildings

Specific objective	Measure	Stakeholders
	(No additional measures beyond the current policy framework for the waste sector until 2030 and in the period 2030-2050 if the emission pathway is to be consistent with the M2 scenario)	(After 2030, if M3 or M4 are chosen: local self-governments, public utility companies; private entities; consumers)
	Measures where additional effort will be required compared to B2/M2, after 2030 if mitigation pathway is to be consistent with scenarios M3 or M4: construction of sanitary landfills; source separation and construction of material recovery facilities; construction of biological treatment facilities (composting plants); construction of thermal treatment (incineration) plant;	
	Measures where additional effort will be required compared to B2/M2, after 2030 if mitigation pathway is to be consistent with scenario M4: construction of biological treatment facilities (anaerobic digestion); improved waste prevention.	
Specific objective 3: Increase the carbon sink in the Serbian forests by 17% until 2030 and between 22% and 132% by 2050, compared to 2010.	Afforestation	PE “Srbijašume” and PE “Vojvodinašume”, private forest owners (in particular, the Serbian Orthodox Church), universities
	Closer to Nature Forest Management and Climate Smart Approach to Forestry	
	Conversion of coppice to high forest	
	Short Rotation Forestry Plantations	
	Regeneration of overmature stands (beech)	
	Definition of guidelines for the reduction of negative abiotic and biotic factors	
	Research, training and awareness raising programme for the increase of the carbon sink and the creation of resilience of forests to climate change in the Republic of Serbia	
Specific objective 4: Preserve the potential of mitigation measures, determined for 2030 and 2050, by increasing the resilience to climate change of priority sectors	Construction of water structures for protection against floods, erosion and torrents and additional protection measures in the basin ⁴⁰	Public companies
	Improvement of the system for observation, data collection and early warning systems ⁴¹	
	Increase in water storage capacity (integrated with the mitigation measure “Increasing the use of RES in electricity and heat production (Introduction of RES)”	

⁴⁰ This measure is not included in the “Description of measures included in the Strategy” as its goals are to be met through the implementation of the National Disaster Risk Management Programme (Conclusion 05 No: 217-16233/2014/1 of 19 December 2014) and the Action Plan for the Implementation of the National Disaster Risk Management Programme (2016-2020) (Conclusion 05 No: 217/1906/2017-1 of 3 March 2017), in particular measures stipulated in chapters 3.1., 4.1 and 4.2.

⁴¹ This measure is not included in the “Description of measures included in the Strategy” as its goals are to be met through the implementation of the National Disaster Risk Management Programme and the Action Plan for the Implementation of the National Disaster Risk Management Programme (2016-2020), in particular measures stipulated in chapters 3.1., 4.1 and 4.2.

Specific objective	Measure	Stakeholders
	Construction of new irrigation systems and increased efficiency of the existing ones ⁴²	Construction companies, building and irrigation material suppliers, farmers, seed and agricultural technology suppliers;
	Construction of multi-purpose small reservoirs and standing water (lakes, ponds) and multi-purpose reservoirs for water supply, irrigation, erosion control, ecosystem services ⁴³	
	Adaptation of cultivation technologies (selection of species and agricultural-technical measures)	
	Afforestation using site mapping and tree species adapted to climate change (integrated with the mitigation measure on afforestation)	PE “Srbijašume” and PE “Vojvodinašume”, private forest owners (in particular, the Serbian Orthodox Church)
	Introduction of "Climate Smart Forestry" approach (integrated with the mitigation measure “Closer to Nature Forest Management and Climate Smart Approach to Forestry”)	
	Change of forest management practices in compliance with the “Closer to Nature Forest Management” approach (integrated with the mitigation measure “Closer to Nature Forest Management and Climate Smart Approach to Forestry”)	
Specific objective 5: Promote transition to climate neutral economy and climate resilient society	Climate change education, training for new skills and awareness raising.	Universities, schools, adult training centres, companies, workers, in particular in the value chain of the emission intensive sectors

5.2. Impact of measures

Impacts of the measures, as foreseen in the M2 scenario by 2030 and in the range between M2 to M4 from 2030 to 2050, could be presented as:

5.2.1. Social impacts

The social impacts refer to:

1) *Employment*

The employment in the baseline scenario (including jobs created and jobs lost) are: 2,462 million in 2020, 2473 million in 2030 and 2438 million in 2050 (Table 5).

⁴² This measure is not included in the “Description of measures included in the Strategy” as its goals are to be met through the implementation of the National Agriculture and Rural Development Strategy of the Republic of Serbia 2014-2024 and the Strategy on Water Management in the Territory of the Republic of Serbia until 2034 (“Official Gazette of the Republic of Serbia”, No. 3/17).

⁴³ This measure is not included in the “Description of measures included in the Strategy” as its goals are to be met through the implementation of the Strategy on Water Management in the Territory of the Republic of Serbia until 2034 and the Law on Agricultural Land (“Official Gazette of the Republic of Serbia”, No. 62/06, 65/08 – other law, 41/09, 112/15, 80/17 and 95/18 – other law).

The impact of the implementation of measures is limited. In 2030, a negative impact of 1.4% on net jobs created is expected (this means that in 2030, Serbian economy will generate 2438 million net jobs, compared to 2473 million in the B2 baseline scenario). For 2050, the negative impact on net jobs created is 2% in the M2 scenario, 1.7% in the M3 scenario and 2.5% in the M4 scenario.

However, there is a possibility even to reduce such impacts on employment⁴⁴, if the investments required for the implementation of this Strategy are financed through loans, while the revenues of ETS auctioning or other instruments for determining carbon price are used to support the implementation of climate change measures (at least 50%), and decarbonisation process, and as a direct assistance to poorer households⁴⁵), instead of being used to reduce public debt (Table 5), and Table 8 presents the impacts on GDP in such case⁴⁶.

Table 5: Impacts on employment⁴⁷

	Impacts on employment(%)			
	2020	2025	2030	2050
B2 (000 jobs)	2 462	2 468	2 473	2 483
M2 (%)	0.0%	-1.3	-1.4 [0.84%]	-2.0 [0.93%]
M3 (%)	-	-	-	-1.7 [0.80%]
M4 (%)	-	-	-	-2.5 [0.93%]

The greatest transformations could be expected in the “Mining and quarrying” sectors and in the “Electricity, gas and steam supply”⁴⁸ sectors, where job losses are expected⁴⁹. On the other hand, an important job growth is expected to take place in the “Agriculture and forestry” sectors, in particular in the forestry and the forestry related sectors (for example, wooden products)⁵⁰.

As such, negative impacts on employment can be expected in sectors dominated by large companies, and the positive ones in sectors with the micro and small enterprises.

In addition, two measures, implementation of ETS and afforestation, can be assumed as measures particularly affecting men men, because the first one will reduce jobs in the mining sector, and the second will increase those in the forest and forest related sectors which are traditionally male-dominated occupations.

2) *Share of energy costs in household expenditure*

The share of energy costs in household expenditures slightly fluctuates from 18% in 2020 to 15% in 2050 in the B2 baseline scenario. The implementation of the Strategy measures would imply an increase of the share to 19.1% in 2030. By 2050, the share of energy costs in household expenditure is projected to increase (compared to the same year in the baseline scenario) by

⁴⁴The values in the square brackets [] in Table 5.

⁴⁵For example, through fiscal benefits

⁴⁶ This alternative option also has positive impacts on GDP, which are described in sub-chapter 5.2.2

⁴⁷The value in the square brackets “[]” represents the impact on employment in case investments are financed through loans and that revenues of ETS auctioning or other instruments for determining carbon price are used to support the implementation of climate change measures and, for example, to reduce costs of labour instead to be used to reduce public debt.

⁴⁸In these two sectors, respectively, 77% and 89% of employees work at large companies, in accordance with the data of the Statistical Office of the Republic of Serbia.

⁴⁹This means that more jobs will be lost than new jobs created.

⁵⁰In this sector, 64% of employees work at micro, small and medium enterprises, in accordance with the data of the Statistical Office of the Republic of Serbia.

additional 2.7% (to 17.7%) in the M2 scenario, by 2.8% in M3 (to 17.8%) and by 5.3% (to 20.3%) in the M4 scenario. This increase in energy costs is associated with the internalisation of costs which are related to the carbon emissions and investments in low carbon technologies as part of the energy price paid by households.

In any case, the comparison of the share of costs in households in 2050 with those in 2020 (in B2) shows that the share of energy costs in household expenditure will decrease between 0.2%-0.3% if M2 and M3 scenarios are implemented, i.e. increase by 2.3% if M4 scenario is implemented.

Table 6: Share of energy costs in household expenditure

	Share of energy costs in household expenditures			
	2020	2025	2030	2050
B2(%)	18%	19%	18%	15%
M2 (change from B2)	18.3%	19.8%	19.1% (+1.1%)	17.7% (+2.7%)
M3 (change from B2)	-	-	-	17.8% (+2.8%)
M4 (change from B2)	-	-	-	20.3% (+5.3%)

If it is assumed that women have a particular role in using energy in households (lighting, heating, cooking, cleaning, ironing)⁵¹, then measures that affect the price and the consumption of energy will affect women more than man. Such assumed measures, which imply the increase of energy price (such as the implementation of ETS or introduction of RES) tend to have a negative impact on women, while measures that reduce energy consumption (such as improving the efficiency of electrical appliances for households and heating and cooling infrastructure for households) tend to have a positive impact. In the same way, measures related to biomass use as energy source in households, namely for cooking and heating (such as promotion of proper use of wood) may positively affect women. However, the poorest population will be affected the most with the increase of energy price.

5.2.2. Economic impacts

The economic impacts of the mitigation measures could be presented through impacts on:

1) GDP

The implementation of measures has, in terms of percentage, a low impact on long-term GDP growth rates in the Republic of Serbia.

Table 7: Average annual growth rate of the GDP in the period 2020-2050

	B2	M2	M3	M4
GDP	3.77%	3.68%	3.68%	3.64%

Table 8 includes the projected impact of the implementation of the measures included in this Strategy on GDP, compared to the GDP in the B2 scenario. The impact on GDP amounts to -1.4% in M2 by 2030 and -2.7% in M2, -2.6% in M3 and -3.8% in M4 by 2050 compared to the

⁵¹ Government of the Republic of Serbia and United Nations Country Team in Serbia <http://rs.one.un.org/content/unct/serbia/en/home/publications/gender-equality-and-climate-change.html> (15 May 2019)

B2 scenario. The figures in square brackets “[]” in Table 8 reflect the impacts on GDP in case of the use of ETS revenue and the use of loans for investments.

Table 8 Impacts on GDP compared to the B2 baseline scenario

	2020	2025	2030	2050
M2	0.0%	-1.0%	-1.4%[-0.12%]	-2.7%[-0.76%]
M3	-	-	-	-2.6%[-0.93%]
M4	-	-	-	-3.8%[-1.55%]

This means that GDP will continue to grow according to all scenarios, but slightly slower than in B2 (presented in Table 7). If it is assumed that investments are implemented through loans and use of ETS auction revenues, as described previously, the impacts on GDP will be reduced significantly.

2) Household consumption

Household consumption, expenditure or spending represent how much each family spends and they are the largest component of GDP in developed economies.

As a result of the implementation of this Strategy, household consumption can be affected mainly via the impacts on employment and on the price of energy. On the one hand, the household consumption is affected to the same extent to which the implementation of this Strategy impacts the creation of net jobs.. On the other hand, increased energy costs reduce households’ disposable income for the purchase of other products.

Compared to the baseline scenario, the household consumption will decrease by 2.5% in 2030 and by 5% in the M2 and M3 scenarios and by 5.4% in the M4 scenario by 2050 (

Table9) Regardless of this impact, the household consumption will, in the period 2020-2050, more than double (from 26.0 million EUR to 60.7 million EUR), which indicates that the impacts of the implementation of measures are expected to be below 6% (from 3.0 to 3.4 million EUR).

Table9: Impact on household consumption compared to the B2 baseline scenario

	Household consumption			
	2020	2025	2030	2050
B2 (million EUR)	25,980	31,085	36,635	60,732
M2	0.0%	-2.3%	-2.5%	-5.0%
M3				-5.0%
M4				-5.4%

5.2.3. Environmental impacts

The environmental impacts of the mitigation measures could be presented through impacts on:

1) Emissions of PM2.5

Biggest negative impacts on climate change in the Republic of Serbia result from the combustion of solid and liquid fuels for power generation, domestic heating, vehicle engines and industry. During such combustion, particulate matter which has harmful effects on human health is emitted.

Measures foreseen by the Strategy will contribute to the reduction of PM2.5 emissions by 7% in 2030. After 2030, the reduction of emissions of PM2.5 intensifies, reaching 28.7% in the M2 scenario and 39.7% in the M4 scenario by 2050⁵² (Table 10). Although it is not its goal, the implementation of this Strategy will contribute to cleaner air and to the reduction of health problems associated with air pollution. Premature deaths associated with air pollution from fuel combustion are expected to increase by 34.5% up to 2030 and between 54.8% and 61.8% by 2050.

Table 10: Impacts on Emissions of PM2.5

	Air quality: Emissions of PM2.5			
	2020	2025	2030	2050
B2 (kt)	29.7	28.6	27.0	27.9
M2	8.8%	0.5%	-7.0%	-28.7%
M3	-	-	-	-49.1%
M4	-	-	-	-39.7%

2) Nitrogen balance (N Balance)

Nitrogen balance (N balance) is a measure of nitrogen input (from fertiliser, manure, crop residues, etc.) minus nitrogen output (from gaseous loss, mineral runoff, etc.). Nitrogen is a vital nutrient that helps plants and crops grow, but high concentrations are harmful to people and nature. The closer to zero the N Balance is, the more environmentally friendly the respective measure is.

Table 11 illustrates the actual value of the N Balance (kt) in the B2 baseline scenario, which shows the downward trend from 2020 to 2050. This trend is intensified with the implementation of the Strategy measures. In 2030, the N Balance is reduced by 1.3% in M2 in comparison to the baseline scenario, while by 2050, N Balance reduction amounts to 3.1%, 18% and 33.7% in the M2, M3 and M4 scenarios respectively.

Table 11: Impacts of scenarios on the N Balance

	Soil and Water Protection (N Balance)			
	2020	2025	2030	2050
B2 (kt)	237	208	178	186
M2	0.0%	-0.6%	-1.4%	-3.2%
M3	-	-	-	-18.1%
M4	-	-	-	-33.7%

5.2.4. Administrative impacts

An enhanced inter-sectoral cooperation will contribute greatly to the implementation of the Strategy. The National Climate Change Committee could have an important role in that regard.

The implementation of the Strategy does not require, for the majority of measures, new technical skills to be introduced in the relevant sectoral ministries and institutions.

⁵² Reduction of PM2.5 is higher in M3 than in the M4 scenario, due to the greater use of biomass in M4.

The most notable exception is the transition to the EU-ETS, which requires a set of technical skills and the definition and application of administrative procedures (such as compliance with the EU emissions trading system and/or introduction of other instruments for determining carbon price, issuance of GHG emission permits with appropriate monitoring plans to be able to monitor the implementation of these measures and to ensure proper enforcement of such measures) which currently do not exist in the Serbian administration. A mechanism for the management of revenues from the carbon pricing of final energy consumption needs to be established to ensure the effective support to the implementation of measures included in this Strategy. This mechanism needs to be supported by an appropriate institutional setup that ensures the highest standards and the capacity to process the expected volume of applications to support the implementation of measures.

The implementation of measures contained in the Strategy will require additional administrative capacities, which, when expressed in Full Time Equivalent (FTE), is between 33 and 61 for M2 and M4 scenarios respectively. This is between 330,000 EUR and 610,000 EUR for ensuring annual wages from the budget of the Republic of Serbia (Table 12).

Table 12: Additional number of full-time employees required for the implementation of this Strategy and associated estimated spending

	<i>Additional number of full-time employees - FTE</i>		Estimated annual spending (000 EUR)	
	M2	M4	M2	M4
Energy	19	28	190	280
Agriculture	3	8	30	80
Forestry	11	15	110	150
Waste	-	10	-	100
TOTAL	33	61	330	610

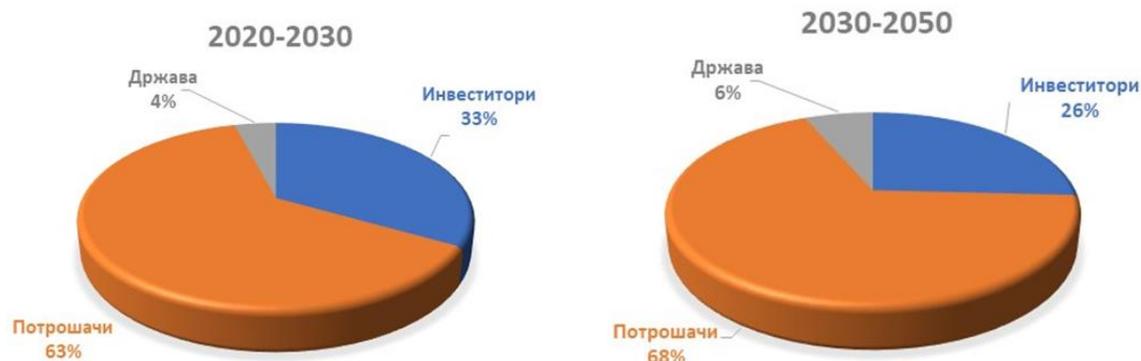
6. COSTS AND POTENTIAL RESOURCES FOR IMPLEMENTATION

6.1. Costs of implementation

Measures proposed by the Strategy require additional investments across different sectors than those in case of the B2 baseline scenario. These additional investment costs are estimated at EUR 6.5bn for the period 2020-2030 and between 37.8 and EUR 76.8bn for the period 2030-2050. Additional costs in energy sector, including energy efficiency, as well as funding sources for investments, stated in this chapter and determined based on assumptions adopted for the Strategy, are subject to detailed analyses within the Integrated National Energy and Climate Plan and accordingly, total investment costs will be determined by this plan, when it is implemented.

Additional investment costs will be shared among consumers/households (for example, by purchasing more efficient cars and electrical appliances or by isolating apartments), investors/companies (new trucks, renewable energy sources) and the state (e.g. renewal of the public transportation vehicle fleet and afforestation in state owned lands). Consumers and investors will bear most of the investments/costs (respectively, 63% and 33% up to 2030; and

68% and 26% in the period 2030-2050)⁵³. The state bears the remaining 4% and 6% of investment costs in the periods 2020-2030 and 2030-2050 respectively.



2020-2030: State – 4%, Investors- 33%, Consumers – 63%

2030-2050: State – 6%, Investors- 26%, Consumers – 68%

Figure 4: Share of investment costs in the period 2020-2030 and 2030-2050

The state will have an additional role to support the implementation of the measures in the Strategy, through the definition of the regulatory, fiscal and incentive schemes. In this context, the revenues from the EU-ETS auctioning and/or other instruments for determining carbon price can be treated by the state as an important source of financing of state incentives in the decarbonisation process.

Generally, the highest additional investment costs, as usual, are associated with the energy sector. The decarbonisation process will trigger a series of additional investments, but particular focus will be on additional investments in the power grid, due to increase of the share of RES. Additional investments in the power grid are estimated at 160 million EUR up to 2030, and in a range between EUR 2.7bn and EUR 4.3bn in the period 2030-2050. The total additional investments triggered by the EU ETS or other instruments for determining carbon price in the 2030-2050 period, (between EUR 2.3bn and EUR 3.6bn), are actually lower than the power grid investments, due to the lower investments needs in the thermal power plants when compared to the B2 baseline scenario.

This means that, because of the decarbonisation process, in the long-term, investments in thermal power plants will be lower than in the baseline scenario (up to EUR -1.4bn in the period 2030-2050), while investments will be realised in the GHG emission reductions.

Furthermore, large additional investment is needed in RES, which will be estimated within the Integrated National Energy and Climate Plan.

According to the M2 scenario, additional investments in the improvement of the thermal integrity of households, that is energy efficiency of the household buildings themselves, including transmission and ventilation losses or gains, and renewal of passenger fleet, will together require the largest share of additional investments up to 2030 (63%) and in the period 2030-2050 (65.9% in M2 and 63.2% in M4)⁵⁴.

⁵³ For the purpose of these estimates, costs have been allocated to the one who makes the investment, irrespective of its capacity to pass the costs of the investment down the value chain to consumers and irrespective of any public subsidies or incentives it received. Investors have been considered to be public or private companies, and farmers, while consumers are households and state represents state investments from the state budget.

⁵⁴ For these shares, the sectors with investment needs lower than in the baseline scenario are not included.

Up to 2030, additional EUR 1.85bn should be invested in the improvement of household thermal integrity. These investments increase to EUR 7.44bn (M2), i.e. to EUR 24.98bn (M4) in the 2030-2050 period. The additional investment in the thermal integrity of households has a great impact on the investment needs in heating and cooling infrastructure, which are, in the long-term, lower than in the baseline scenario. The reduction of investment needs in infrastructure ranges between 37 million EUR and 760 million EUR in the period 2030-2050, as a result of increased energy efficiency based on better thermal integrity of households.

The same is the case with the improvement of energy efficiency and the use of RES in the industry sector, where additional investment needs are, in the long-term, lower compared to the B2 baseline (between EUR 559 million in the M2 scenario and EUR 213 million in the M4 scenario), and the improvement of the efficiency of electrical appliances for households, with lower investment needs in the short and long term.

The renewal of the passenger car fleet will require additional investments of up to EUR 2.3bn until 2030, ranging from EUR 18.2bn and EUR 24.8bn in the period between 2030 and 2050. The additional investment for the IPPU sector will be the costs, covered by equipment producers, associated with compliance with EU regulations on F-gases and Mobile Air Conditioning Directive.. Additional investments by 2030 are estimated at 5 million EUR, while additional investment for the period 2030-2050 is expected to amount to between 82 million EUR and 129 million EUR.

In the agriculture sector, additional investment needs (80 million EUR by 2030) are mostly related to the best practices that enhance carbon sink in the soil, namely through winter cover crops. Additional investment needs in the agriculture sector increase significantly in the long term in the most ambitious scenarios (M3 and M4) and amount to between 469-1585 million EUR in the period 2030-2050, when emission reductions can only be achieved through expensive measures such as linseed as feed additive, nitrification inhibitors and precision farming.

Additional investment costs for the waste sector are limited to the period between 2030-2050 in the M3 and M4 scenarios, given that the baseline scenario already includes the investments required for the transposition of the EU legislation for this sector.

The investments in the forestry sector amount to 92 million EUR in the period up to 2030 and mostly represent the effort required to meet the afforestation targets foreseen in this Strategy. In the long term, the level of investment needs remains constant, except for M4, where the target for afforestation is extremely ambitious, requiring significant investments (621 million EUR in the period 2030 – 2050). Table 13 includes the additional investment costs required for Strategy implementation for each sector, with a more detailed overview of the energy sector where highest additional investment costs are expected.

Table 13: Additional investment costs required for the implementation of Strategies' low carbon development pathways (upper and lower) (in comparison with the baseline scenario)⁵⁵ (million EUR)

⁵⁵ The measure "Taxes and excise duties on energy and carbon pricing" is not included in the table as there are no investment costs associated with it (as for the ETS, this measure triggers the investments in RES and energy efficiency, as presented in this table). Furthermore, improving energy efficiency and increasing use of CHP and RES in district heating systems is included under the implementation of the ETS and increasing the use of RES in electricity production

	2030	2030-2050	
	M2	upper	lower
Energy sector (total)⁵⁶	6,335	37,088	74,219
Industrial Process and Product Use	5	82	129
Agriculture	80	469	1585
Waste	0	0	239
LULUCF	92	183	621
TOTAL additional costs (compared to the baseline scenario)	6,511	37,822	76,792

The costs associated with the implementation of the EU-ETS or other instruments for determining carbon price in the Republic of Serbia are different from those associated with other measures: the direct costs of these measures can be expressed as potential carbon penalties if requirements are not implemented by the entry into force of the EU-ETS⁵⁷. These so-called “other measures” aim to gradually create price signals equivalent to those of the EU-ETS thereby enabling decarbonisation and smoother preparing of operators for the participation in the EU-ETS. These costs are considered running costs and, therefore, are not included in the table above. However, given the importance of the measure and the magnitude of costs of exposure to these measures and later also to the EU-ETS, they are presented in Table 14 below, together with additional investment costs for the energy sector, and are determined based on the assumptions specified in this Strategy.

Table 14: Costs related to the EU-ETS and other measures for carbon pricing (million EUR)

	2020-2030	2030-2050		
	M2	M2	M3	M4
Costs of non-compliance with other measures for carbon pricing (2026-2029)	0 – 2,046	-	-	-
Costs related to ETS carbon price (after 2029)	806	31,027	24,969	25,420
Total EU-ETS related costs and other measures for carbon pricing	806 – 2,852	31,027	24,969	25,420

6.2. Financing options

Some of the financing options for the implementation of the Strategy are described in the following chapters.

⁵⁶ Costs in energy sector specified in this table, including energy efficiency, as well as the structure of these costs by business activities, technologies and activities, are subject to detailed analyses within the Integrated National Energy and Climate Plan and will be accordingly amended and determined by this plan.

⁵⁷ When the EU introduced the EU-ETS in 2005, the electricity producers and industrial installations received free allowances for their GHG emissions. The electricity producers only after 2013 received no free allowances while other industrial installations received free allowances on the basis of EU benchmark values.

6.2.1. Polluter pays principle

The polluter pays-principle is introduced in the Treaty on the Functioning of the European Union (Article 191(2) TFEU) and has been a dominant EU concept in combating climate change and in financing long-term sustained emissions reductions. This principle helps consumers to identify the actual cost.

Three options of polluter pay principle are available for the financing of the Strategy:

1) Use of revenues from non-compliance with other carbon pricing measures

The revenues from non-compliance can only be considered as a potential and exceptional source of funding the measures defined in this Strategy. It is estimated that the penalties for non-compliance if installations holding GHG permit and subject to equivalent measures would decide for “non-action” could reach up to EUR 2.05bn in the period 2026-2029⁵⁸.

2) Use of auctioning revenues from implementation of the EU-ETS and/or other carbon pricing instruments

In compliance with the rules of the EU ETS, at least 50% of the revenues generated from the auctioning of emission allowances should be used to finance policies and measures in the field of combating climate change (otherwise given in this Strategy), such as:

- (1) develop renewable energies;
- (2) improve energy efficiency, district heating systems and thermal integrity of buildings, or provide financial support to address social aspects in lower- and middle-income households;
- (3) encourage a shift to low-emission public and other modes of transportation;
- (4) promote skill development and reallocation of labour in order to contribute to the fairness of the effort to reduce emissions across the economy and the society, particularly in regions most affected by jobtransition, in close coordination with the social partners.

Auctioning revenues can amount up to EUR 22.41bn in the period 2030-2050, in the M2 scenario.

3) Implementation of carbon pricing on fuels for final consumption⁵⁹

Implementation of carbon pricing has to be in principle gradually implemented in sectors not covered by the EU-ETS (therefore the installations subject to other carbon pricing instruments are not subject to carbon pricing mechanism), in order to reflect the true costs of GHG emissions and therefore lower the emissions and contribute to Serbia’s future obligation under the Effort Sharing Regulation (EU) 2018/842.

Implementation of carbon pricing on fuels used in final consumption (excluding transport) can generate additional EUR 0.9bn, if applied in the period 2026-2050, as assumed within the M2 scenario.

This Strategy foresees that revenues from carbon pricing in accordance with EU regulation and practice, and at least 50% of the revenues from the ETS auction will be used to support the implementation of emission reduction measures. The remaining 50% are to be used

⁵⁸ Assuming the EU-ETS in Serbia will apply from 2030 onwards. If EU-ETS would not apply from 2030 the estimated revenues would remain the same.

⁵⁹ Final consumption consists of a fuel used by final consumer such as households, transport commercial and institutional sector and industry not covered by the ETS.

for other costs in the decarbonisation process, including the costs of the effects of the decarbonisation process in regions that are predominantly engaged in coal production. This will mitigate the impacts of the implementation of the Strategy on GDP, employment and energy poverty.

6.2.2. Public financing

Public financing is the catalyst of the implementation of the Strategy and consequently, the long-term transition to a low carbon economy. As a catalyst, it will not finance the implementation alone and it is not necessarily the greatest financier of each measure. Public finance can provide the seed capital to mobilise other sources of financing, namely those from the private sector and/or from international partners, such as the EU, the UNFCCC or other bilateral and multilateral organisations.

Green Bond Framework

The Green Bond Framework will support Serbia's ambitious commitment towards fighting global environmental issues and raise a part of the necessary funding from the international capital market.

The proceeds raised from the issuance of sovereign bonds including green bonds will contribute to the financing of the sovereign budget as a whole. An amount equivalent to the proceeds raised from green bond issuance will be assigned to Eligible Green Expenditures, in the following "green categories": renewable energy, energy efficiency, transport, sustainable water and wastewater management; pollution prevention and control and circular economy; protection of the environment and biodiversity and sustainable agriculture.

The Republic of Serbia raised 1 Billion EUR in the first green bond auction in September 2021. These funds should be made available during the period of implementation of this Strategy.

Budgetary funds and programme activities

Available budgetary funds and programme activities for financing of energy efficiency measures, enhancement of carbon sinks and emission reductions, included the following in 2020:

- 1) Budgetary fund for energy efficiency programme activities (500.2 million RSD);
- 2) Budgetary fund for forest programme activities (800 million RSD) / Budgetary fund for AP Vojvodina forest programme activities (123 million RSD)⁶⁰;
- 3) Green Fund (4 341 billion RSD);
- 4) Budgetary Fund for Water of the Republic of Serbia (RSD 3.880bn) / Budgetary Fund for Water of the Autonomous Province (RSD 4.435bn).

Aggregate financing in 2020 was RSD 14 179bn that is app. 102-103 million EUR, which currently represents just a fraction (3-4%) of the resources needed. Although in 2021 and 2022, budgetary funds for these programme activities have been significantly increased, they are still not sufficient to achieve the goals.

⁶⁰ Due to COVID-19 the budget of the Forest Fund was adjusted to 606 million RSD, while the budget of the Forest Fund of the Autonomous Province was adjusted to 73 million RSD.

In addition, an upgrading and streamlining of these instruments may be required, so as to ensure the effective management of future revenues to be generated and their timely use for supporting the implementation of the measures included in this Strategy.

6.2.3. Private sector financing

The private sector, including state-owned companies, will take up a share of the required investments to increase energy efficiency and reduce GHG emissions. In order to support and promote such private sector investments, a set of “green finance” instruments have been developed, which are available at European level and expected to be available to Serbian stakeholders as well. Such instruments include: Green bonds, Green loans, Blended finance, Sustainable investment funds; Impact funds/impact investments.

6.2.4. International financing

EU Financing

The key sources of financing from the EU for the purpose of economic convergence by less-developed regions, employments, social inclusion and good governance, agriculture, regional and urban development, research, innovation and modernisation and sustainable development are:

- 1) Instrument for Pre-accession Assistance – IPA⁶¹;
- 2) The Cohesion Fund;
- 3) IPARD –Instrument for Pre-Accession in Rural Development, until the EU accession, and after the EU accession, as follows:
 - (1) the European agricultural guarantee fund (EAGF),
 - (2) the European agricultural fund for rural development (EAFRD) – regional and urban development;
- 4) The European Social Fund (ESF);
- 5) Innovation and Modernisation Fund (two funds under the EU-ETS);
- 6) LIFE - Programme for the Environment and Climate Action;
- 7) Connecting Europe Facility;
- 8) Western Balkan Investment Framework (WBIF);
- 9) Western Balkans Guarantee Facility;
- 10) European Fund for Sustainable Development Plus;
- 11) Structural Reform Support Facility;
- 12) InvestEU;
- 13) EU Territorial Cooperation Programmes (INTERREG);
- 14) Horizon 2020/ Horizon Europe;
- 15) Action Plan: Financing Sustainable Growth (COM (2018) 97 Final);
- 16) Just Transition Fund - for EU candidate countries and signatories of the Energy Community Treaty.

Bilateral and Multilateral funds and partners

The key sources of bilateral and multilateral financing are:

⁶¹ After entry into the EU (in 2025 taken as the projected year of accession) the Republic of Serbia will use IPA funds for two additional years, being included in the EU budget from 2028 onwards.

- 1) The Green Climate Fund – (GCF);
- 2) The Global Environmental Facility – (GEF);
- 3) The World Bank;
- 4) The European Investment Bank (EIB);
- 5) The European Bank for Reconstruction and Development (EBRD);
- 6) The Council of Europe Development Bank (CEB);
- 7) KfW (German Development Bank);
- 8) AFD (French Development Agency).

7. FRAMEWORK FOR MONITORING AND REPORTING

Responsible authorities and organisations shall be obliged to carry out an assessment of effects of their policies and measures on the GHG emissions level and shall report to the Ministry of Environmental Protection.

In this context, monitoring of implementation of a specific measure will be done by the responsible institution and report to the Ministry of Environmental Protection. Implementation of the measure will be monitored by the National GHG inventory and using a set of indicators. (Figure 5).

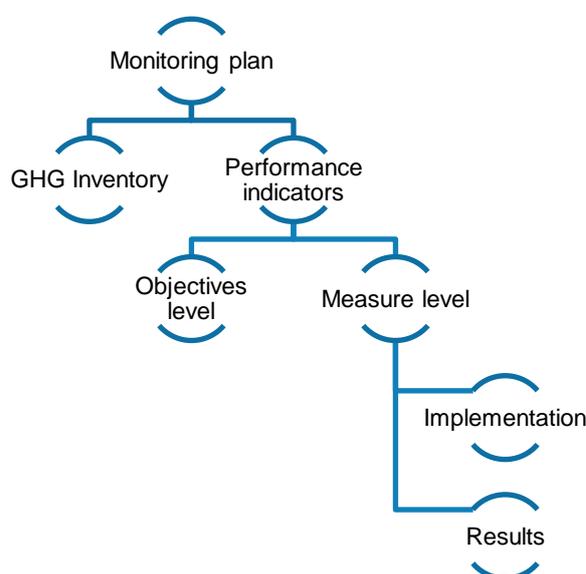


Figure 5: Monitoring framework

In accordance with Article 43 of the Law on Planning System of the Republic of Serbia, MEP will report to the Government, on results of the implementation of the Strategy, no later than 120 days upon expiry of every third calendar year from its adoption, and by means of the final report submitted no later than six months upon its expiry date.

The performance indicators at the level of the Strategy vision, general and specific objectives are presented in Table 15 and will also fulfil the requirements of the Paris Agreement.

Table 15: Key performance indicators at the level of the Strategy Vision and the general and specific objectives

Elements of the Strategy	Indicator	Baseline Value	Target Value			Source of verification	
		2015.	2030.	2050.			
				upper	-		lower
Vision: The Republic of Serbia is by 2050 a low-carbon society with a competitive and resource-efficient economy that provides citizens with new, green jobs and enhanced quality of life in a climate-resilient society	Emissions per capita tCO ₂ e/capita	8.6	8.0	4.1	-	2.8	National GHG Inventory (emissions without LULUCF) and Population statistics of SORS ⁶²)
	Carbon intensity of the economy tCO ₂ e/GDP(MioEUR'13)	2020	1074	321	-	221	National GHG Inventory (emissions without LULUCF) and yearly national accounts - SORS
	Energy related CO ₂ intensity of GDP tCO ₂ /GDP(MioEUR'13)	1524.3	576.7	96.1	-	49.4	National GHG Inventory report (IPCC category - 1A; CO ₂) and yearly national accounts-SORS
General Objective: Reduction of national GHG emissions (excluding LULUCF) by 13% up to 2030, and at least 55% to 69% by 2050 compared to 2010 levels.	Total GHG emissions (without LULUCF) (ktCO ₂ e)	61,233	54,396	28,180	-	19,366	National GHG Inventory report (CRF ⁶³ _emissions; without LULUCF)
	[Total GHG emissions (with LULUCF) (ktCO ₂ e)]	[56,700]	[47,820]	[23,766]	-	[6,284]	National GHG Inventory report (CRF_ emissions; with LULUCF)
Specific objective 1:	GHG Emissions in the ETS Sector (ktCO ₂ e)	40,874	34,806	13,743	-	9,486	Verified Annual ETS Emissions Report (Serbian Environmental Protection Agency-SEPA)

⁶² Statistical Office of the Republic of Serbia (SORS)

⁶³ Common Reporting Format – (CRF)

Elements of the Strategy	Indicator	Baseline Value	Target Value			Source of verification	
		2015.	2030.	2050.			
				upper	-		lower
Reduction of GHG emissions covered by the EU-ETS by 15% in 2030, that is between 66.4% and 76.8% by 2050 compared to 2010 levels	Carbon intensity of electricity and heat production (t of CO ₂ /MWh)	0.73	0.56	0.12	-	0.06	National GHG Inventory report / Energy Balance of Serbia (EB)
Specific objective 2: Reduction of GHG emissions not covered by the EU-ETS by 9.7% in 2030 and between 33.5% and 54.5% by 2050 compared to 2010.	GHG Emissions in the non-ETS Sector (ktCO _{2e})	20,359	19,590	14,436	-	9,880	National GHG Inventory (emissions without LULUCF) Verified Annual ETS Emissions Report (Serbian Environmental Protection Agency-SEPA)
	GHG Emissions in Manufacturing industry (ktCO _{2e})	3,452	3,651	2,691	-	1,917	National GHG Inventory report (IPCC category - 1A2)
	GHG Emissions in other sectors (ktCO _{2e})	2,711	2,089	1,035	-	772	National GHG Inventory report (IPCC category - 1A4 and 1A5)
	Carbon intensity of the industry tCO ₂ /toe	1.89	1.44	0.80	-	0.58	National GHG Inventory report (IPCC category - 1A2) / Energy Balance of Serbia (EB)
	Carbon intensity of the residential sector tCO ₂ /toe	0.51	0.28	0.09	-	0.04	National GHG Inventory report (IPCC category - 1A4b) / Energy Balance of Serbia (EB)
	GHG Emissions in Transport Sector (ktCO _{2e})	5,995	7,433	4,731	-	3,091	National GHG Inventory report (IPCC category- 1A3)
	Carbon intensity of road transport (tCO ₂ /toe)	3.0	2.9	2.7	-	2.5	National GHG Inventory report (1A3-CO ₂ passenger transport)/ Energy Balance of Serbia (EB)

Elements of the Strategy	Indicator	Baseline Value	Target Value			Source of verification	
		2015.	2030.	2050.			
				upper	-		lower
	Freight transport efficiency (toe/Mtkm)	25.4	22.6	19.0	-	15.6	Statistical office of the Republic of Serbia - Freight Transport statistics
	Average Global Warming Potential of F-gases in product used	2,790	2,440	2,320	-	1,998	National GHG Inventory report (IPCC category - 2F)
	GHG Emissions in Agriculture Sector (ktCO _{2e})	3,883	4,994	4,539	-	4,787	National GHG Inventory report (IPCC category - 3)
	GHG Emissions in Waste Sector (ktCO _{2e})	2,709	2,371	1,936	-	845	National GHG Inventory report (IPCC category - 5)
	Food and garden waste landfilling (%)	85	55	35	-	0	Ministry of Environmental Protection/SEPA
Specific objective 3: To increase forest carbon sink in Serbian forests by 17% up to 2030, i.e., between 22% and 132% by 2050 compared to 2010 levels	Net GHG Emissions in LULUCF Sector (ktCO _{2e})	-4,533	-6,576	-4,414	-	-13,082	National GHG Inventory report (IPCC category - 4)
Specific objective 4: To preserve the potential of mitigation measures by increasing the resilience to climate change of priority sectors	Agricultural land under irrigation (%)	1.5	7	10	-	15	Statistical office of the Republic of Serbia
	Biological, biotechnical and technical measures for protection against erosion and torrents on river basins (Mio m ³)	0.35	1.00	1.00	-	1.00	Republic Water Directorate through Public Water Management Companies/ /Monitoring of the implementation of Water Management Strategy

Elements of the Strategy	Indicator	Baseline Value	Target Value			Source of verification	
		2015.	2030.	2050.			
				upper	-		lower
	Forest land (ktCO ₂)	-5,150	-6,626	-4,439	-	-13,106	National GHG Inventory report (IPCC category - 4A)
Specific objective 5: To promote transition to climate neutral and climate resilient economy and society	National plan on climate change education, training for new skills and awareness raising	-	National plan adopted	-	-	-	Ministry of Environmental Protection
	Number of jobs in carbon intensive sectors upgraded with new skills and transferred to jobs in Environmental Economy	-	200	9000	-	20000 ⁶⁴	Statistical Office of the Republic of Serbia; employment statistics

⁶⁴ Preliminary numbers for 2030 and 2050 are subject to update in line with key performance indicators of the National plan on climate change education, training for new skills and awareness raising.

8. DESCRIPTION OF MEASURES INCLUDED IN THE STRATEGY

Table 16: List of measures with main descriptions, gases affected, estimate of climate change mitigation impact (hereinafter: estimated mitigation impact) and implementing entities and partners

Specific objective 1: Reducing GHG emissions covered by the EU-ETS by 15% by 2030 compared to 2010 levels	
No.	<u>Name of the measure: Implementation of measures to align with the EU emissions trading system and/or the introduction of other carbon pricing instruments</u>
1	<p><u>Type of measure:</u> Regulatory, financial</p> <p><u>Description of measure:</u></p> <p>The objective of the implementation of this measure is to accelerate the reduction of GHG emissions from facilities that have permits for GHG emissions in accordance with Article 29 of the Law on Climate Change.</p> <p>This is a transitional measure which is to be implemented in the period from 2026 at the earliest, thus ensuring a gradual transition towards the full internalisation of climate costs in the price of electricity and other products. The boundaries of this measure (e.g. maximum permissible emissions) for 2030 are set by M2 scenario. For example, emissions for electricity and heat production in the public sector should amount to 26,807kt CO₂ in 2030, which is a 21% emission reduction compared to 2015. Electricity producers will be allowed to integrate emission costs into the price of their products, if they pledge⁶⁵ to invest in decarbonisation and contribute to the increased use of RES in electricity production. If the electricity producer exceeds the annual emission allocation, the exceeded amount will be regulated accordingly. In order to enable flexibility and reflect annual variations in electricity production, the banking and borrowing of annual emission allocation is limited to the level of 5% of sectoral emissions in 2015.</p> <p>The equivalent measures could be applied also to the manufacturing industry where, in accordance with M2 scenario, the GHG emissions may increase by 5.8%, while the emissions from industrial processes may also increase approximately by 28.6 % up to 2030 compared to 2015 levels. The equivalent measures compliances mechanism for manufacturing industry is to take into account that those activities are in the EU subject to free allocation of allowances subject to activity specific benchmark values.</p> <p>Upon accession to the EU, it is expected that the Republic of Serbia will join the EU-ETS. ETS works on the “cap and trade” principle. A cap is set on the total amount of certain greenhouse gases that can be emitted by installations covered by the system. The annual compliance under the EU-ETS is enforced through the surrendering of the EUA allowances equivalent to the amount of emissions as determined in the verified emission report. Implementation of the monitoring, reporting and verification (MRV)⁶⁶ aspects of EU-ETS as determined by the relevant provisions of the Law on Climate Change in Serbia is expected to take place by 2024, while the EU-ETS compliance mechanism is expected to be fully implemented with the accession of the Republic of Serbia to the EU .</p>

⁶⁵ Pledge will be operationalised through contractual emission reduction mechanism between the Ministry of Environmental Protection and installation operators.

⁶⁶ Implementation of the monitoring, reporting and verification is a prerequisite for monitoring compliance with measures to align with the EU emissions trading system and/or the introduction of other carbon pricing instruments.

<p><u>Additional objectives to which the measure contributes:</u></p> <p><i>Specific objective 2, Sectoral target:</i> Reducing emissions by increasing energy efficiency and use of RES in the industrial sector by 15% up to 2030, that is by 40% in the residential and commercial sectors also by 2030, compared to 2010 levels.</p> <p><i>Specific objective 2, Sectoral target:</i> Limiting increase in GHG emissions from industrial processes and product use to 7%, compared to 2010 levels</p> <p><u>EU Accession Negotiation Process: Chapter 27 - Environment</u></p>					
	<p>Key Implementing entity</p> <p>Ministry of Environmental Protection, Ministry of Finance (for implementation of measures to align with the EU emissions trading system and/or the introduction of other carbon pricing instruments)</p>	<p>Implementation partners</p> <p>Environmental Protection Agency, Civil Aviation Directorate of the Republic of Serbia, Accreditation Body of the Republic of Serbia, Ministry of Mining and Energy</p>	<p>ETS/ non-ETS</p> <p>ETS</p>	<p>Main gases affected</p> <p>CO₂, N₂O</p>	<p>Estimate of mitigation impact by 2030 [kt CO₂ eq.]</p> <p>6942</p>
No.	<p>Name of measure: <u>Increasing the use of RES in electricity production</u></p>				
2	<p><u>Type of measure:</u> Incentive; financial; regulatory</p> <p><u>Description of measure:</u> It is necessary to put into practice measures to support the production of electricity from renewable energy sources, which is prescribed by the Law on the Use of Renewable Energy Sources. This Law envisages two systems of incentives: the system of feed-in tariffs for small plants and the system of market premiums. Incentives are awarded through a competitive auction process, and the volume of capacities that are supported is determined by the Government through the process of prescribing quotas based on technology. Quotas are determined in accordance with the Law on the Use of Renewable Energy Sources, planning documents in the field of energy, assumed international obligations, that is, available data on existing capacities, planned needs and other data important for determining quotas.</p> <p>By 2030, the total installed capacity of RES power plants in the Republic of Serbia should be defined by the Integrated National Energy and Climate Plan, which is compatible with the general objective and special objective 2 of this Strategy and aligned with the Energy Sector Development Strategy of the Republic of Serbia until 2025 with projections until 2030.</p> <p>It has to be noted that in order to promote the implementation of this measure, it is necessary to remove administrative barriers, increase permitting capacities at the level of relevant competent authorities (local and central level) and provide long-term investment environment to achieve needed increase of RES capacity.</p> <p><u>EU Accession Negotiation Process: Chapter 15 – Energy</u></p>				
	<p>Key Implementing entity</p>	<p>Implementation partners</p>	<p>ETS/ non-ETS</p>	<p>Main gases affected</p>	<p>Estimate of mitigation impact by 2030 [kt CO₂ eq.]</p>

	Ministry of Mining and Energy	Ministry of Environmental Protection	ETS	CO ₂	IE (No.1) ₂
No.	Name of measure: <u>Improving energy efficiency and increasing the use of CHP and RES in district heating systems</u>				
3	<u>Type of measure:</u> Incentive; financial; regulatory				
	<u>Description of measure:</u> The Law on Energy Efficiency and Rational Use of Energy foresees a financial incentive through feed-in tariffs and market premiums for high-efficiency cogeneration plants with a capacity of up to 10 MWe. In accordance with this Law, all high-efficiency cogeneration plants that are not covered by financial incentives shall be provided non-financial incentives based on the issuance of guarantees of origin, which shall be issued by the transmission system operator. This Law provides for the priority takeover of electricity produced through high-efficiency cogeneration. New and reconstructed energy facilities for the production of heat or electricity with a capacity of 5 MW and more, are required to submit an energy efficiency report containing an economic analysis of the possibility of applying combined heat and electricity production in order to obtain an energy permit/building permit.				
	<u>EU Accession Negotiation Process: Chapter 15 – Energy</u>				
	Key Implementing entity	Implementation partners	ETS/ non-ETS	Main gases affected	Estimate of mitigation impact by 2030 [kt CO ₂ eq.]
	Ministry of Mining and Energy	Municipalities, Local self-governments	ETS	CO ₂	IE (No.1)
Specific objective 2: Reducing GHG emissions not covered by the EU-ETS by 9.7% in 2030					
Sectoral target: Reduce emissions, through the increase energy efficiency and use of RES, in the industrial sector by 15%, and in the residential and commercial sectors by 40% by 2030 compared to 2010					
No.	Name of measure: <u>Carbon pricing and excise duties on energy</u>				

4	<p><u>Type of measure:</u> Regulatory; financial</p> <p><u>Description of measure:</u> The introduction of carbon pricing and the appropriate levels of excise duties as a policy instrument, enables implementation of the polluter pays principle in the non-ETS sectors and activities not covered by measures to align with the EU emissions trading system and/or the introduction of other carbon pricing instruments. The purpose of this objective is to make fossil fuels less competitive for use by final consumers, compared to sustainable biomass or other less carbon intensive fuels. In the medium-term, appropriate carbon pricing is an important driver for consumers to redirect their investments into low or zero carbon technologies and energy efficiency. The funds collected from carbon pricing should be used to support implementation of measures relating to cutting of GHG emissions by final consumers such as households, commercial and institutional sector and industry.</p> <p>Furthermore, the excise duties on energy products need to be fully harmonised with Directive 2003/96/EC, so that the Excise Duty Law includes excise duties for coke and coal. In addition, further harmonisation of the excise policies on petroleum products with Directive 2003/96/EC is necessary, in the part concerning minimum amounts of excise taxes in various applications/sectors (such as motor fuel for industrial and commercial purposes, agriculture, forestry, fish farming, public works, stationary engines, etc.), as well as harmonisation of excise duties on electricity.</p> <p>Such instrument can be combined with taxation exemptions for small and medium-sized enterprises (hereinafter: SMEs), subject to contractual emission reductions arrangements where SMEs are investing in GHG emission reduction measures.</p> <p><u>EU Accession Negotiation Process: Chapter 16 – Taxation</u></p> <table border="1" data-bbox="174 746 2197 917"> <thead> <tr> <th data-bbox="174 746 712 810">Key Implementing entity</th> <th data-bbox="712 746 1375 810">Implementation partners</th> <th data-bbox="1375 746 1603 810">ETS/ non-ETS</th> <th data-bbox="1603 746 1794 810">Main gases affected</th> <th data-bbox="1794 746 2197 810">Estimate of mitigation impact by 2030 [kt CO₂ eq.]</th> </tr> </thead> <tbody> <tr> <td data-bbox="174 810 712 917">Ministry of Finance</td> <td data-bbox="712 810 1375 917">Ministry of Environmental Protection, Ministry of Mining and Energy</td> <td data-bbox="1375 810 1603 917">non-ETS</td> <td data-bbox="1603 810 1794 917">CO₂</td> <td data-bbox="1794 810 2197 917">161</td> </tr> </tbody> </table>	Key Implementing entity	Implementation partners	ETS/ non-ETS	Main gases affected	Estimate of mitigation impact by 2030 [kt CO ₂ eq.]	Ministry of Finance	Ministry of Environmental Protection, Ministry of Mining and Energy	non-ETS	CO ₂	161
Key Implementing entity	Implementation partners	ETS/ non-ETS	Main gases affected	Estimate of mitigation impact by 2030 [kt CO ₂ eq.]							
Ministry of Finance	Ministry of Environmental Protection, Ministry of Mining and Energy	non-ETS	CO ₂	161							
No.	Name of measure: <u>Improving energy efficiency in industrial sector</u>										
5	<p><u>Type of measure:</u> Regulatory; incentive; financial</p> <p><u>Description of measure:</u> Improving energy efficiency in the energy intensive industrial sector is crucial to enhance competitiveness. The industrial sector will have to promote and implement energy efficiency projects and employ best available technology (BAT) to retain its competitive advantage.</p> <p>Energy efficiency improvement in the industry will be achieved with a package of instruments. Based on 4th National energy efficiency action plan from 2021, the instruments are:</p> <ol style="list-style-type: none"> 1) introduction of the Energy Management System in large industrial consumers; 2) energy efficiency improvement programme in industry; 3) incentive tariffs for highly efficient CHP in industry; 4) minimum energy efficiency requirements for new and upgraded plants for the production of electricity and heat, or systems for the combined production of electricity and heat. 										

<p>Pursuant to Article 7 of the Energy Efficiency Directive (2012/27 / EU), an energy efficiency obligation scheme or alternative measures can be introduced. Based on this system, the companies that sell energy to end consumers would have an obligation to achieve energy savings in terms of end consumers based on various measures. The measures are to be financed by the companies themselves which are also required to report on the savings achieved on an annual basis.</p> <p>In support of the aforementioned, Commission Regulation (EU) 2019/1781 (laying down eco-design requirements for electric motors and variable speed drives) has not been transposed yet, while Directive (EU) 2009/125/EC on eco-design was transposed through the Regulation on eco-design of products that affect energy consumption (Official Gazette of the RS, No. 132/21) which was adopted in December 2021.</p> <p><u>EU Accession Negotiation Process: Chapter 15 – Energy</u></p>					
	Key Implementing entity	Implementation partners	ETS/ non-ETS	Main gases affected	Estimate of mitigation impact by 2030 [kt CO₂ eq.]
	Ministry of Mining and Energy	Ministry of Economy, Chamber of Commerce and Industry of Serbia	ETS / non-ETS	CO ₂	715
No.	Name of measure: <u>Increasing use of RES in the industry</u>				
6	<u>Type of the measure:</u> Incentive; financial				
	<u>Description of measure:</u> The use of renewable energy sources in industry should significantly increase by 2030 in accordance with the framework that will be determined by the Integrated National Energy and Climate Plan. In terms of the industry included in the ETS, high prices of CO ₂ allowances are going to be an important driver for switching from fossil fuels to RES. Concerning the non-ETS industries, this area will be regulated by the introduction of carbon pricing. However, additional measures are needed in the form of subsidies for new wood-fired boilers or for utilization of waste heat by means of heat pumps. Such subsidies may be provided, for instance, by Energy efficiency fund.				
	<u>EU Accession Negotiation Process: Chapter 15 – Energy</u>				
	Key Implementing entity	Implementation partners	ETS/ non-ETS	Main gases affected	Estimate of mitigation impact by 2030 [kt CO₂ eq.]
	Ministry of Mining and Energy	Ministry of Economy, Chamber of Commerce and Industry of Serbia	ETS / non-ETS	CO ₂	IE (No.5)
No.	Name of measure: Improving thermal integrity of households				
7	<u>Type of measure:</u> Regulatory; incentive; financial; informational and educational; organisational, governance and institutional				

	<p>Description of measure: Improving thermal integrity of households reduces heating and cooling needs, consequently reducing energy costs as well as investment costs in heating and cooling infrastructure. There is an estimate that 85% of the existing buildings do not fulfil minimum energy efficiency requirement⁶⁷.</p> <p>Renovation of a building is financially very demanding, therefore financial support to households in terms of implementing these measures is crucial. However, to support the most appropriate investment decision for households, an independent advice network of energy experts should be established which would, free of charge, provide advice to citizens on energy efficiency measures and use of RES in households. The advisory network should be financed by the Government. It is planned to prepare the Information Portal through the World Bank project intended to fund energy rehabilitation of residential buildings, where citizens will be able to find relevant information concerning all EE measures. Building regulations for new buildings and renovations of the old ones, must then be updated to comply with the EU Directive on the energy performance of buildings 2018/844/EU, which came into force in 2018. A full transposition of Energy Efficiency Directive is also needed. Please note that Article 4 of the Directive 2018/844/EU requires the preparation of the Long-term strategy for mobilising investment and facilitating the renovation of national building stock. This strategy, titled Long-Term Strategy for Stimulating Investment in the Renovation of the National Building Stock of the Republic of Serbia until 2050, was adopted in February 2022.</p> <p>EU Accession Negotiation Process: Chapter 15 – Energy</p>													
	<table border="1"> <thead> <tr> <th data-bbox="604 582 1429 662">Key Implementing entity</th> <th data-bbox="1429 582 1621 662">Implementation partners</th> <th data-bbox="1621 582 1830 662">ETS/ non-ETS</th> <th data-bbox="1830 582 1982 662">Main gases affected</th> <th data-bbox="1982 582 2199 662">Estimate of mitigation impact by 2030 [kt CO₂ eq.]</th> </tr> </thead> <tbody> <tr> <td data-bbox="604 662 1429 774">Ministry of Construction, Transport and Infrastructure</td> <td data-bbox="1429 662 1621 774">Ministry of Mining and Energy, Chamber of Commerce and Industry of Serbia</td> <td data-bbox="1621 662 1830 774">non-ETS</td> <td data-bbox="1830 662 1982 774">CO₂</td> <td data-bbox="1982 662 2199 774">220</td> </tr> </tbody> </table>	Key Implementing entity	Implementation partners	ETS/ non-ETS	Main gases affected	Estimate of mitigation impact by 2030 [kt CO ₂ eq.]	Ministry of Construction, Transport and Infrastructure	Ministry of Mining and Energy, Chamber of Commerce and Industry of Serbia	non-ETS	CO ₂	220			
Key Implementing entity	Implementation partners	ETS/ non-ETS	Main gases affected	Estimate of mitigation impact by 2030 [kt CO ₂ eq.]										
Ministry of Construction, Transport and Infrastructure	Ministry of Mining and Energy, Chamber of Commerce and Industry of Serbia	non-ETS	CO ₂	220										
No.	<p>Name of measure: <u>Energy efficiency improvement of heating and cooling infrastructure and promotion of use of RES in households</u></p>													
8	<p>Type of measure: Regulatory; incentive; financial; informational and educational</p> <p>Description of measure: A large number of single-family houses predominantly uses old inefficient coal- and wood-fired boilers. Coal combustion causes high specific CO₂ emissions, while coal and wood biomass use in inefficient boilers also cause high emissions of PM 2.5, thus adversely affecting the health of citizens. More efficient furnaces/boilers reduce fuel consumption, while also decreasing emissions.</p> <p>In 2015, the EU adopted the Regulation on eco-design requirements for solid fuel boilers (1189/2015) and solid fuel local space heaters (2015/1185) that will take effect from 1 January 2020 and 1 January 2022, respectively. The regulations set minimum requirements for seasonal space heating energy efficiency and emissions of particulate matter (PM), volatile organic compounds (VOC), carbon monoxides (CO) and nitrogen oxides (NO_x). Devices that do not meet the requirements of eco-design cannot be placed on the EU market. With transposition and implementation of the abovementioned regulations, customers will not be able to buy devices that do not comply with the minimum requirements set. In the Republic of Serbia, the legal framework for transposing EU regulations in the field of eco-design is governed by the Law on Energy Efficiency and Rational Use of Energy (LEERUE) and the Regulation on eco-design of products that affect energy consumption, which transposed Directive 2009/125/EC of 21 October 2009 thus establishing a general framework for determining eco-design requirements for products that affect energy consumption. Adoption of the rulebook prescribing eco-design requirements for solid fuel boilers and solid fuel local space heaters, which transposes the aforementioned Commission (EU) regulations, is planned in 2023.</p>													

⁶⁷ IPA Project “Climate Change Strategy with Action Plan”; Annex I of Result 1 Report: Assessment of Current Serbian Climate Change Policy Framework - Energy sector

In addition to regulations that define the eco-design requirements that are mandatory for the products in order to be placed on the market, in 2015, the EU also passed regulations on the energy efficiency marking (energy labelling) of these devices, i.e., the Delegated Regulation with regard to the energy labelling of local space heaters (2015/1186) and the Delegated Regulation on the labelling of solid fuel boilers and packages of solid fuel boilers, auxiliary heaters, temperature controllers and solar devices (2015/1187). The amendments to the first Delegated Regulation by the EU are planned to be implemented in the second half of 2023, after which the amended regulations can be transposed into the legal system of the Republic of Serbia, while the amendments to the second Delegated Regulation are not planned in the near future, so it is planned that it will be transposed in this form into the legal system of the Republic Serbia. The legal framework for transposing EU regulations in the field of energy labelling is also regulated through LEERUE. Energy labelling regulations are important because they give potential buyers of products information about their energy efficiency, compared to the efficiency of other devices on the market and their energy consumption, so that th consumers can take this data into account when purchasing new devices.

In order to support the replacement of old inefficient solid fuel space heating devices (boilers, furnaces and other space heaters), especially coal fired ones, households should be provided with subsidies for the purchase of new, more efficient space heating devices, i.e., those that use renewable energy sources (biomass boilers, heat pumps, etc.), which meet the eco-design requirements, that is, which have a mark of a higher level of energy efficiency (the Energy Star mark). The Ministry of Mining and Energy is already subsidising the purchase and installation of new efficient biomass and gas boilers, while as of 2021, this has been done within the framework of public calls for energy rehabilitation of residential buildings, family houses and apartments, carried out by local self-government units, as well as city municipalities, with the technical and financial support of the Directorate for Financing and Promotion of Energy Efficiency, hence in 2022, 670 biomass boilers were installed in households throughout the Republic of Serbia. In 2023, a similar number of efficient boilers is expected to be installed, while in the next five years more than 1000 boilers per year are planned to be installed, given that the implementation of the project “Clean energy and energy efficiency for citizens in the Republic of Serbia”, which is financed by a loan provided by the World Bank, will begin in the mid-2023. The mentioned project aims to continue financing the energy rehabilitation of family houses, which, among other measures, will include the installation of biomass boilers.

EU Accession Negotiation Process: Chapter 15 – Energy

EU Accession Negotiation Process: Chapter 15 – Energy

Key Implementing entity	Implementation partners	ETS/ non-ETS	Main gases affected	Estimate of mitigation impact by 2030 [kt CO ₂ eq.]
Ministry of Mining and Energy	Ministry of Construction, Transport and Infrastructure, Chamber of Commerce and Industry of Serbia and Ministry of Environmental Protection	non-ETS	CO ₂	IE (No.7)

No. Name of measure: Improving energy efficiency and use of RES in the tertiary sector

Type of measure: Regulatory; incentive; financial

Description of measure: Commercial and institutional buildings represent important opportunities for the application of energy efficiency measures, as they are professionally managed and their respective owners and/or managers are sensitive to energy costs, which are projected to keep growing (through the inclusion of the emission price in electricity and of the carbon pricing on fuels).

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This measure is aimed at reducing energy consumption in the governmental/services/commercial buildings. The objective of measure is to generally improve the way heating and cooling needs in the tertiary sector are met, including the improvement of electrical appliances used in the services sector. The objective of the measure is reducing consumption of energy (including electricity) and fuel switching from fossil fuels to zero or lower emitting fuels for heating purposes.

	<p>The public sector has defined minimum requirements for certain energy using equipment which is purchased by means of the public procurement process (office information technology, cooling appliances, air conditioning, lighting). The scope of products and services will also have to be broadened in line with the EU green public procurement criteria. Through this instrument, the public sector also provides support to the market of energy efficient products.</p> <p><u>EU Accession Negotiation Process: Chapter 15 – Energy</u></p>				
	Key Implementing entity	Implementation partners	ETS/ non-ETS	Main gases affected	Estimate of mitigation impact by 2030 [kt CO₂ eq.]
	Directorate for Financing and Promotion of Energy Efficiency, Ministry of Mining and Energy	Ministry of Construction, Transport and Infrastructure, Ministry of Finance, municipalities, local self-government and other public administration and private sector entities	non-ETS	CO ₂	365
No.	Name of measure: <u>Improving thermal integrity in the tertiary sector</u>				
10	<p><u>Type of measure:</u> Regulatory; incentive; financial</p> <p><u>Description of measure:</u> Improving thermal integrity (insulation) of the tertiary sector buildings reduces heating and cooling needs, thus contributing significantly to energy savings. Consequently, energy costs, as well as investment costs in heating and cooling infrastructure are reduced. In the Republic of Serbia, an important share of buildings in the tertiary sector, in particular public buildings, are connected to district heating systems, which leaves the building managers without options to manage the energy supply side - covered by the measure “Improving energy efficiency and use of RES in the Tertiary sector”. This is the main reason these two measures are separate, given that, in many cases, tertiary building managers cannot influence the efficiency of heat production.</p> <p>Considering all buildings, the priority shall be the improvement of the thermal integrity. Buildings that have heating infrastructures (boilers), shall invest in them in parallel or only after the investments in the insulation are completed. The development of energy services market is foreseen in the National Energy Efficiency Action Plans and the Republic of Serbia has already included ESCO⁶⁸ approach in the primary and secondary legislation. The situation needs to be improved by support schemes combining ESCO financing with budgetary grants for public buildings. This approach should be rolled out immediately, as financing of energy efficiency projects in the public sector can more efficiently be done through energy performance contracting (EPC). Since 2014, the Ministry of Mining and Energy has been financing projects to improve the EE of public buildings, and so far 144 buildings in local self-government units have been financed. Also, this Ministry supported ESCO financing through the adoption of model contracts with the public sector.</p> <p><u>EU Accession Negotiation Process: Chapter 15 – Energy</u></p>				
	Key Implementing entity	Implementation partners	ETS/ non-ETS	Main gases affected	Estimate of mitigation impact by 2030 [kt CO₂ eq.]
	Directorate for Financing and Promotion of Energy Efficiency, Ministry of Mining and Energy	Ministry of Construction, Transport and Infrastructure, Ministry of Finance, municipalities, local self-governments and other public administration and private sector entities	non-ETS	CO ₂	IE (No.9)

⁶⁸ ESCO is a company or other legal entity or entrepreneur registered for the provision of energy services which by providing energy services increases the energy efficiency of the facility, technological process and service and which to some extent, accepts the financial risk for the energy services provided, by collecting its services, in whole or in part, on the basis of the savings achieved through the measures implemented and the fulfilment of other agreed performance criteria

Sectoral target: Limiting GHG emissions growth in the transportation sector to 10% by 2030 compared to 2010 levels

No. **Name of measure: Renewal of the passenger fleet and promotion of sustainable passenger transport**
Efficiency improvement of vehicle stock and usage of vehicles

Type of measure: Regulatory; incentive; financial; informational and educational

Description of measure: New vehicles are becoming more efficient based on CO2 standards that are in effect in the EU, of which the Republic of Serbia benefits indirectly. The EU adopted Regulation 443/2009 which set targets for CO2 emissions of 130 gCO2/km in 2015 and 95 gCO2/km in 2021, respectively. In 2019, the EU targets for 2030 were agreed, thus emissions are to be decreased by 37.5 % by 2030 compared to 2021 levels for cars and by 30 % for vans. The EU, for the first time in 2019, agreed also on the emissions reduction target for trucks and buses, therefore the average emissions of new vehicles in 2030 will have to be 30 % lower than in 2019. Based on these targets, vehicles in the Republic of Serbia will become more efficient regardless of the fact whether Serbia is a part of the EU, since the same vehicles are sold in Serbia and in the EU. The Republic of Serbia needs to align its legislation with the EU legislation no later than 2023.

Concerning the improvement of the efficiency of vehicles, it is important that the Republic of Serbia controls the import of used cars and their use, especially regarding very old vehicles. There is a risk that, due to upcoming electrification, even more old vehicles from the EU will be imported to Serbia, limiting the effects of the legislation on new vehicles. That is why the legislation on yearly taxation has to change in the way that it will stimulate buying of vehicles that are more efficient and that contribute less to the greenhouse effect. The Law on taxes on the use, possession and carrying goods (Official Gazette of the Republic of Serbia Nos. 26/01, 80/02, 43/04, 31/09, 101/10, 24/11, 68/14 – other law, 112/15, 86/19 and 118/21), introduced taxes on the use, possession and carrying of goods. Tax on the use of motor vehicles is paid for motor vehicles covered by the mentioned law, however, data on greenhouse gas emissions is currently not considered as one of the elements of the criteria for taxation. Discount for older cars needs to be gradually removed, since they have much greater negative impact on the environment than new cars. Therefore, the use of motor vehicles whose impact on the environment is more favourable and which contribute less to the greenhouse effect should be encouraged. For a faster introduction of electric vehicles, subsidies would need to be offered, at least in the early stage of market development. Furthermore, the Public Procurement Directive, aligned with the Directive on the Promotion of Clean and Energy Efficient Road Transport Vehicles, recognises that public procurement can be a powerful market driver concerning the introduction of new technologies, including the clean and highly energy-efficient vehicles. This is not only due to their direct large impact on emissions reduction, but also due to their large eco-friendly effect which is easily perceived. The Republic of Serbia will have to invest in charging infrastructure for electric vehicles, as well as charging infrastructure for other vehicles that run on alternative fuels (natural gas).

EU Accession Negotiation Process: Chapter 27 - Environment

Key Implementing entity	Implementation partners	ETS/ non-ETS	Main gases affected	Estimate of mitigation impact by 2030 [kt CO ₂ eq.]
Ministry of Environmental Protection, Ministry of Finance	Ministry of Construction, Transport and Infrastructure	non-ETS	CO ₂	752

No. **Name of measure: Renewal of the passenger fleet and promotion of sustainable passenger transport**
Promotion of public transport and non-motorised transport

12 **Type of measure:** Regulatory; informational and educational; organisational, governance and institutional

	<p>Description of measure: An increase in the use of public transportation (33 % until 2030 compared to 2010), is fundamental in order to limit the emissions growth up to 2030. In that regard, a package of measures is needed, including improved planning, investments in competitive different means of transport and changing commuting habits. Those measures should build on a revised Transport Strategy which should include climate change aspects of transport and mobility development. Furthermore, regional/local low-carbon transport strategies and sustainable mobility urban plans are to be developed with the focus on improvement of non-motorised transport infrastructure. Investments in infrastructure (railway) have already started and need to continue, in accordance with the National plan for public railway infrastructure.</p> <p>EU Accession Negotiation Process: Chapter 14 – Transport policy</p>				
	<p>Key Implementing entity</p>	<p>Implementation partners</p>	<p>ETS/ non-ETS</p>	<p>Main gases affected</p>	<p>Estimate of mitigation impact by 2030 [kt CO₂ eq.]</p>
	<p>Ministry of Construction, Transport and Infrastructure</p>	<p>Municipalities, Local Self-Government, Public transport companies, National railway company, Ministry of Environmental Protection</p>	<p>non-ETS</p>	<p>CO₂</p>	<p>under No.11</p>
<p>Name of measure: <u>Renewal of vehicle fleet for transport of passengers and promotion of sustainable passenger traffic</u> <u>Promotion of use of alternative fuels and biofuels</u></p>					
<p>13</p>	<p>Type of measure: Regulatory; incentive</p> <p>Description of measure: Directive 2009/28/EU and 2015/1513/EC (amended with Directive 018/2001/EU) were partly transposed into the Law on Energy Industry.</p> <ol style="list-style-type: none"> 1) Rulebook on Technical and Other Requirements for Biofuels and Bioliquids (Official Gazette of RS, No. 73/19) 2) Regulation on Guarantee of Origin (Official Gazette of RS, No. 82/17) 3) Regulation on Criteria for Sustainability of Biofuels (Official Gazette of RS, No. 89/19) <p>A system of providing support to the production of biofuels from sustainable energy sources (SES - from waste, remains of cellulose and lignocellulosic material) has not been established yet, therefore, there is no production. It is necessary to prepare a Directive Specific Implementation Plan concerning the transposition and application of the Fuel Quality Directive as well as to implement updated directive on SES in order to support introduction of the second-generation biofuels on Serbian market of transport fuels and to establish a system of support for production of biofuels.</p> <p>EU Accession Negotiation Process: Chapter 15 – Energy</p>				
	<p>Key implementing entity</p>	<p>Partners</p>	<p>ETS/ non-ETS</p>	<p>Main gases affected</p>	<p>Estimate of mitigation impact by 2030 [kt CO₂ eq.]</p>
	<p>Ministry of Mining and Energy</p>	<p>Ministry of Construction, Transport and Infrastructure, Ministry of Economy, Chamber of Commerce and Industry of Serbia</p>	<p>non-ETS</p>	<p>CO₂</p>	<p>Under No. 11</p>
<p>No.</p>	<p>Name of measure: <u>Renewal of vehicle fleet for transport of passengers and promotion of sustainable passenger traffic</u></p>				

14	<p>Type of measure: Regulatory; organisational, governance and institutional</p> <p>Description of measure: Freight transport is necessary for economic growth and it usually has a higher growth rate than the GDP. Therefore, in the context of growing Serbian GDP, it is expected that the freight transport will continue to grow. Therefore, it is important to find modalities to limit emissions from this source, without necessarily limiting the growth of freight transport. Two important traffic corridors – Corridor X and Corridor XI, run through Serbia, which contributes to high both domestic and international freight flows. Such traffic flows will significantly increase once Serbia joins the EU, due to free trade and movement of goods. This is supported by the experience of other countries that joined the EU.</p> <p>Therefore, in order to support promotion of sustainable freight transport it is important to review and adapt annual fees for HDV infrastructure in accordance with CO2 emission performance standards and implement road tolls for freight vehicles based on the EURO emission standard.</p> <p>Furthermore, the new Transport Development Strategy of the Republic of Serbia for the period 2023-2030 (currently in drafting phase) has to be prepared to assess different aspects of transport development as well as Serbia's needs and capabilities relating to defining an optimal infrastructure development path for the future in order to ease the subsequent pressure on road infrastructure.</p> <p>EU Accession Negotiation Process: Chapter 14 - Transport Policy</p>				
	Key implementing entity	Partners	ETS/ non-ETS	Main gases affected	Estimate of mitigation impact by 2030 [kt CO2 eq.]
	Ministry of Construction, Transport and Infrastructure	Ministry of Finance, PE Putevi Srbije, Ministry of Environmental Protection	non-ETS	CO ₂	156
Sectoral target: Limiting increase in GHG emissions from industrial processes and product use to 7% by 2030 compared to 2010 levels					
No.	Name of measure: <u>Implementation of the F-gas Regulation and MAC Directive</u>				

Type of measure: Regulatory; informational and educational

Description of measure: The European Union adopted revised F-gas Regulation (517/2014), replacing the previous Regulation (842/2006). The revised Regulation entered into force on 1 January 2015. It aims to reduce emissions of fluorinated greenhouse gases (F-gases) by two-thirds compared to 2017 levels by 2030. The revised Regulation kept many important and successful features of the previous F-Gas Regulation related to leak prevention, F-gas recovery and technical training. Key additional instruments that have to be transposed and implemented are:

- 1) Product and equipment ban: restrictions on the placing on the market (bans) of certain refrigeration and air conditioning equipment, foams and propellants using F-gases, and of SF₆;
- 2) Service and maintenance bans: Limits on the use of higher GWP gases, such as R404A and R507A, in existing refrigeration equipment from 2023;
- 3) Cap and phase down: Reductions on the placing on the market of F-gases via a cap and phase down on the supply of HFCs.

Based on the Law on Air Protection (Official Gazette RS, No. 36/2009 and 10/2013 and 26/21), in 2013, a national Regulation on fluorinated greenhouse gases management, as well as on conditions for license issuance to import and export of such gases (Official Gazette RS, No. 120/13) was adopted. This by-law transposed into national legislation of the RS some of the requirements of EU regulations, such as 842/2006/EC, 1493/2007/EC, 1494/2007/EC, 1497/2007/EC, 1516/2007/EC and Directive 2006/40/EC. However, the EU Regulation transposition into Serbian national legislation is in its initial stage. The national Regulation is not yet fully harmonised with the provisions referring to training and certification of technical persons, control of the use of fluorinated greenhouse gases, establishing and allocation of quotas for placing of fluorinated greenhouse gases on the market.

Serbia is to transpose F-gas Regulation with some derogations as follows:

15

- 1) Service and maintenance bans: Limits on the use of higher GWP gases, such as R404A and R507A, in existing refrigeration equipment with a charge size of 40 tonnes of CO₂ equivalent or more (around 10 kilograms) will be considered from 2023. If charge size is lower than 40 tonnes of CO₂ equivalent R404A is allowed to be used;
- 2) For Equipment with a charge size of 40 tonnes of CO₂ equivalent or more (around 10 kilograms) a regenerated R404A can be used by 2030. Equipment retrofit is allowed for switching to R448A, R449A and R452A in accordance with restrictions as contained in F-gas Regulation.

Furthermore F-gas emissions from mobile air conditioning (MACs) in EU are regulated based on Directive 2006/40/EC on mobile air conditioning. Mobile Air-conditioning Systems Directive has been implemented in three phases, starting from 2008. Second phase implies that air conditioning systems in new vehicle types had to be filled with gases with a GWP lower than 150. From 2017 onwards, this applies to all new air-conditioned vehicles on the EU market. Although MACs Directive has not been yet transposed into Serbian legal system, the EU automotive industry operating in Serbia implements this Directive in order to ensure conformity of its products with the EU standards.

EU Accession Negotiation Process: Chapter 27 - Environment

Key implementing entity	Partners	ETS/ non-ETS	Main gases affected	Estimate of mitigation impact by 2030 [kt CO ₂ eq.]
Ministry of Environmental Protection	Ministry of Economy, Chamber of Commerce and Industry of Serbia	non-ETS	HFC, SF ₆	114

Sectoral target: Reducing GHG emissions in agricultural sector by 15% by 2030 compared to 2010 levels

No. Name of measure: Winter cover crops

16

Type of measure: Incentive; informational and educational

Description of measure: The planting of winter cover crops is generally considered as having positive effects for the management of soil erosion, soil fertility, soil quality, water and weed control, as well as for biodiversity and the mitigation of GHG emissions. The area for cover crops is limited to the area not covered by regular crops during the winter season. Winter cover crops do not produce a market output, but have costs for machinery, other inputs and seed. If winter cover crops are legumes, the bio-fixation will reduce fertilizer demand of the main future crops. Having in mind the positive effects regarding fertilisation and phytosanitary functions, this measure is beneficial to farmers, however knowledge about the positive effects of winter cover crops, as well as provision of financial support (e.g. direct payments) need to be increased through enhanced activities of the Agriculture Advisory Service. In parallel, Good Agricultural and Environmental Conditions (GAEC) shall be gradually introduced into the agricultural policy in the course of the pre-accession period.

EU Accession Negotiation Process: Chapter 11 - Agriculture and Rural Development

Key implementing entity	Partners	ETS/ non-ETS	Main gases affected	Estimate of mitigation impact by 2030 [kt CO2 eq.]
Ministry of Agriculture, Forestry and Water Management	Agricultural Advisory Service, Directorate for Agrarian Payments, Administration for Agricultural land, Farmers	non-ETS	CO ₂ , N ₂ O	579.05

No. Name of measure: Increased legume share in fodder area

17

Type of measure: Incentive, informational-educational

Description of measure: Legumes on temporary grassland increase bio-fixation and, therefore, reduce fertiliser needs. It is assumed that the legume share on temporary grassland can be increased to a maximum of 20%, which is equivalent to a nitrogen fixation rate of 15%.

This measure saves costs for fertilizer and provides nutritious fodder, so it is beneficial to farmers. The precondition is increasing the knowledge of farmers and implementation of environmental standards regarding use of fertilizers.

EU Accession Negotiation Process: Chapter 11 - Agriculture and Rural Development

	Key implementing entity	Partners	ETS/ non-ETS	Main gases affected	Estimate of mitigation impact by 2030 [kt CO2 eq.]
	Ministry of Agriculture, Forestry and Water Management	Agricultural Advisory Service, Directorate for Agrarian Payments, Administration for Agricultural land, Chamber of Commerce and Industry of Serbia, Farmers	non-ETS	CO ₂ , N ₂ O	14.6
No.	Name of measure: <u>Breeding for higher milk yields</u>				
18	<u>Type of measure:</u> Incentive; informational and educational; organisational, governance and institutional				
	<u>Description of measure:</u> A genetic selection of cows with higher milk yields may reduce overall emissions of greenhouse effect gases if the milk yield per cow is increased and simultaneously the health protection of milking cows is improved. This will lead to overall increase of milk yield, but not necessarily the increase in the number of milking cows, which should in turn, lead to limited growth of greenhouse effect gases. The necessity to improve milk yield and increase efficiency and competitiveness of the Serbian dairy producers is recognised in the Action Plan for Implementation of the Government Programme 2023 -2026 (The Official Gazette of the RS, No. 30/18), in the Strategy of Agriculture and Rural Development (2014-2024) as well as in the IPARD.				
	<u>EU Accession Negotiation Process: Chapter 11 - Agriculture and Rural Development</u>				
	Key implementing entity	Partners	ETS/ non-ETS	Main gases affected	Estimate of mitigation impact by 2030 [kt CO2 eq.]
	Ministry of Agriculture, Forestry and Water Management	Directorate for Agrarian payments, Veterinary Directorate, Chamber of Commerce and Industry of Serbia, Research institutions	non-ETS	CH ₄	IE ⁶⁹
Sectoral target 3: Increasing carbon sinks in Serbian Forests by 17% by 2030 compared with 2010 levels					
No.	Name of measure: <u>Afforestation</u>				
19	<u>Type of measure:</u> Regulatory, incentive				
	<u>Description of measure:</u> This measure prescribes the afforestation of 3770 ha up to 2030, in accordance with the Action Plan for Implementation of the Government Programme for 2023-2026, as well as continuation of afforestation in the period from 2026 to 2030 (to be continued up to 2050), in accordance with the strategic documents in the forestry sector and Spatial Plan of the RS. In order to enhance the resilience of new forests to the impacts of climate change, and as a new approach compared to the draft Forestry Development Programme, site mapping is to be used in order to identify the appropriate tree species that should be planted on each site. Based on the results of the mapping, only adapted tree species should be planted.				

69 The emission savings achieved through implementation of afforestation measures are considered in the total savings, however CAPRI model used for assessment of emission reductions in agriculture sector cannot be applied to a single planting measure

	<p>A package of instruments should be used for the implementation of this measure, where the most important are financial, regulatory and informational/educational instruments.</p> <p>Dialogue among different forest related policies and institutions (forestry, cadastre units, agriculture, water management, and nature protection) should be initiated in order to minimise conflicts between land use categories, especially in the Autonomous Province of Vojvodina. Public enterprises for forest management and others should have sufficient capacities to prepare enough seedlings or seeds to support afforestation.</p> <p>The update of cadastre regarding land use category is a precondition for successful afforestation in addition to the removal of the legal barriers for afforestation of the class V to class VIII agriculture land. This measure will decrease transaction costs and create attractive opportunities for larger afforestation activities, especially in terms of private entities.</p> <p><u>EU Accession Negotiation Process: Chapter 27 - Environment</u></p>				
	Key implementing entity	Partners	ETS/ non-ETS	Main gases affected	Estimate of removals by 2030 [kt CO2 eq.]
	Ministry of Agriculture, Forestry and Water Management	Research institutions, Directorate for Agrarian Payments, Organisations responsible for the forest management, Private forest owners	non-ETS	CO ₂	259.1
No.	Name of measure: <u>Close to Nature Forest Management and Climate Smart Approach to Forestry</u>				
	<p><u>Type of measure:</u> Informational-educational</p> <p><u>Description of measure:</u> Close to nature forest management is one of the components of sustainable forest management, therefore, it implies implementation of measures aimed at ensuring continued productivity, vitality and service provision. In addition, this includes measures that will be implemented in the future for the purposes of adaptation to climate change.</p> <p>This measure also considers fulfilment of multiple forest functions on different spatial scales. In the most basic approach, close to nature forest management means that site adapted tree species are used and forest ecosystems are composed of mixed stands of coniferous or broadleaved tree species, constructed in several layers. In addition, regeneration based on natural regeneration is the dominant approach in forest management, by focusing on the best and most vital tree species in the stand, systematic pest management etc.</p> <p>Climate smart forestry approach, as an adaptation measure, is a forest management approach that optimally uses forest sites to increase forest growth. It means that an optimal silvicultural approach in combination with proper forest road network and active management is used, in order to provide fuel wood for substitution of fossil fuels for energy production. The result of improvement of forest ecosystems using guidelines for forest management as part of implementation of close to nature forest management, will be the production of more technical wood used for furniture and packaging production, with long term carbon storage. This technical wood, at end of the useful life period, can, following the principles of circular economy, be converted into renewable material for biomass powerplants.</p> <p><u>EU Accession Negotiation Process: Chapter 27 - Environment</u></p>				
20	Key implementing entity	Partners	ETS/ non-ETS	Main gases affected	Estimate of removals by 2030 [kt CO2 eq.]

	Ministry of Agriculture, Forestry and Water Management	Research institutions, Organisations responsible for the forest management, Private forest owners	non-ETS	CO ₂	4.19	
No.	Name of measure: <u>Conversion of coppices into high forests</u>					
21	<p><u>Type of measure:</u> Regulatory; informational and educational</p> <p><u>Description of measure:</u> This measure prescribes the annual conversion of 7.000 ha of coppice forests to high forests, in particular oak and beech coppice forests. Government is financing amelioration of forests, which also includes direct conversion of coppice forests ecosystems. Direct conversion of coppice forest is a process consisting of use of natural seed from the best trees of coppice origin and then artificial planting in places where there was not enough natural regeneration. This measure is available for both State and private forests.</p> <p>Improvement of coppice and devastated forests on adequate sites by redefining productivity parameters and by extending the duration of the production process in these woods, followed by adequate tending intervention, will generate products with higher diameter which leads to products that will have long-term CO₂ storage (furniture, doors and other wood products with long term storage capacity). Surplus of the fuel wood that results from these activities can be used as a source of energy for boilers in local communities or in cogeneration plants again as a substitute for fossil fuels. The quantity of wood which will be felled during this process will, in the short term, increase emissions (during the burning process), but due to the higher average increment in high forests that will arise out of successful conversion (3.0 m³/ha higher, compared to increment in coppice forests), the total balance will result in an increase in CO₂ sink.</p> <p>Production of sufficient planting material where direct and indirect conversion is not successful, needs to be planned in advance, in order to be able to secure sufficient and proper planting material for the sites populated by certain tree species. Increasing of harvesting operations will produce demand for sufficient number of qualified forest workers and machinery.</p> <p><u>EU Accession Negotiation Process: Chapter 27 - Environment</u></p>					
	Key implementing entity	Partners		ETS/ non-ETS	Main gases affected	Estimate of removals by 2030 [kt CO₂ eq.]
	Ministry of Agriculture, Forestry and Water Management	Research institutions, Organisations responsible for forest management, Public Enterprises managing National Parks, Private forest owners		non-ETS	CO ₂	458.4
No..	Name of measure: <u>Short Rotation Plantations (SRP)</u>					
22	<p><u>Type of measure:</u> Regulatory, incentive, educational and informational</p> <p><u>Description of measure:</u> This measure proposes an area of additional 1500 hectares to be established annually using poplars and willows as the main tree species. Annual increment in SRP is 10 m³/ha up to age 10, and 18 m³/ha after that. The biomass from short rotation plantation will serve as a source of bioenergy for combined heat and power plants.</p> <p>Concerning the afforestation measure, the updating of the cadastral data and harmonisation of land use among different land users and owners is a precondition for successful establishment of SRP and removal of all cross-sectoral barriers regarding the implementation of the SRP on agricultural land.</p> <p><u>EU Accession Negotiation Process: Chapter 27 - Environment</u></p>					

	Key implementing entity	Partners	ETS/ non-ETS	Main gases affected	Estimate of removals by 2030 [kt CO2 eq.]
	Ministry of Agriculture, Forestry and Water Management	Research institutions, Directorate for Agrarian Payments, Organisations responsible for forest management, Private forest owners	non-ETS	CO ₂	654.9
No.	Name of measure: <u>Regeneration of overmature stands (beech)</u>				
23	<p><u>Type of measure:</u> Regulatory, incentive, educational and informational</p> <p><u>Description of measure:</u> The objective is to remove mature and overmature trees which have low production capacity (and that can even cause an increase in carbon emissions through side effects) from the forest stands and establish new natural or artificial forest stands with high productivity (group mixture where possible). This is of significant importance for the forestry and climate change sectors, since the annual increment of overmatured stands is only 3 m³/ha and their absorption capacity is negligible, compared to increment of young stands which is 8 m³/ha.</p> <p>Production of sufficient planting material for afforestation of areas where natural regeneration is not successful is needed in order to secure enough planting material of site adapted tree species. Increasing of harvesting operations will produce demand for sufficient number of qualified forest workers and machinery.</p> <p><u>EU Accession Negotiation Process: Chapter 27 - Environment</u></p>				
	Key implementing entity	Partners	ETS/ non-ETS	Main gases affected	Estimate of removals by 2030 [kt CO2 eq.]
	Ministry of Agriculture, Forestry and Water Management	Organisations responsible for the forest management, Private forest owners	non-ETS	CO ₂	545.74
No.	Name of measure: <u>Definition of guidelines for the reduction of negative biotic and abiotic factors</u>				

24	<p><u>Type of measure:</u> Informational and educational; organisational, governance and institutional</p> <p><u>Description of measure:</u> This measure foresees the adoption of a set of technical and managerial guidelines to reduce the area of forest affected by negative biotic and abiotic factors⁷⁰. These guidelines will provide forest managers at different levels of management the instructions on how to act concerning the matters relating to prevention or remediation of such factors.</p> <p>Guidelines for the following matters are needed:</p> <ol style="list-style-type: none"> 1) improvement of the observation system and early warning of the occurrence of forest fires; 2) definition of the degree of vulnerability of forest areas to fire; 3) definition of proper equipment for forest fire fighting teams, including for quick intervention; 4) definition of instructions for the construction and maintenance of forest roads and forest lines against fire; 5) Instruction for prevention and remediation against insects. <p>Instructions should be developed for management of vulnerable forests at national level, including the intensive training of the responsible staff working at the forest management companies and private forest owners' organisations on the prevention measures to be implemented should any negative abiotic and biotic factors occur in managed forest ecosystems.</p> <p><u>EU Accession Negotiation Process: Chapter 27 - Environment</u></p>				
	Key implementing entity	Partners	ETS/ non-ETS	Main gases affected	Estimate of removals by 2030 [kt CO2 eq.]
	Ministry of Agriculture, Forestry and Water Management	Ministry of Environmental Protection, Research institutions, Public companies responsible for the forest management, Private forest owners	non-ETS	CO ₂	-
No.	Name of measure: Research, training and awareness raising programme for the enhancement of the carbon sink and the resilience of Serbian forests to climate change				

⁷⁰ Abiotic factors are non-living parts of an ecosystem that shape its environment. These include elements such as sunlight, temperature, wind, water, soil and naturally occurring events such as storms, fires. Biotic factors are the living parts of an ecosystem, such as plants, animals and micro-organisms.

Type of measure: Informational and educational

Description of measure: In order to reduce the vulnerability of Serbian forests to climate change impacts and to be able to explore the full mitigation potential of the measures included in this Action Plan, the entire forestry system in the Republic of Serbia needs to be considerably strengthened.

The implementation of these measures needs to be supported by a training and awareness raising programme that builds both general knowledge on climate change and forest management, as well as the specific technical skills required to successfully implement each measure. Additionally, there is a need to strengthen scientific knowledge and to base the techniques used in the implementation of the measures on such knowledge, so as to ensure the full integration of the current and future measures in Serbian forest ecosystems with a view to new climate conditions affecting the Republic of Serbia.

The training and awareness programme should be designed taking into account the specific requirements of each measure and the different aspects addressed by the training.

The following topics should be included in the training programme:

- 1) Concerning the afforestation measure: site preparation, afforestation and forest tending. Additional research on potential productivity for afforestation on salty soils, especially in Vojvodina.
- 2) Close to nature forest management and climate smart approach to forestry: training on the specific methods and approaches to forest management;
- 3) Conversion of coppice into high forest: different techniques for regeneration of forests, as well as for forest tending after conversion;
- 4) Short rotation plantations: site preparation, afforestation and forest tending;
- 5) Regeneration of over mature stands: different techniques for regeneration of forests, as well as adequate measures for forest tending after regeneration;
- 6) Prevention measures and their application in forest management;
- 7) For all measures:
 - (1) Project preparation and management (promotion and training in preparation and management of projects financed from national and/or international financing schemes),
 - (2) Establishing permanent research and demonstration plots (for monitoring climate change impacts on forest management and monitoring of different forest management objectives and measures towards climate change mitigation and adaptation),
 - (3) Promotion of proper and increased use of wood, targeting the different uses of wood and respective users: households (wood for energy), construction sector (use of wood as construction material) and other sectors using wood,
 - (4) Improving management of private forests: promote the association of private forest owners through and with a view to increasing forest management knowledge.

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EU Accession Negotiation Process: Chapter 27 - Environment

Key implementing entity	Partners	ETS/ non-ETS	Main gases affected	Estimate of mitigation impact by 2030 [kt CO2 eq.]
Ministry of Agriculture, Forestry and Water Management	Research institutions, Organisations responsible for the forest management, Private forest owners, forestry related sector and construction sector.	non-ETS	CO ₂	-

Sectoral target 4: Preserving the potential of mitigation measures by increasing the resilience to climate change of priority sectors

No. Name of measure: Adaptation of cultivation technologies to climate change (selection of species and agrotechnical measures)

26 **Type of measure:** Informational and educational; organisational, governance and institutional

Description of measure:

This measure can be realized, *inter alia*, through proper choice of hybrids and varieties, introduction of new crop and fruit varieties, crop shading for water savings and sunburn injury protection, cooling the crops, stables, hencoops and fishponds, determination of suitable sowing dates, soil water conservation, new pest or disease control, etc.

Concerning the R&D segment, several faculties (e.g., Faculties of Agriculture in Novi Sad and Zemun) and research institutes (e.g, the Institute for Field and Vegetable Crops in Novi Sad, the Institute for Corn in Zemun Polje, the Fruit Research Institute in Čačak) conduct important research relating to agriculture, as well as research effects of climate change on agriculture.

As for the dissemination segment, the Agricultural Advisory Service (AAS) is the key instrument for transfer of knowledge concerning agriculture through informal education. Since 2013, the number of advisors has been increasing almost every year. In 2013, a total of 158 advisors provided advisory services on the territory of the Central Serbia, and in 2022 the number of advisors amounted to 208 professionals. Due to the increase in number of advisors, as well as due to focusing to group methods of advisory work, the number of users of advisory services grew together with the number of advice and support provided. According to available data provided by the software “Poljosavet” in 2022, the number of agricultural producers covered by advisory services was 82511 which is 24.67% of the total number of registered agricultural holdings in 2022 on the territory of the Republic of Serbia, excluding the territory of AP Vojvodina (334,396).

The National Agriculture and Rural Development Strategy sets the increase in the number of clients using the services of the Serbian Agriculture Advisory Service by 30% until 2024 as its goal. It is vital that this goal be achieved in order to facilitate the implementation of the measure.

EU Accession Negotiation Process: Chapter 11 - Agriculture and Rural Development

Key implementing entity	Partners	ETS/ non-ETS	Main gases affected	Estimate of mitigation impact by 2030 [kt CO2 eq.]
Ministry of Agriculture, Forestry and Water Management	Agricultural Advisory Service, Research Institutions	-	-	-

Sectoral Target 5: Promoting transition to climate neutral and climate resilient economy and society

Name of measure: Climate change education, training for new skills and awareness raising

27	<p><u>Type of measure:</u> Informational and educational</p> <p><u>Description of measure:</u> Combating climate change requires change in behaviour of all actors in society from the top level decision making processes in public and private sectors to everyday consumption patterns. Change is best operated through a multitude of stimuli, which can effectively be provided through education, training for new skills and awareness raising.</p> <p>The implementation of the measures included in this Action Plan and the achievement of the general and specific objectives set out in the Strategy will affect the reduction of activities in some sectors and increase of activities in others. This means that sectors with reduction in activities will have labour surplus, while sectors with increased activities could face labour shortage. Therefore, the plan is to give special attention to the development of activities aimed at promoting the acquisition of skills relevant for sectors with increased activities by workers of the sectors where labour surplus is expected. The implementation of this measure will contribute to social fairness of the transition to a low carbon economy.</p> <p>The proposed National Plan shall include three areas:</p> <ol style="list-style-type: none"> 1) Education: focusing on age groups from kindergarten to 12th grade (kindergartens, primary and secondary schools), with a view to identifying opportunities and issuing recommendations for integration of climate change issues into school curricula; recommendations concerning university studies may also be integrated in the plan; 2) Training to gain new skills needed for transition to carbon constrained economy: focusing on adult learning with the aim of identifying technical needs required to fight climate change, in particular concerning the implementation of the measures included in this strategy; 3) Awareness raising aimed at reaching the widest audience possible, focusing on the key aspects/behaviours that can contribute to the successful implementation of the measures included in this strategy. <p><u>EU Accession Negotiation Process: Chapter 27 - Environment</u></p>				
	Key implementing entity	Partners	ETS/ non-ETS	Main gases affected	Estimate of mitigation impact by 2030 [kt CO2 eq.]
	Ministry of Environmental Protection	Ministry of Education, Science and Technological Development, Ministry of Labour, Employment, Veteran and Social Affairs, Chamber of Commerce and Industry of Serbia	ETS/ non-ETS	CO ₂ , CH ₄ , N ₂ O, F-gases	-

9. FINAL SECTION

9.1. Action Plan

Action Plan to the Low Carbon Development Strategy 2024 -2030 shall be adopted within a year from the date of the adoption of the Strategy.

9.2. Publication

This Strategy shall be published on the websites of the Government of the Republic of Serbia and the Ministry of Environmental protection, respectively, as well as on the eUprava Portal (the eGovernment Portal of the Republic of Serbia), within seven working days from the date of the adoption of the Strategy.

This Strategy shall be published in the Official Gazette of the Republic of Serbia.

05 No. 353- 4730/2023

Done in Belgrade, on 1 June 2023

G O V E R N M E N T

PRESIDENT

Ana Brnabić, handwritten signature

APPENDIX 1

OBSERVED CHANGES IN THE CLIMATE OF THE REPUBLIC OF SERBIA AND PREDICTIONS OF FUTURE CLIMATE

Based on the results of the studies produced for the purpose of the elaboration of Serbia's Third National Communication to UNFCCC, it was found that during the period from 1961 to 2017 the temperature increased by 0.36°C per decade, while in the period from 1981 to 2017 the recorded temperature increase was 0.60 ° C per decade. The analysis of the spatial variation trends regarding accumulated annual and seasonal precipitation for both analyzed periods (the one from 1998 to 2017 and the other from 2008 to 2017) shows an increase of precipitation up to 10%.

The Intergovernmental Panel on Climate Change has developed two scenarios of future climate that have been downscaled to Serbia. These are the RCP4.5 (moderate scenario in which emissions peak around 2040 and then decline) and the RCP8.5 (high-emissions or “business as usual” scenario in which emissions continue to rise throughout the twenty-first century).

In accordance with the results of the mentioned scenarios of future climate in Serbia, in terms of the scenario RCP4.5, an increase of about 0.5°C in the period 2016-2035 is foreseen, while for the period 2046-2065 the calculated increase of 1.5°C is predicted, i.e., about 2°C in the period 2081-2100 compared to the reference period (1986-2005).

In terms of the scenario RCP8.5, the temperature is predicted to increase by 1°C in the period 2016-2035, 2°C in the period 2046-2065 and over 4.3°C in the period 2081-2100, compared to the reference period (1986-2005).

As for the precipitation, according to the scenario RCP4.5, the yearly value is projected to increase by about 0.7% in the period 2016-2035, then decrease by about 1.4% in the period 2046-2065 and again increase about 2% in the period 2081-2100, compared to the reference period (1986-2005).

Based on the scenario RCP8.5, annual precipitation is projected to decrease by about 1% in the period 2016-2035, then increase by about 3.8% in the period 2046-2065 and decrease by about 4.5% in the period 2081-2100, compared to the reference period (1986-2005)⁷¹.

Extreme weather

Heat waves

Heat wave is a period lasting at least 6 consecutive days when the daily maximum temperatures exceed the expected maximum temperatures during the year in which the heat wave occurred.

⁷¹ In both scenarios, the variations in temperature and precipitation differ according to the region of the country and the period of the year.

During the period 1998-2017, the number of days of heatwave increased for 15 to 25 days concerning the larger part of the country's territory, while warmest temperature peaks lasted over 25 days in eastern and western Serbia.

Over the last ten years (2008-2017), the number of days of heatwave increased for more than 20 days, while the maximum increase in the number days of heatwave amounting to 30 heatwave days was recorded in western and eastern Serbia.

In terms of the near future, the number of heatwave days is projected to increase by 26 days based on the RCP4.5 scenario and 32 days based on the RCP8.5 scenario (average value for the territory of Serbia). Concerning the mid-century period, according to the RCP4.5 and RCP8.5 scenarios, the number of heatwave days will increase for 58 days and 70 days, respectively. Towards the end of the century, the RCP4.5 scenario is expected to stabilise the climate, however, according to the the RCP8.5 scenario, due to the occurrence of anomalies, the number of heatwave days will reach an average value of 66 days.

Droughts

The frequency of droughts was analysed using the SPEI Index⁷². The SPEI index, in addition to taking into account the precipitation, which is the prerequisite for determining drought during the selected period, also takes into account the increased evapotranspiration of moisture from the soil due to the relevant air temperature. SPEI index values of less than -1 indicate dry periods/years. Lower SPEI index values are related to the whole territory of Serbia for the month of August (i.e., for the period from March to August) in the period from 1950 to 2017. These six-month values have been selected due to the fact that the analyses of accumulated seasonal precipitations showed deficits during the last twenty years precisely during these months; on the other hand, these are the months when agricultural production depends precisely on the available precipitation, so during the years when there is a precipitation deficit over the period from March to August, agricultural yields are usually lower than expected. After 2000, the frequency of drought has become somewhat higher. Years in which SPEI index had a value which was less than -1 were 2000, 2003, 2007, 2011, 2012, 2015 and 2017. Prior to 2000, only three years had SPEI index of less than -1.

Regarding future climate scenario, the indicator used as a proxy for drought is the Period with successive dry days.

The change in the longest non-precipitation period over the course of the year shows a slight increase of about 1, 2 and 3 days for the three periods (2016-2035; 2046-2065; 2081-2100), according to RCP4.5. According to the RCP8.5 scenario, a significant increase amounting to 6 days is predicted at the end of the century.

Extreme precipitation

In order to carry out the analysis of extreme precipitation, the number of days with precipitation over 40 mm expressed as the average number of days in the last ten- and twenty-

⁷² SPEI index - Standardised Precipitation Evapotranspiration Index

year periods compared to the average number of days during the period 1961-1990, was used as an indicator.

The number of days with precipitation of over 40 mm in the period 2008-2017 were less than one day in a larger part of the central Serbia, however, concerning the western and the eastern parts of the country, a four-times higher increase was recorded.

Maximum precipitation accumulated during one day (P_{max1}) shows an increase in precipitation on the territory of Serbia in the future. In the near future, the change, that is the predicted increase in precipitation of up to 5% is predicted in both scenarios. In the mid-century period, an extreme increase is predicted. According to the RCP8.5 scenario, in some parts of southern and central Serbia, the value of the predicted increase in precipitation will exceed 10%. This also applies to the Autonomous Province of Vojvodina. By the end of the century, according to the RCP4.5 scenario, the extreme change in precipitation exceeds the aforementioned values in some parts of the Autonomous Province of Vojvodina, as well as in some other smaller areas in other parts of Serbia, while based on the RCP8.5 scenario, the increase in precipitation can be as high as 20% in some parts of the Autonomous Province of Vojvodina.

The future projections of precipitation quantities on the territory of the Republic of Serbia predict an increase in the maximum precipitation accumulated during 5 consecutive days (P_{max5}). Concerning the changes predicted in the near future, they are similar to P_{max1} . In the middle of the century, a significant change is predicted based on the RCP8.5 scenario, where precipitation values exceeded 15% in the Autonomous Province of Vojvodina and even 20% in smaller areas of southern Serbia. By the end of the century, the deviations of this index are somewhat higher than P_{max1} . In certain areas, the value exceeds 15% referring to the RCP4.5 scenario, while in the RCP8.5 scenario, the value generally exceeds 15%, however, in some areas in southern Serbia and in eastern parts of the Autonomous Province of Vojvodina, the mentioned value exceeds 20%.

APPENDIX 2

INFORMATION ON STRATEGY DEVELOPMENT CONSULTATION PROCESS

The development of the Low Carbon Development Strategy involved active stakeholder engagement. A working group was established in order to provide regular feedback to the Ministry of Environmental Protection concerning the analytical results and proposals. In addition, a larger number of stakeholders provided their support and input depending their respective area of expertise, for example in the process of developing mitigation scenarios and the risk assessment associated with the climate change impacts in the priority sectors.

The key stakeholders took part in the following activities/events during the development of the Strategy:

1) A kick off meeting marking the start of a project “Climate Strategy and Action Plan (13 September 2016)” organized as a part of the Conference “*Combating Climate Change: Where does Serbia Stand*”;

2) Seven meetings of the Working Group engaged in the project “Climate Strategy and Action Plan” (the first meeting was held on 25 September 2016, the second on 20 March 2018, the third on 28 September 2018, the fourth on 22 April 2019, the fifth on 9 May 2019, the sixth on 25 October 2019 and the seventh, final meeting was held on 12 November 2019);

3) Three sectoral technical working group meetings for the identification and evaluation of adaptation options (24 – 25 October 2017);

4) A *Workshop on Adaptation to Climate Change in Priority Sectors*, Result 5 (26 September 2018);

5) A meeting of the technical working group concerning the development of two mitigation scenarios as the basis for conducting the subsequent online survey “Vision 2050 - Serbia” (20 December 2018);

6) A public hearing concerning the draft SEA Scoping Report (held on 15 April 2019) and a public consultation (organized in the period from 29 March to 29 April 2019);

7) The assessment of the economic, social and environmental impacts of the four mitigation scenarios done by completing an online survey (in the period 13– 17 May 2019);

8) A discussion on the draft Strategy, including a public presentation event, as well as the period for submitting comments and suggestions via email (from 27 December 2019 to 24 January 2020) – Conclusion of the Government No. 353-128528/2019-1 of 26 December 2019).

The pie chart presented below shows the respective shares of different stakeholders participating in the Working Group meetings, indicating a diversified structure dominated by public administration organisations.

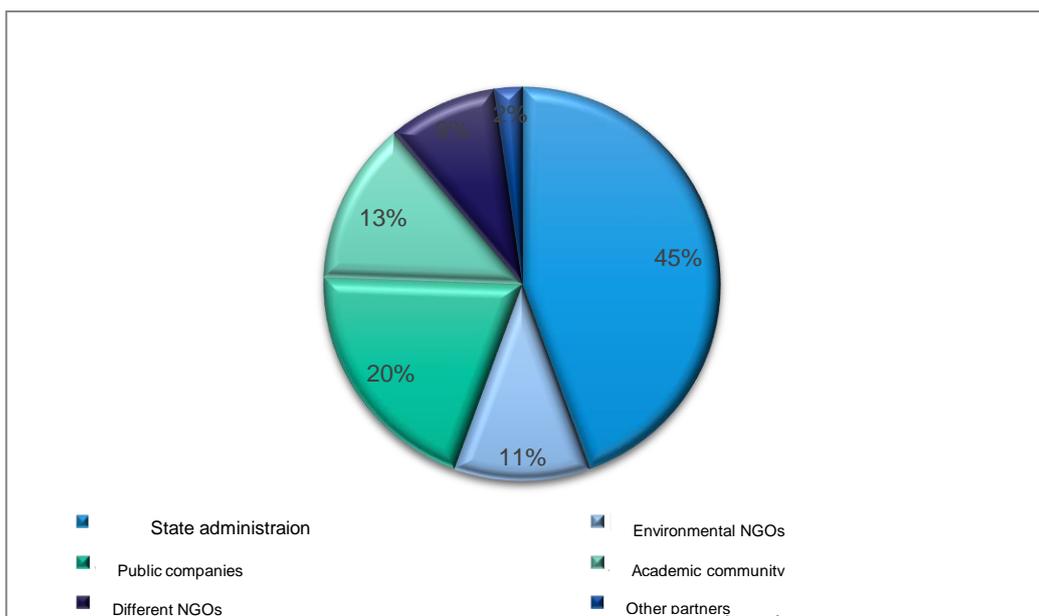


Figure 6: Types of stakeholders participating in the Working Group meetings

The engagement of the stakeholders throughout the process of the Strategy elaboration allowed for identification of the key issues for the different types of stakeholders, both public and private ones. This subsequently allowed for the inclusion of the key tasks of each stakeholder in the analytical work performed, as well as the definition of proposals which take into account, to the best extent possible, the various specific interests.

Therefore, the regular engagement of key stakeholders allowed for the broad acceptance of the proposals included in the Strategy.

The content of key questions raised by the stakeholders during the online consultations procedure, as well as the manners of providing relevant answers, are presented in the Report on the Public Consultation.

Comments provided during the public hearing are addressed in detail in the Report on Public Hearing on the Draft Low Carbon Development Strategy and Action Plan which is available on the website of the Ministry of Environmental Protection.

Upon completion of public consultations, the draft Low Carbon Development Strategy was submitted to relevant institutions in accordance with the procedure of obtaining official opinions. The draft Strategy was revised in accordance with the opinions provided and aligned so as to follow the formulation of measures from the Action Plan for the Implementation of the Green Agenda for Western Balkans. In accordance with the Law on Planning System and the Regulation on the Methodology of Public Policy Management, the analysis of effects of public policies and regulations as well as with the content of individual public policy documents, the document that will define activities for implementation of measures and achievement of goals set out in the Strategy shall be the subject of a special public consultation session.

INFORMATION ON REGULATIONS TO BE ADOPTED OR AMENDED

The following list includes only the changes to legislation required for the purpose of the full implementation of this Strategy. Please note that such changes are not related to the transposition of EU legislation.

Law on Climate Change (and bylaws)

- Introduction of provisions governing the implementation of measures aimed at achieving harmonization with the GHG Emissions Trading System and/or introduction of other instruments referring to carbon pricing for period 2026 – 2029, as well as achieving full implementation of the EU-ETS before accession to EU;
- Introduction of carbon pricing based on carbon intensity of the fuel.

Law on Energy Efficiency and Rational Use of Energy

- Improvement of operations of the Energy Efficiency Administration (additional funds and diversification of the types of support provided).

Law on Use of Renewable Energy Sources

- Support to production of thermal energy from the renewable energy sources for end users.

Amendment of the Law on Tax on the Use, Possession and Carrying of Goods, concerning the section of the Law governing the tax on use of motor vehicles, in order to promote the use of eco-friendly motor vehicles or low-emission vehicles.

- Deadline for adoption of this Law: end of 2024
- Deadline for application of this Law: 1 January 2028

Law on Traffic Safety (Official Gazette of the RS, No. 41/09, 53/10, 101/11, 32/13 – CC, 55/14, 96/15 – other law, 9/16 – CC, 24/18, 41/18, 41/18 – other law, 87/18, 23/19 and 128/20 – other law)

- Introduction of “Eco-driving” in the driver training curriculum for both passenger car drivers and professional drivers.

Law on Planning and Construction

- Preparation of revised traffic strategy that includes the climate change aspects;
- Inclusion of development of local/regional low carbon traffic strategies and sustainable urban mobility plans into the legal framework.

Law on Charges for Usage of Public Goods (Official Gazette of the RS, No. 95/18 and 49/19)

- Introduction of a road toll based on the EURO emission standard

Forestry

Forestry Development Programme

- Supplementation of the draft Forestry Development Programme so as to include measures and goals envisaged by the Strategy.

APPENDIX 4

SECTORAL BREAKDOWN OF EMISSIONS SCENARIOS

The following tables represent detailed sectoral breakdown of emissions up to 2050 in the scenarios B2 M2, M3 and M4, including the comparisons of 2030 and 2050 levels with those recorded in 2010, 2005 and 1990.

B2	1990	2005	2010	2015	2020	2025	2030	2050	2030/ 2010	2050/ 2010	2030/ 2005	2050/ 2005	2030/ 1990	2050/ 1990
Energy industry	44146	35557	33050	34700	34451	34188	34590	37472	4.7 %	13.4 %	-2.7 %	5.4 %	-21.6 %	-15.1 %
Manufacturing industry and construction	6418	6064	4278	3452	3898	4062	4014	3837	-6.2 %	-10.3 %	-33.8 %	-36.7 %	-37.5 %	-40.2 %
Traffic	4564	6702	6742	5995	7197	7822	8354	9518	23.9 %	41.2 %	24.6 %	42.0 %	83.0 %	108.6 %
Other sectors	7048	3029	3477	2711	2627	2660	2677	2532	-23.0 %	-27.2 %	-11.6 %	-16.4 %	-62.0 %	-64.1 %
Fugitive emissions	3841	2973	2409	2523	2406	2474	2221	1750	-7.8 %	-27.3 %	-25.3 %	-41.1 %	-42.2 %	-54.4 %
IPPU	5455	4729	4660	3883	4736	5384	5671	6608	21.7 %	41.8 %	19.9 %	39.7 %	4.0 %	21.2 %
Agriculture	6186	6238	5305	5259	5133	5046	4752	5721	-10.4 %	7.8 %	-23.8 %	-8.3 %	-23.2 %	-7.5 %
Waste	3868	2800	2730	2709	2755	2582	2371	1936	-13.1 %	-29.1 %	-15.3 %	-30.9 %	-38.7 %	-49.9 %
Total B2 (without LULUCF)	81526	68091	62650	61233	63204	64218	64650	69374	3.2 %	10.7 %	-5.1 %	1.9 %	-20.7 %	-14.9 %
LULUCF	-1432	-7090	-5627	-4533	-6532	-5451	-5050	-4161	-10.3 %	-26.1 %	-28.8 %	-41.3 %	252.7 %	190.6 %
Total with LULUCF	80094	61001	57023	56700	56672	58767	59600	65213	4.5 %	14.4 %	-2.3 %	6.9 %	-25.6 %	-18.6 %

M2	1990	2005	2010	2015	2020	2025	2030	2050	2030/ 2010	2050/ 2010	2030/ 2005	2050/ 2005	2030/ 1990	2050/ 1990
Energy industry	44146	35557	33050	34700	34548	31164	27426	7596	-17.0 %	-77.0 %	-22.9 %	-78.6 %	-37.9 %	-82.8 %
Manufacturing industry and construction	6418	6064	4278	3452	3842	4101	3651	2691	-14.7 %	-37.1 %	-39.8 %	-55.6 %	-43.1 %	-58.1 %
Traffic	4564	6702	6742	5995	7096	7406	7433	4731	10.2 %	-29.8 %	10.9 %	-29.4 %	62.9 %	3.7 %
Other sectors	7048	3029	3477	2711	2393	2267	2089	1035	-39.9 %	-70.2 %	-31.0 %	-65.8 %	-70.4 %	-85.3 %
Fugitive emissions	3841	2973	2409	2523	2429	2279	1938	220	-19.6 %	-90.9 %	-34.8 %	-92.6 %	-49.5 %	-94.3 %
IPPU	5455	4729	4660	3883	4736	5178	4994	4539	7.2 %	-2.6 %	5.6 %	-4.0 %	-8.4 %	-16.8 %
Agriculture	6186	6238	5305	5259	5132	4813	4493	5432	-15.3 %	2.4 %	-28.0 %	-12.9 %	-27.4 %	-12.2 %
Waste	3868	2800	2730	2709	2755	2582	2371	1936	-13.1 %	-29.1 %	-15.3 %	-30.9 %	-38.7 %	-49.9 %
Total M2 (without LULUCF)	81526	68091	62650	61233	62931	59790	54396	28180	-13.2 %	-55.0 %	-20.1 %	-58.6 %	-33.3 %	-65.4 %
LULUCF	-1432	-7090	-5627	-4533	-6766	-6323	-6576	-4414	16.9 %	-21.6 %	-7.2 %	-37.7 %	359.2 %	208.2 %
Total with LULUCF	80094	61001	57023	56700	56165	53467	47820	23766	-16.1 %	-58.3 %	-21.6 %	-61.0 %	-40.3 %	-70.3 %
M3	1990	2005	2010	2015	2020	2025	2030	2050	2030/ 2010	2050/ 2010	2030/ 2005	2050/ 2005	2030/ 1990	2050/ 1990
Energy industry	44146	35557	33050	34700	34287	27051	20843	6286	-36.9 %	-81.0 %	-41.4 %	-82.3 %	-52.8 %	-85.8 %
Manufacturing industry and construction	6418	6064	4278	3452	3856	4175	3109	2334	-27.3 %	-45.4 %	-48.7 %	-61.5 %	-51.6 %	-63.6 %
Traffic	4564	6702	6742	5995	6924	7011	6613	4228	-1.9 %	-37.3 %	-1.3 %	-36.9 %	44.9 %	-7.4 %
Other sectors	7048	3029	3477	2711	2409	2130	2081	1134	-40.1 %	-67.4 %	-31.3 %	-62.5 %	-70.5 %	-83.9 %
Fugitive emissions	3841	2973	2409	2523	2417	2166	1667	210	-30.8 %	-91.3 %	-43.9 %	-92.9 %	-56.6 %	-94.5 %
IPPU	5455	4729	4660	3883	4731	5167	4641	5104	-0.4 %	9.5 %	-1.9 %	7.9 %	-14.9 %	-6.4 %
Agriculture	6186	6238	5305	5259	5132	4691	4249	5056	-19.9 %	-4.7 %	-31.9 %	-19.0 %	-31.3 %	-18.3 %
Waste	3868	2800	2730	2709	2601	2134	1488	917	-45.5 %	-66.4 %	-46.8 %	-67.2 %	-61.5 %	-76.3 %
Total M3 (without LULUCF)	81526	68091	62650	61233	62357	54525	44692	25269	-28.7 %	-59.7 %	-34.4 %	-62.9 %	-45.2 %	-69.0 %

M3	1990	2005	2010	2015	2020	2025	2030	2050	2030/ 2010	2050/ 2010	2030/ 2005	2050/ 2005	2030/ 1990	2050/ 1990
LULUCF	-1432	-7090	-5627	-4533	-6725	-6672	-7274	-5720	29.3 %	1.7 %	2.6 %	-19.3 %	408.0 %	299.4 %
Total with LULUCF	80094	61001	57023	56700	55632	47853	37418	19549	-34.4 %	-65.7 %	-38.7 %	-68.0 %	-53.3 %	-75.6 %

M4	1990	2005	2010	2015	2020	2025	2030	2050	2030/ 2010	2050/ 2010	2030/ 2005	2050/ 2005	2030/ 1990	2050/ 1990
Energy industry	44146	35557	33050	34700	34537	27995	22824	3767	-30.9 %	-88.6 %	-35.8 %	-89.4 %	-48.3 %	-91.5 %
Manufacturing industry and construction	6418	6064	4278	3452	3851	4112	3134	1917	-26.7 %	-55.2 %	-48.3 %	-68.4 %	-51.2 %	-70.1 %
Traffic	4564	6702	6742	5995	6944	7006	6396	3091	-5.1 %	-54.1 %	-4.6 %	-53.9 %	40.1 %	-32.3 %
Other sectors	7048	3029	3477	2711	2392	2115	1996	772	-42.6 %	-77.8 %	-34.1 %	-74.5 %	-71.7 %	-89.0 %
Fugitive emissions	3841	2973	2409	2523	2424	2168	1709	171	-29.1 %	-92.9 %	-42.5 %	-94.2 %	-55.5 %	-95.5 %
IPPU	5455	4729	4660	3883	4731	5167	4625	4787	-0.7 %	2.7 %	-2.2 %	1.2 %	-15.2 %	-12.2 %
Agriculture	6186	6238	5305	5259	5132	4691	4249	4015	-19.9 %	-24.3 %	-31.9 %	-35.6 %	-31.3 %	-35.1 %
Waste	3868	2800	2730	2709	2317	1551	1207	845	-55.8 %	-69.1 %	-56.9 %	-69.8 %	-68.8 %	-78.2 %
Total M3 (without LULUCF)	81526	68091	62650	61233	62328	54804	46140	19366	-26.4 %	-69.1 %	-32.2 %	-71.6 %	-43.4 %	-76.2 %
LULUCF	-1432	-7090	-5627	-4533	-7273	-8424	-9746	-13082	73.2 %	132.5 %	37.2 %	84.5 %	580.6 %	813.5 %
Total with LULUCF	80094	61001	57023	56700	55055	46380	36394	6284	-36.2 %	-89.0 %	-40.3 %	-89.7 %	-54.6 %	-92.2 %